🐝 Business Document

CONRAD

Innovation Challenge

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Conrad Innovation Challenge - Energy and Environment Division: TrHive Systems LLC Concept + Business Model

Executive Summary

The Problem:

Pollination is at an all time low. Currently, bee populations are declining across the globe, with many being faced with habitat destruction, invasive competition and lack of food sources to pollinate. Worse, it is difficult for hives to sustain themselves, as up to **30%** die out **every winter** globally (Ohio State University), with numbers rising past 40% of hives lost annually in the US (USDA). As a result of these issues, a global catastrophe is occurring as an estimated **35%** of all invertebrate pollinators (including bees, wasps and hornets) are at risk of **extinction** (European Parliament). Pollinators are **essential** when it comes to production of fruits, vegetables, flowers, oilseeds, alfalfa and more, causing catastrophic events on human populations with food insecurity. Food security is unstable across the world. Thousands of people go to bed hungry daily and production of agriculture is slowly declining, shown by the FRAC as, "about one in seven households (13.5 percent) in America struggled with hunger in 2023." This amounts to **47 million** people, including 13 million **children**, **annually** according to Feed America. Globally, "**1 in 12** people go to be hungry every year and **2.83 billion** people cannot afford a decent meal" (Action Against Hunger).

Despite this, producing more food, at least through current methods, isn't helpful. Sustainability in agriculture is being overlooked drastically as practices like the use of chemical fertilizers (particularly those made using the Haber-Bosch Process) damage soil and crops long-term, making entire **acres** of farmland unusable and infertile. The impact also directly impacts humans too, since the runoff from unsustainable agricultural processes can cause problems like birth defects, diseases and water shortages that directly impact local populations. In fact, "Agricultural runoff is the leading cause of water quality impacts to rivers and streams in the U.S" (USEPA), and this can cause physical issues, diseases and water shortages; agriculture is responsible for polluting **78%** of water and using 70% of freshwater (Our World in Data). The dark truth is that farming itself is unsustainable, as according to Carbon Brief: "**One-third of all greenhouse gas emissions** come from the global food system, and even if all fossil fuels were phased out, "food can on its own push us beyond the 1.5C limit."" The effects of this threaten marginal communities all over the world, the livelihoods of struggling farmers, unstable, fragile ecosystems' biodiversity (since bees are essential for the pollