



# RESEARCH REPORT

Pollination Mobility Systems

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# ABSTRACT

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This report focuses on the importance of bees in the food security and agriculture industry. Research was gathered and was followed by a literature review to identify the key concepts, methods and opinions that have shaped the way of beekeeping. A focus was on commercial beekeeping which do pollination services to crops and farmers that shape our food industry today. Keys areas that were discussed in the current literature were hive design, environmental challenges, handling of the hives as well as transportation of hives. Some of the research was outdated and required further information.

Methods of surveys, interviews and observations allowed for a better understanding of day to day processes of beekeeping. Through a thorough literature review and qualitative research the design opportunities could be identified. These opportunitites highlighted the ergonomics, transportation and management of hives. The research highlighted key factors however the qualitative research, especially interivews allowed for a better understanding of the topic.

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# INTRODUCTION

The production of honey has undergone minimal transformation since the late 1800s, coinciding with the advent of the Langstroth hive (Cook, Blackler, & Hauxwell, 2021). Beekeeping is stratified into different categories, depending upon the amount of hives under management. Commercial beekeepers oversee more than 200 hives, while those managing fewer are categorized as amateur beekeepers. In Australia, as of 2019, there were over 668,000 hives, with a notable majority, exceeding 80%, operated by commercial beekeepers — a number that continues to rise (BeeAware, 2020). They primarily use *Apis mellifera* Linnaeus, commonly known as the European honeybee, for both pollination services and honey production.

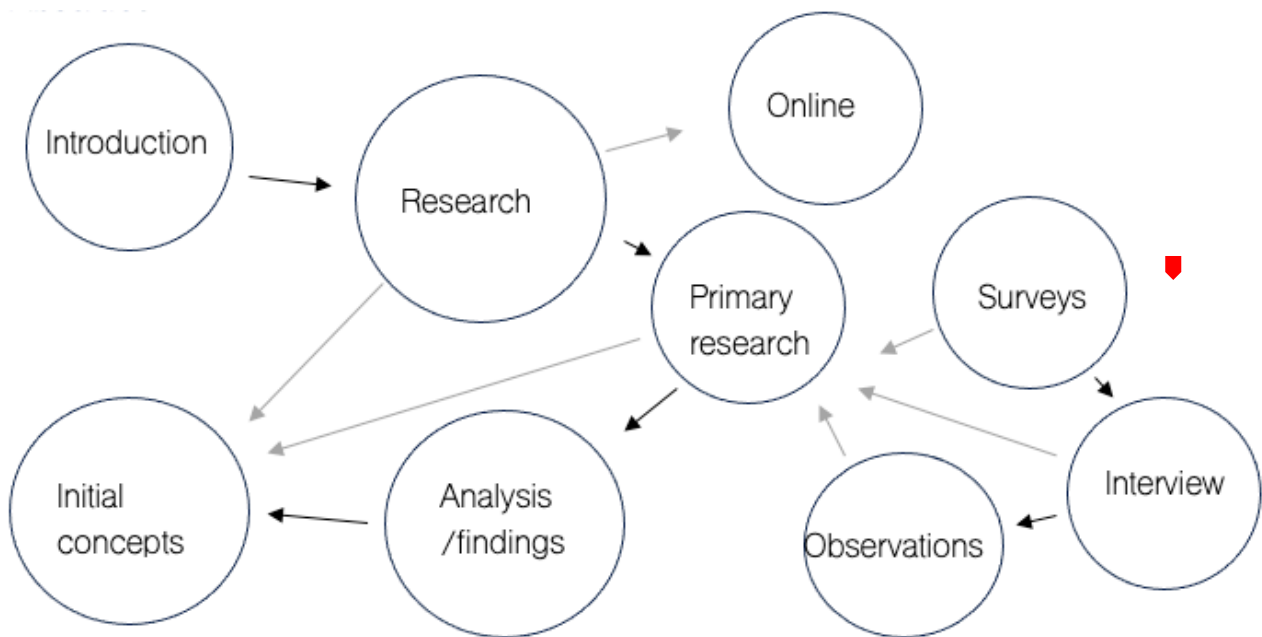
In the context of food security, commercial beekeepers play a crucial role by renting their hives to farmers for crop pollination purposes. Approximately 65% of horticultural and agricultural crops introduced into Australia since European settlement rely on various pollinators, including honeybees, as well as other natural factors like wind and birds (Clarke & Le Feuvre, 2021). The revenue generated from these pollination services has become increasingly vital to the beekeeping industry (Rural Industries Research and Development, 2007). These hives are transported all over the country to various crops which can be seen in Table 1.

*Table 1 Honeybee dependence for pollination of crops (Rural Industries Research and Development, 2007)*

| <b>Crop</b>                    | <b>Dependence %</b> | <b>Crop</b>            | <b>Dependence %</b> |
|--------------------------------|---------------------|------------------------|---------------------|
| <b>Tree crops</b>              |                     | <b>Vine crops</b>      |                     |
| Almond                         | 100                 | Cucumber               | 100                 |
| Apple                          | 100                 | Kiwi                   | 80                  |
| Apricot                        | 70                  | Pumpkin                | 100                 |
| Avocado                        | 100                 | Rockmelon              | 100                 |
| Blueberry                      | 100                 | Squash                 | 10                  |
| Cherries                       | 90                  | Watermelon             | 70                  |
| Citrus (depends on variety)    | 30-80               | <b>Seed production</b> |                     |
| Grapefruit                     | 80                  | Beans                  | 10                  |
| Lemon and lime                 | 20                  | Broccoli               | 100                 |
| Macadamia                      | 90                  | Brussel sprout         | 100                 |
| Mandarin                       | 30                  | Cabbage                | 100                 |
| Mango                          | 90                  | Canola                 | 100                 |
| Nectarine                      | 60                  | Carrot                 | 100                 |
| Orange                         | 30                  | Cauliflower            | 100                 |
| Papaya                         | 20                  | Celery                 | 100                 |
| Peach                          | 60                  | Clover                 | 100                 |
| Pear (depends on variety)      | 50-100              | Lucerne                | 100                 |
| Plum and prune                 | 70                  | Mustard                | 100                 |
| <b>Broadacre crops</b>         |                     | Onions                 | 100                 |
| Canola                         | 15                  |                        |                     |
| Faba beans                     | 15                  |                        |                     |
| Cotton                         | 10                  |                        |                     |
| Soy                            | 10                  |                        |                     |
| Sunflower (depends on variety) | 30-100              |                        |                     |

The main pollination season occurs from late winter through to early summer. Whilst bees are responsible for achieving such large success in pollination, beekeepers manipulate the hive strength, composition, numbers, and placement to align with different conditions (Phillips, 2014). During transportation, overheating and chilling can negatively affect the hives which can result in hive loss (Melicher, et al., 2019). Trucks move thousands of hives daily whilst using forklifts and pallet systems to get them on and off the trucks. Over the last 50 years there has been a 300% growth in the demand for paid pollination services (RRATRC, 2014). This highlights the profound influence of honeybee pollination services on food security and the agricultural sector.

This projects aim is to explore the redesign of beehive transport systems, products, and processes, spanning from individual hives to road-train scale, with the aim of enhancing efficiencies and biosecurity within the pollination services industry. By means of surveys, interviews, observations, and in-depth research into current commercial beekeeping practices, we aim to identify opportunities for initial design interventions.



# LITERATURE REVIEW

Beekeeping, a vital component of agricultural ecosystems, relies heavily on hive designs, environmental conditions, and handling practices. This literature review explores the current state of beekeeping practices, with a focus on hive design, hive environmental conditions, and the challenges associated with hive handling. It is evident that while certain aspects of beekeeping have remained consistent for over a century, there are pressing concerns that necessitate modernisation and improvement.


## Hive design

The Langstroth hive remains the standard hive design within the Australian apiculture system. This hive structure, comprised of a bottom board, a deep super housing the queen bee, a queen excluder, honey supers, and a cover, was established in 1852 and has undergone limited fundamental changes. Although alternative hive designs exist, they are generally more suitable for amateur beekeepers rather than the demands of commercial beekeeping. However, noteworthy modifications have been introduced to the Langstroth design, including the addition of multiple openings on the front face (Sudarsan, 2012), and the incorporation of heaters and fans to regulate hive environments (Erdogan, 2009). In the Commercial Beekeeping in Australia Report it also stated that many of the beekeepers “still make their own boxes and lids” (Rural Industries Research and Development, 2007).

## Environmental challenges

There are different ways a beekeeper may lose a hive – temperature, humidity, pests, etc. In a review from 2017 regarding the impacts caused by temperature and humidity, it suggests that the importance of temperature and humidity of the hive “requires a new design of beehives to help in the survival of honeybees under harsh summer and winter conditions” (Abou-Shaara , Owayss, Ibrahim, & Basuny, 2017). There are many articles that address sensor monitoring systems for hives that, however in the 2022 article, Djemali address that almost all the “scientific experiments and papers were using very limited number of connected beehives during a short period of time” (Djemali, Bouchoucha, & Ngara, 2022). The device measures the inner beehives and brood’s temperature and relative humidity and location, using a GPS module. The article suggested that there was a larger difference in temperature between the summer and winter months.

The materials of the hive need to be at a certain standard otherwise, if the hive is constructed with poor insulating materials the hive the bees divert from their natural jobs including defence, gathering, and cleaning to maintain homeostasis (Kiheung Ahn, 2013). The bees heat the hive themselves through the vibrations of the antagonistic thoracic flight muscle which then radiates through the hive (Cook D. , Blackler , McGree, & Hauxwell, 2021).



An article by Daniel Cook in 2021, demonstrated an experiment on whether ventilation lids would help with the cooling of the hive. The results revealed that hives without lids release stored heat energy faster than sealed hives (Cook D. , Blackler , McGree, & Hauxwell, 2021). This suggests that ventilated lids decrease the “efficacy of stored honey as thermal mass, effectively cooling the hive by drawing external air in and venting the warm moist air through the lid” (Cook D. , Blackler , McGree, & Hauxwell, 2021). This shows that to optimise the use of the colony’s thermal mass the lid of the hive needs to be redesigned so that it is ventilated, which links to the hive design.

## Handling of the hives

The process of handling beehives has long been a concern within the beekeeping industry. Many beekeepers still rely on manual handling practices when moving hives. This approach is not only time-consuming but also poses risks to beekeepers’ safety and requires significant labour (Rybin, Rodionova, Karimov, Kopets, & Chernetskiy, 2021). In a 2022 article, Wang proposes an innovative solution to enhance beekeeper efficiency — a multifunctional beekeeping loading box. This technology addresses the challenges of hive handling by streamlining the process and reducing labour demands (Wang, 2022). While hive controllers and semi-automatic beehive lifters have also been introduced in this area, concerns remain regarding their functionality, particularly in apiary settings. Wang’s multifunctional loading box offers a promising solution for beekeepers. However, it is noteworthy that there is limited literature on hive handling practices, potentially due to the continued prevalence of manual hive handling.

## Transportation of hives


Beekeepers move their hives to different sites to follow nectar flow for honey production and for commercial pollination. Transporting commercial beehives to and from apiary sites presents unique challenges. Beekeepers typically utilize flatbed trucks or semi-trucks, using pallets for loading and unloading hives. To secure hives during long-distance transportation, a net is placed over the load to prevent bees from escaping (Lee & Reuter, 2021). There is no one-size-fits-all approach to hive transportation, and beekeepers adapt their methods based on logistics and hive needs.

When the hives are loaded on to the trucks, the positioning of the hives are important. The hives need to maintain an internal temperature between 32 and 35 degrees Celsius, however when placed on the truck, the orientation of the hive could be towards the centre or outwards, effecting the airflow (Melicher, et al., 2019). An experiment was conducted where it measured the temperature of the hives during the transportation, and it was concluded that the location and orientation may affect internal temperature variation, however, there needs to be more testing to prove this theory (Melicher, et al., 2019).





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In conclusion, this literature review underscores the enduring traditions and emerging challenges within the beekeeping industry. While hive design, environmental control, hive handling, and transportation practices exhibit time-tested conventions, the need for modernization and innovation is evident. The beekeeping community must navigate a dynamic landscape, balancing tradition with adaptation to ensure the well-being of honeybee populations and the sustainability of the industry. 

# RESEARCH

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## Research

A qualitative method was used in to gather the research. The methods include surveys, semi structured interviews, and observations. All participants agreed to the consent form and being recorded. All surveys participants responses were anonymous.

## Surveys

Two surveys were conducted to gain insights into the current methods of beehive transportation. Both surveys were created using Microsoft Forms and distributed within beekeeping social media groups.

The first survey, conducted during the initial stages of research, collected 47 responses. It included a mix of qualitative and quantitative questions. After each of the quantitative question the participants were given the opportunity to provide recommendations and elaborate on their responses through a short response questions. The survey took approximately 6 minutes to complete. Some of the questions from this survey were as follows.

Qualitative questions:

- How do you currently transport your beehives?
- What time of day do you typically move the hives?
- How do you prevent bees from escaping during transit?

Quantitative questions:

- How many beehives do you currently own?
- Do you regularly transport your beehives?
- Do weather conditions impact the transportation of beehives?

The second survey, which specifically targeted beekeepers with 50 or more hives for transportation, received only three responses and was conducted at a later stage of the research. This survey primarily consisted of short-response qualitative questions. This survey took approximately 10 minutes to complete. Here are some sample questions from this survey.

Qualitative questions:

- How do you secure your hives for transportation?
- What materials are your hives constructed from?
- What steps do you take to prepare your hives for transport?
- In the event of disease or pest issues at the pollination site, please describe the actions taken when transporting the affected hive back.
- What is the recommended distance for separating beehives when placing them at a pollination site

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## Interview

Two semi structured interviews were conducted during the research stage to gain a better understanding from talking to a beekeeper. One interview was conducted via the phone and other interview was face to face. Experts in beekeeping were found via pollination services online, family network and researchers. All information and consent form were sent out to the participants prior to the interview process, and all agreed with the terms. Participants were informed that the information they provided will be turned into a transcript and can be viewed by them prior to it being used and that it will only be used for this project.

## Phone interview

One phone interview was conducted in a semi structured manner. The participant was comfortable with being recorded and could review the transcript prior to being used. The semi structured interview allowed for more information provided as there would be more topics to talk about.

## Face to Face interview

This interview was conducted at the Queensland University of Technology Samford Ecological Research Facility (SERF). The participant was comfortable with being interviewed as well as being recorded. The questions were based off the first phone interview. Observations were also taken during the interview and due to it being semi structured, other questions relating to the observations were discussed and allowed for a better understanding.

## Observations

The observations took place at the SERF in the morning. The expert allowed video footage to be taken and documented, as well as a transcript of the explanations that took place during the observations.



# ANALYSIS + FINDINGS

All the data was analysed by comparing the data to different research methods. This was shown through undertaking surveys, interviews and observations. The results of all re-search methods discussed below.

## Survey

In the first survey, the quantitative data allowed to get a better initial understanding of how current beekeepers manage their hives. **Figure 2** shows the type of hives that the participant currently uses. It can be observed that 94% of the participants use a Langstroth hive which is the Australian standard. The other 6% were variations of the Langstroth hive whether that be self-made long Langstroth hive or have similar features.



Figure 1 Types of hive used

Figure 3 shows if the participants transport their hives. With 87% of the participants agreeing that they transport their hives and 13% of the participants disagreed with moving their hives.



Figure 2 Do they participants move their hives?

In the first survey, the qualitative data allowed the participants to add their own unique answer as beekeeping methods vary from person to person. In Figure 3 shows the current ways of moving their beehives with the top answer being truck and trailer and the other answers are variations.



Figure 3 Current modes of beehive transportation

There was also room for recommendations from the participants. This question allowed to gather data straight from the experts as they are always working with them. Figure 4 show the recommendations that could be applied to the current hive design, including insulation in the lid, covering on the outside and mesh bottom boards. This question was only answered by 12 participants.



Figure 4 Recommendations that can be applied to the current hive design.

Figure 5 shows the different ways the beekeepers get the hives on and off of the truck. With 30% of participants choosing to load the hives with a loader. There were other variations of the answer as well as other methods such as pallets, hive crane, manually lifting and bobcat.



Figure 5 Different ways the beekeepers get the hives on the truck and trailer

The second survey was only answered by 3 participants. This makes the data less reliable, however still can use the data for a general understanding. The first question that was asked was the current materials their hives are made out of. The participants answers are listed below in Figure 6.

"Timber and plastic "

"Finland Polly hives there lighter and I can carry more. "

"I have timber plastic and foam hives"

Figure 6 Hive materials

## Interview

The topics discussed during the interview were transportation methods, how they managed their hives. The interviews were transcribed, and participants were names speaker 1 and 2.

The first interview was with a beekeeper that does pollination services for over 250 hives. The method that he uses to load the hive on to the truck is an “*easy loader ... it’s Australian made in Ballina in Northern New South Wales and it’s a crane that goes underneath individual hives. So, they’re not on pallets, but they’re individually... so it’s [loader] on the back of the truck.*” He doesn’t use the pallet system because “*a lot of my sites are very, very remote. I might have to cross creeks and that type of thing. And I’m only small scales only run about two 50 hives. And the reason is I’ve also got a four-wheel drive Ute ... I can get the Ute and trailer into these sites. So, I’ve got a lot of little sites that I use. So, then I’ve also, obviously for the big stuff I can use the trailer. But yeah, for pallets it’s not suited for me.*” I also used some of the questions from the survey to ask the participants being interviewed. When transporting the hives, he uses a piece of wet cloth to put into the entrances (Appendix 1). The hives are put on the truck and “*they can be jam packed. The bases of each hive I use is ventilated, so I don’t use ventilated lids, but the bases are ventilated, and I do it at night-time, so they’re the coolest part of the night, so I leave at, sort of midnight at night to move. That’s the best time of day, best time to do it so they don’t overheat.*” As he moves them during the night, the beehives don’t require being sprayed with water as the hives won’t overheat. ▾

The hives that he currently uses are made from “*Australian pine ... wax dipping ... boxes are cooked in wax at 180 degrees Celsius for 10 to 15 minutes. And so that dries out the wood and helps curate it ... they’re painted four times with white concrete paint ... literally get decades out of them.*”

The other expert beekeeper suggested that “nothing locks together or is lipped or self-locating”. When demonstrating how to dismantle and reassemble the hive when beekeepers move the hives that when you “lift it like this [normal way to carry a box with arms in neutral position] isn’t too bad, but when I hold it out this way [arms reaching out whilst holding the hive, Figure 7] it gets really painful”. The hive design was also discussed with this expert and stated that “there are so many variants ... everyone has a solution, but there is no standard ... no one has agreed ... no one uses the same stuff because its manufacture specific”. This shows the overlapping from the surveys where the participants were asked if they had any recommendations for the hives. The transportation of the hives was also discussed as “they use a forklift and put them on to pallets ... but the pallets aren’t standard pallets, they either modify their pallets or use a pallet that is too big”.



Figure 7 Manual Handling of the hives

# DISCUSSION

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This comprehensive exploration of beekeeping practices, combining literature articles and qualitative research, has revealed critical gaps and areas of focus within the industry. Notably, these areas encompass hive handling, transportation methods, and various components of hive design. Some research overlaps, particularly in the realm of hive transportation.

The utilization of qualitative research methods, including surveys, interviews, and observations, has provided invaluable insights into beekeeping practices. Survey participants shared their individual methods and experiences, demonstrating a rich tapestry of approaches. While short responses often had foundational similarities, each participant added their unique twist, enhancing the depth of understanding. For instance, responses to the question “how do they currently move their hives” ranged from “truck and trailer” to “Ute and trailer,” highlighting the diversity of methods employed.

It’s worth noting that many sources consulted during the literature review were outdated, published more than five years ago. This reliance on qualitative research emerged as a more reliable source of current information, providing a nuanced perspective on the subject. Notably, there is a substantial body of research on temperature control and thermoregulation in hives, whether in motion or at rest.

A significant gap between existing literature and expert insights became evident, particularly regarding hive management and moving practices. The unique nature of moving hives, tailored to individual beekeepers, necessitated gathering information directly from experts through research methods such as interviews. These experienced beekeepers, with a decade or more of hands-on knowledge, contribute invaluable insights to bridge this gap.

Another notable observation is the dearth of Australian-specific data in the literature. While research from other countries provides relevant insights, the distinct climate and conditions of Australia warrant focused investigation and analysis within the local context.

Additionally, one article pointed to the stress experienced by bees during hive movement, highlighting the manual nature of hive transportation. Surprisingly, there is limited research on the long-term effects of transportation, emphasizing the importance of expert interviews to gather insights from beekeepers with extensive experience.

# DESIGN IMPLICATIONS

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Based on the research articles, interviews, surveys, and observations, the analysis of the data and discussion highlighted some key implications. The areas for opportunity are through ergonomics, mobility, and management of the hives. The designs would need to tailor the needs of commercial beekeeper as they are moving the hives more.

## Ergonomics of products


The ergonomics need to be explored more throughout the hive design. All the interviews showed the importance of making sure that the hives are easier to carry. The design of the current hives, still use the plans from the original Langstroth hive. The modifications that are currently being placed on to the hives allow for easier and more efficient way of moving hives. Current Langstroth hives create a larger risk of injury to beekeepers, especially hobbyists as they are more likely to move their hives by hand. Other products including pallets and smokers have not changed despite modern technology. By improving the ergonomics, it will increase efficiencies of moving the hives, creating less injuries and allowing for easier movement of the hives.

## Transportation opportunities

Although there is limited research into the transportation of beehives, the surveys, interviews, and observations allowed for a justified area for opportunity. Most beekeeper use a forklift and truck to move their hives for pollinations services, with pallets that are either the wrong size or have been modified. These methods have not changed since the start of commercial beekeeping and thus highlight an area of opportunity by incorporating modern technology. There could also be an area of opportunity with the type of vehicles that are currently being used, instead of using trailers and trucks.

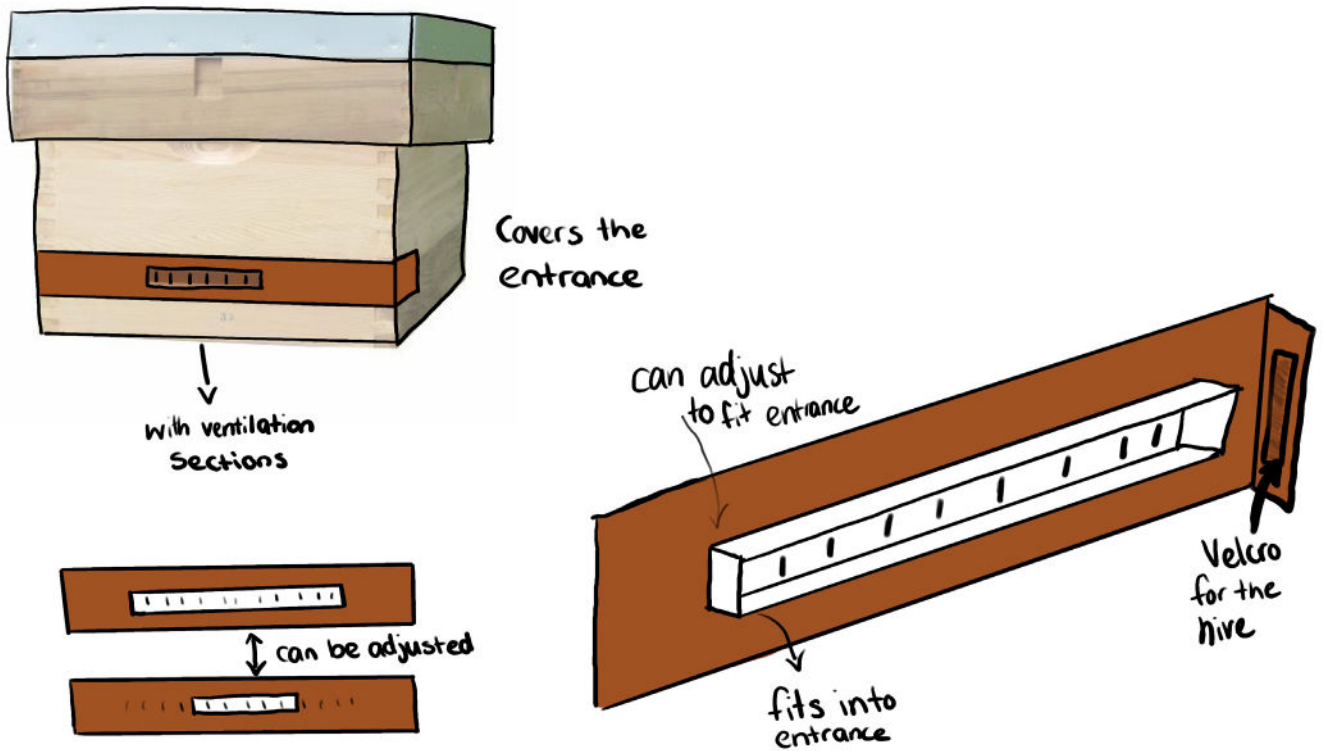
## Management opportunities

All literature research pointed towards the management of the hives during transportation as well as the interviews. The importance of keeping a hive healthy is fundamental to beekeepers as it is a very large industry. Whilst also producing honey, the bees must pollinate the crops in our food security industry. Overheating was the main issue whilst transporting the hives and this creates another area for opportunity. When on the truck the orientation of the hives matter as different parts of the truck get different airflows whilst driving. A cooling system could enhance the safety of the bees and thus keeping the food security and agricultural industry flowing.



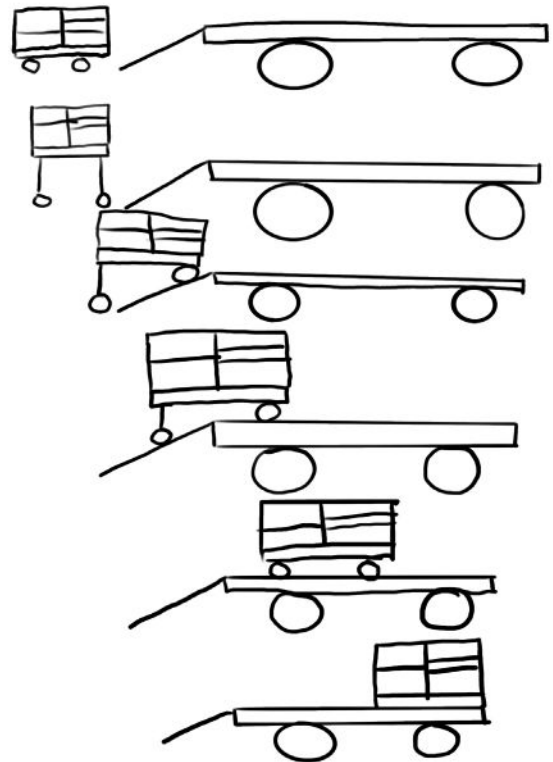
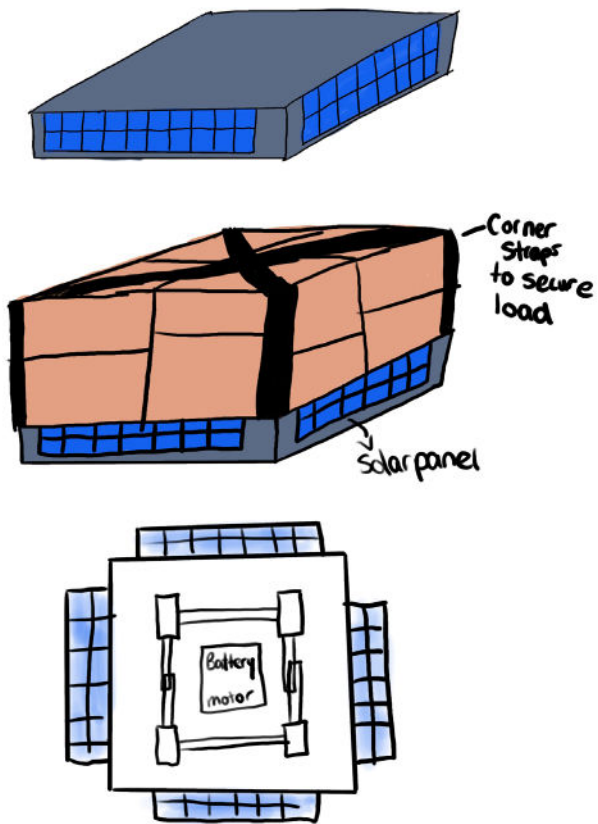


# CONCEPT 1



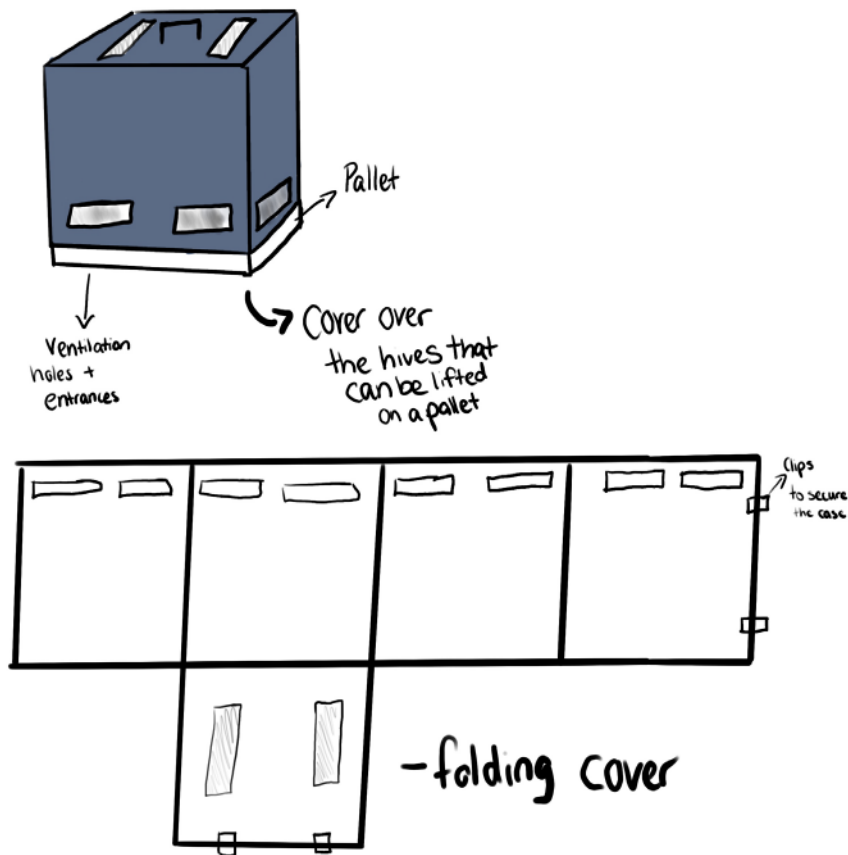
This design highlights the importance of the ergonomics whilst also highlighting sustainability. It is a reusable hive entrance cover. It allows for airflow within the hives which helps with managing the hives. As most hives have been modified, the entrance can be adjusted to fit within the entrance way. When the bees are being transported over night and depending how far they are travelling, could potentially be moved during the day, this cover allows for proper ventilation whilst not needing a full mesh cover for the hole vehicle .

# CONCEPT 2



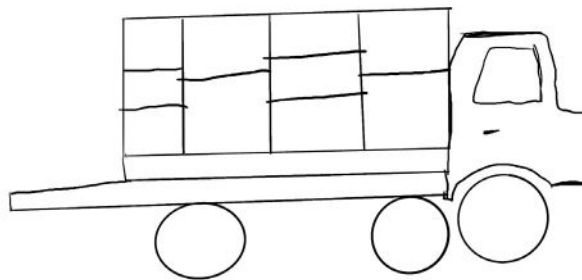
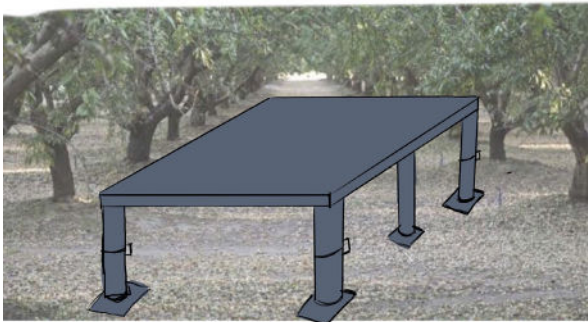
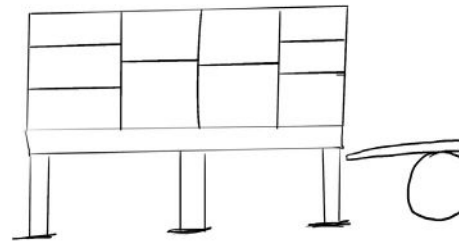
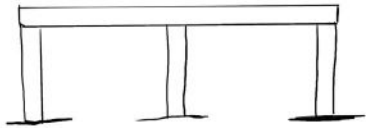
This concept addresses the opportunity of transportation and ergonomics. It is a pallet that fits four hives perfectly as well as being remote controlled. The hives will be secured to the pallet with corner straps allowing for better security. The whole system will be solar powered so that it is sustainable and with hives being outside, it allows for a good power source. When the hives need to be moved, the pallet will lift up, and move to where the truck is. Once positioned correctly, the system will self adjust to move up the ramps and then once positioned it will lock on the truck. This allows for less manual labour required for moving the hives.

# CONCEPT 3



This design highlights the importance of the ergonomics, management and transportation. It will be a hard cover, that will be placed around the pallet with the four hives on the pallet. It will lock into place and this will then be lifted up by a crane system on the back of the truck. This design makes a system where the hives do not need to be individually taken off the pallets when being unloaded. It allows for the hives to be a single unit. There is also entrance holes so that the bees can get airflow as well as being able to fly in and out of the hives.

# CONCEPT 4



This design highlights the importance of the ergonomics and transportation. The hives can be loaded on to the tray and left of there for multiple uses. The system will be able to be loaded on and off the truck in a singular unit. The tray can then be adjusted to the desired height. When collecting the hives, the truck and simple drive underneath the unit and the tray can be secured to the truck

# CONCLUSION



In summary, this research underscores the importance of combining literature findings with qualitative research to gain a holistic understanding of beekeeping practices. It highlights the unique challenges faced by Australian beekeepers and emphasizes the vital role that experts play in filling gaps in knowledge within this dynamic and essential industry.

The main areas that were focused on when identifying the design impacts and opportunities were the ergonomics, management and transportation of the hives and products. Many opportunities for design were created for this and was also informed by the literature finding and research. More long term studies of literature need to be done in order to fully understand the beekeeping industry in depth, including in Australia.

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# APPENDICES

Survey number 1

## Beehive transportation questions

\* Required

1. How many hives do you have? \* 

- 0-10
- 11-25
- 26-40
- 41-60
- 61+

2. What type of hive design do you currently use?

- Self made hive
- Langstroth hive
- Warre hive
- Top bar hive
- Other



3. Do you think there are any faults in the current design of the hives that you have? \*

Yes

No

4. If "Yes", please state faults below.

5. Do you have any recommendations that could be applied to the hives?

6. Do you transport your hives? \*

Yes

No

7. If "Yes", how far do you transport them?

With in my property

To different sites/states

8. How do you currently move your hives?

9. if you use a trailer or a truck, how do you get the bee hives from the ground to the trailer/truck?

10. What time of day do you move the hives?

11. When transporting the hives, are there any hive losses during the process?

Yes

No

12. Do weather conditions affect the transportation of bee hives?

Yes

No

13. If "Yes", what are the best conditions to transport in?

14. When transporting hives larger distances, what are the main concerns that arise during the process?

15. How do you cover the entrances of the bee hives, so they don't escape during transit?

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 Microsoft Forms

# Bee transportation PT.2

For pollination services

\* Required

1. Has your vehicle got stuck (bogged) whilst transporting hives? \*

Yes

No

2. Can you elaborate on your answer?

3. What materials are your hives made out of?

4. Have you tried other materials for the hives that you didn't like ?  
Please elaborate why you don't use them now

5. How do you secure your hives for transportation?

6. How do you prepare your hives for transport?

7. Once arrived at pollination site, how do you unload the hives?

8. How long roughly are your hives at a pollination site?

9. If the hives are at the pollination site for a longer period of time, do you have to check on the hives?

10. What do you do to a hive when it gets a disease or pest?

11. When at the pollination site and a hive has a disease or pest, what happens to the hive when transporting it back? Please elaborate.

12. How do you keep the temperature of the hives consistent/cool whilst transporting them?

13. Have you tried insulation for the hives to control the temperature of the hives? Please elaborate

14. How far away do bee hives need to be separated when placed at pollination site?

15. Is there a limit of how many hives can be placed in the same area of site? Please elaborate if you can

16. If you have anything else, you would like to add please feel free to add below. Thankyou!

## Transcript

Speaker 1:

Perfect. So when you transport them, what type of vehicle do you use?

Speaker 2:

I have a small flatbed truck and trailer.

Speaker 1:

Perfect. And could you describe the process of loading the bees onto that vehicle?

Speaker 2:

Okay, so the bee, I've got what's called an easy loader. What I can do is, I'll text your phone, see what it looks like. It's basically, it's Australian made in Ballina in Northern New South Wales and it's like a crane that goes underneath individual hives. So they're not on pallets, but they're individually text you a photo right now so you can see it. So it's on the back of the truck.

Speaker 1:

Okay. Have you tried using the pallet system to transport them?

Speaker 2:

Oh, okay. Good question. The reason why I don't use pallets, because a lot of my sites are very, very remote. I might have to cross creeks and that type of thing. And I'm only small scales only run about two 50 hives. And the reason is I've also got a four-wheel drive ute and the photo I sent you with the truck, I can actually get the ute and trailer into these sites. So I've got a lot of little sites that I use. So then I've also, obviously for the big stuff I can use the trailer. But yeah, for pallets it's not suited for me.

Speaker 1:

Okay. That's all good. So when you transport the hives, do you close off the entrance way?

Speaker 2:

Yes, I do actually, yes, I close the entrance off when I transport.

Speaker 1:

What do you use for that?

Speaker 2:

Ironically, I just used a, was bit different is a cloth to blocked the entrance. So then I use that because find it actually the easiest way. I've tried hive closes and all sorts of things over the years, but with a cloth, once you're on site, all I've got to do is quickly run around and pull the cloth and it releases the bees. And for me it's, it's a primitive way of doing it, but I found that the best way.

Speaker 1:

Yeah. Okay. How far do you take the bees? Does that depend on the season or?

Speaker 2:

Yeah, so how far? So from what would be say, Yarra Valley and they go to just near Robin Vale. So that's in a truck that's about a seven hour drive



Speaker 1:  
In a truck

Speaker 2:  
And it's about 500 something, just over 500 kilometres.

Speaker 1:  
That's a lot.

Speaker 2:  
I know I was doing that the other day. I had to do it twice. Yeah.

Speaker 1:  
Oh gosh. So do you have to do anything in particular before transporting the beers to get 'em ready for it or anything?

Speaker 2:  
Probably, yeah, good question. If I'm doing sort of big moves and there's not that many throughout the year, they're mostly sort of smaller ones. But I do, the bigger shift that I do is I just consolidate 'em at one site so they're all in one area and then I can do that, then I can move them from one area rather than going to all these different areas, loading 'em and then going have them all consolidated in one spot.

Speaker 1:  
Okay. Yep. So when you move them, how do you keep track of them?

Speaker 2:  
Track of got stickers that are on top of the hives and it's got, usually it's more got to do with strength of hive and what queen or genetics are inside each hive. But there is a room for notes, so I can go usually as far as where they've come from, I usually put the suburbs, so that could be Mansfield, could be Yara Junction, could be kangaroo grounds, so I can use that. It's pretty basic, but it kind of works.

Speaker 1:  
Yeah. So with the var mites spreading, how do you keep the hives from getting those diseases? Or is there no way to stop it?

Speaker 2:  
No, there's no way to stop it because the particular mites actually, they grow exponentially and if there's an infected hive close by, your hive can easily get it easily. It's transported by the bees.

Speaker 1:  
Oh, right, okay. Yes. Yep. So when you load the hives onto the truck, do they need a certain amount of room in between them or can they be jam packed together?

Speaker 2:  
No, they can be jam packed. The bases of each hive I use is ventilated, so I don't use ventilated lids, but the bases are ventilated and I do it at nighttime, so they're the coolest part of the night, so know's where I leave at, sort of midnight at night to actually move my phone. That's the best time of day, best time to actually do it so they don't overheat.

Speaker 1:

Oh yeah, perfect. Do you have to take regular stops to spray them down or anything?

Speaker 2:

No. No. Okay. Because the time of year being that spring, it's cool enough to do it. The big trips I do is always this time of year where if I'm doing smaller trips, once again it's at nighttime. Even on a hot night it's okay because I'm only a couple of hours driving and because you've got that wind driving, that keeps 'em cool. So I don't have to actually spray myself. And that's with the spots I'm usually in is a little bit more temperate as opposed to crazy hot. So that's not a concern.

Speaker 1:

So when you are preparing them moving into one side, do you manually do that with hands or do you use something else?

Speaker 2:

So there's fundamentally three ways. So let's say I've got the crane on the truck but doing big loads. I've also got a lifter, it's called a lift, carta lift, and that's made in Hungary and that's like a trolley and it's got a lifter on it. Yeah, electronic sort of lifter.

Speaker 1:

Yep. And I can see that you've got the straps going around the truck.

Speaker 2:

Yes.

Speaker 1:

Do they move, do the hives move around?

Speaker 2:

Oh, good question. If I've done the straps correctly. No they don't. Okay.

Speaker 2:

It's actually funny, the other day I lose track of days. I work full on this time of year, but I had a strap come off on the back of my trailer with five hives tied down to it and a truck was passing me and he sort of gave me the toot and fingers pointing towards the back of the trailer because I can't see it in my mirror. And I pulled over and actually the strap had come off and so the end, the hives were just sitting there. I'm quite embarrassing actually, but I'm a careful driver. So it's luckily they didn't fall off because that'd be devastating and dangerous. And dangerous too.

Speaker 1:

Yeah. Oh god,

Speaker 2:

I know. It's the sort of things where happened, you got to be careful because the other day it's a 19 hour solid working, so 19 hours solid and when you're tired, that's when you make mistakes. I hadn't done it really tight and it just happened to come loose.

Speaker 1:

So when you get to the different sites, do you use the loader to put them on the ground?

Speaker 2:

Not always. Sometimes I like to actually use a bit of physical movement, so if the hives crazy heavy, quite often I'll just lift them off by hand. I'll manually do it. Probably the reason so much driving involved is your body gets a bit stagnant and so to actually use some physical muscular sort of energy and actually I don't mind doing that so often, not always, but I'll often just manually do it. Probably not too crazy heavy.

Speaker 1:

And I assume that you can't put all the hives in one area?

Speaker 2:

Yeah, that's right. Yeah, generally not. Yeah, you've got to be spread out. Right.

Speaker 1:

And then do you put a mesh cover over the top of it as well or just leave it open? No,

Speaker 2:

No, I don't. Each hive is individually blocked. Yeah, I actually, because I don't shift them when they're with open entrances, yeah. I don't have to put a mesh over 'em. Alright.

Speaker 1:

Do you have anything else you could add or anything I should know?

Speaker 2:

I suppose tell me, so the project, I guess, what do you want to achieve with the project? You're doing

Speaker 1:

Better

Speaker 2:

Idea.

Speaker 1:

It is F for a design project, so I either have to, I'm trying to focus on the actual transporting the hives onto the trucks and just understanding that area of it because does it affect the bees a lot if they're being moved around?

Speaker 2:

Oh, good question. That's a good question. I think there is a certain amount of stress involved. Yeah, there's a certain amount of stress, but you know what I mean, it's obviously, yeah, but it's not detrimental. What I mean, so if I was to be in at a hive, I wouldn't be locked up and sort of thrown on and bounced around for hours and hours, but it doesn't, it's not detrimental to 'em. Okay. So it's got to settle down. Usually within four to six hours they've settled down, they've orientated and they've flat out foraging for pollen and nectar. So it's sort of not that bad.

Speaker 2:

Yeah, so if you're thinking like a design, they're called molden, pretty sure it's Molden honey, he's come up with a system for moving hives. So it's like a truck. The big trucks have got the curtains on the side and he's got a set up where there's a mister can set on a pump and it basically mist with water all that internal of inside the truck. So he moves his bees zone in hot weather so he can do that. So it's a bit done in a sort of quite unique sort of way. So that's one thing he does. As far as the loading aspect goes, having an all terrain forklift with pallets is definitely easier. But the problem is, it's kind of funny because the beekeepers you see that have pallets and forklifts, they're always fat. That true, always fat because they're not using any physical sort of movement. You know what I mean? So it's kind of funny. So that's how they do and that is a better way of doing it, more efficiency as far as loading, because loading is, other than the driving from site to site, it is quite time consuming. Loading bees onto a vehicle of sorts, there's a lot to it.

Speaker 1:

So the project is to drive increased efficiencies and biosecurity in the pollination service industry.

Speaker 2:

Okay, okay. Yeah, it's an interesting one. And as far as diseases that pests diseases go, the biggest culprits are beekeepers moving their bees and I'm guilty of moving bees and that's where this particular role might. Whereabouts are you based, Emily? Whereabouts are you?

Speaker 1:

Brisbane.

Speaker 2:

Oh, Brisbane, okay. So yeah, as far as have you've sort of seen in Sydney, Newcastle, it's spreading everywhere. I think there's over 230 IPS infected premises and all of them is because of beekeepers, even their bees. So they're the ones to blame as such. I do the same thing. So as far as biosecurity, as far as I suppose, yeah. What else? There's safety aspect, you know what I mean? I think the old straps around them, that works. You know what I mean? Whether it's pellets or singly, loaded hives during winter's, almond pollination on, there's always a beehive sitting on the side of the road where it's come off.

Speaker 1:

Oh wow.

Speaker 2:

Always. Yeah, always. Yeah. So it's kind of, I think maybe increasing that safety, but I think it's because it's the busiest time of year for beekeepers. Once again, once you're tired and you've got suffering from fatigue, that's when mistakes happen. So being fatigued, that's when that's more likely that be a problem than happen. Yeah, yeah. I'm trying to think of anything else I can add to it.

Speaker 1:

Any products or processes,

Speaker 2:

So processes of moving bees? Yeah,

Speaker 2:

Well the easy load is good. An Australian, I text you what it is, you can Google that, not all that far from you in Bona. So it's Australian design, they've been around for 30, 40 years or something. And that's a great, and they've got different models and definitely look at their website. We've got different models as to what they do from a small sort of sideline, hobbyist, beekeeper right up to big commercial beekeepers who can actually move one pallets. So these cranes can actually lift I think two box pallets. So that's a great sort of design. There's positives with using an easy loader. A crane is, it takes less footprint on a truck so that that's a negative when it comes to forklifts. So if you've got a forklift, you've got a big footprint on the truck so that all of a sudden that bigger footprint means you take less hives. So yeah, that's negative for that where a crane is efficient in aspects. As I said, for other beekeepers, for smaller beekeepers, there's this called comfort lift, so I'll send you that so you can sort of visualise that and that's a really good design for doing, finding that. Okay, there we go. So yeah, someone's sort of running 2050 pipes is a good, great way of doing it too. So I've got one of them as well, which is great for, yeah, as far as products go, I'll just text that to you. Yeah, yeah.

Speaker 1:

Oh yeah,

Speaker 2:

You said that's a little truck? Yeah, I think Where are the photos? Oh, oh, actually another one. Yeah, another. Okay. I'm just, sorry, I'm looking at photos and I'm going to send you a photo. You can see what happened to me. This happened to me a couple of days ago. A big, big problem with getting bees into various areas is getting bogged, getting stuck, you know what I mean? So there is something that some beekeepers have, it's hugely expensive, which is really good on putting on trucks. It's called C T I, which stands for Central Tyre Inflation. And having that on a vehicle, what it does is it basically makes your tyres go flat and when your tyres are flat, you've got more surface area to drive on sand and things like that.

Speaker 1:

Yep, that's a good idea.

Speaker 2:

Yeah, it is. Yeah, they do it. It's big in the logging industry in America, Canada and so forth. So the big trucks that moving logs or wood, they use it this C T I, but it is his expensive. That's the only problem. What else else can I tell you? Yeah, so I think transportation getting bogged all the time. Beekeepers get bogged because you're dealing with a big weight and I mean vehicles, some beekeepers use four wheel drive trucks, problems with a four wheel drive truck, you add another \$50,000 onto the price, you know what I mean? So it's not necessarily the efficiency of it's not necessarily that good and they don't drive as well. All our trucks on the highways. Yeah. What else can I tell you? Really?

Speaker 1:

I don't know.

Speaker 2:

I think that's send you a couple of photos. This is one of me, so you can sort of visualise it. There's one of me workers there, it's on Corolla. I'll sent a couple of photos last few days. So you get to sort of see

Speaker 1:  
How long do they stay on the sites for?

Speaker 2:  
Oh, good question. It does vary from crop to crop, any the sort of nuts and things they stay on usually three to four weeks, depending on weather dependent apples. All your stone fruits are the same, berries are different. Boobies, raspberries, blackberries, they can stay on for an extended period of time because what happens, you get the flowers coming on at different times. So yeah, so that's where they don't just have this big flowering period and then they stop. You know what I mean? Flowers can trickle. So especially breweries can go for sort of two months. You get big air flashers

Speaker 1:  
And you don't have to do anything to maintain them or anything.

Speaker 2:  
Yeah, it depends on how long in a short period of time. So less than a month, the answer's no, if it's that two months, usually enough to do one visit to make sure that they're happy and healthy bees. So it's usually that's enough to, for 'em to just make sure. Sometimes, obviously depending on the crops, a lot of crops can be very poor. Their flowers nutritional, their nutritional value can be quite poor. They've got low levels of proteins in a pollen and minimal nectar, so like apple's, pears, it can be really quite bad for these in that aspect, but it's for a short period of time. So it's not a big concern in that aspect. It does vary from crop to crop.

Speaker 1:  
And if they do get diseases, what do you do with the hives?

Speaker 2:  
Good question. It depends on the disease. So generally bees are going to, if you look at say chalk brood, that's a fungal infection that's usually got to do with the genetics of the bees and weather conditions and nutrition. So usually it's a case of increasing nutrition of the bees is enough, and sometimes require introducing new genetics, that's enough to clear up chalk brood you are up in brey, so if you've got bees up there, they have issues what's called African small hive beetles a real problem, you know what I mean? Sort of northern New South Wales, right up Queensland for the sheer fact is the beetles, the larval stage is like a maggot and they can kill hives like slime 'em out. So they're problem because it's cold and temperate down here, it's not a problem for us in Victorians, they don't have in Tasmania, upper small high Beetles as far as trying, you do see from time to time European fery disease and the worst ones American foul brew disease. It does happen from time to time, but those bees ever, it does happen. They're euthanized. And then what I do is any of the equipment, the box and frames and things goes to a place called stereo tech and they use the type of a microwave gamma radiation and the box is sterilised so I can use them again. Okay. So it's a way of minimising infection and that type of thing. And that just helps that more prevention as far as that type of thing.

Speaker 1:  
So if you took it to a site and then one hive managed to get a disease like that, would you take it back with the rest of them or would you do a separate trip?

Speaker 2:

No, no, I'll take it back with the rest of them. But they're locked up. Yeah, so they're locked up, so there's no way they could be transferred that disease. Yeah.

Speaker 1:

Okay. Your hives are made out of wood.

Speaker 2:

Yes. So I try and keep things as sustainable as possible. So it's Australian pine, sometimes it's New Zealand pine, so you buy 'em as a flat pack and we assemble 'em here. The boxes are treated in a very unique way. There's not a heap of beekeepers do it, but it's called wax dipping. So think of it like a potato, like a chip. So the boxes are cooked in wax at 180 degrees Celsius for 10 to 15 minutes. And so that dries out the wood and helps ate it. And then they're painted four times with white concrete paint that really? Yeah, you literally get decades out of them. That's a way of preserving the wood. I hate plastic, but the bases I use are made out of plastic. They're a ventilator plastic base. They're good for the fact they don't rot, you know what I mean? Wood rots over time. But being a plastic base that works really, really well. They're made here in Victoria in Swan Hill and they use a certain amount of recycled plastics, so they're quite plastics go. It's quite sustainable in a roundabout way.

Speaker 1:

Yeah. Have you tried different materials for the hives?

Speaker 2:

I've tried everything, absolutely. If there's a hive out there, I've tried it from e p s, which is expanded polystyrene to plastic hives to different types of wood and that type of one. So I've done all different types. I've found wood to be the best. I mean I try and keep the bees as natural as possible. So yeah, so I found that's the best product to use. But there's positives and negatives with all different types. So if you look at say polystyrene hives, they've got the best thermal properties. So their thermal properties are absolutely fantastic because actually they're three times better insulation than wood. So the bees will actually consume less honey over winter. They're known to produce more honey because they can once again due to the thermal properties, but they're negative is been polystyrene. They break easy. The wax moth, which is another pest, can chew holes in it, mice can bird can glass cockatoos. So that can be a bit of a problem. And I've tried them, there's two brands that I've tried, one out of Finland and the other one out of pond tried them, they're good, but once again, you tie a strapped to 'em, even though it's expanded poly historian. So it's hardened, it still can actually bend and break. So I'm not a fan of them and that's just me personally.

Speaker 1:

Yeah. So when you have them just not on the truck, when they're just on the ground, are they elevated?

Speaker 2:

No, not at all.

Speaker 2:

No, just go straight the ground, no issues with rot or anything. I use those plastic bases. I said every other component of the hives would, I don't use plastic beeswax sheets, so I use pure bees wax, which are embedded onto stainless steel wire. So I find they're really, really good. Once plastic's got its positives, but once again, it's prefer not plastic. If you give a frame of plastic to inside a bee, Ivan and natural wax, the bees always go for natural wax. They always prefer it. Yeah.

Speaker 1:

Okay. Can't think of anything else.

Speaker 2:

Yeah, I think if you've got any other questions or you don't be scared, just let me know if there's anything. Yeah, yeah. Shoot you for a message or yeah, let us know. Am I the first beekeeper you've spoken to?

Speaker 1:

Yes.

Speaker 2:

Have you talk to beekeepers? A little trick for you. You've got to hassle on. Okay. Yeah, don't be scared with beekeepers, don't be scared to pester 'em. Send them five messages a day. Beekeepers, generally you struggle to get 'em during the daytime, so yeah, after dinner is usually the best time to get 'em. What's your job, Emily? What do you do outside of studying? What do you

Speaker 1:

Do? I'm a swimming teacher. Oh, cool. Okay. Awesome. Cool. Very different.

Speaker 2:

No, it is different. Yeah, so you'll find, yeah, so don't be scared if you want to talk to other beekeepers, hustle 'em. Don't be timid, you've got to just hustle 'em. Call 'em even. Call 'em five times a day. But yeah, generally speaking, during the daytime it's a bit tricky getting beekeepers if it's nice weather. But yeah, if you need to talk to others, even after dinner, if you're not working, beekeepers will talk at nighttime.

Speaker 1:

Well thank you very much.

Speaker 2:

My pleasure. No worries. Anything. No, happy to help. And thank you for your patience too. Thank you. That's okay. And if you need any other help, I'm there for you. So if there's anything else, just lemme know. Happy to help.



Observation photos



Manually handling the hives

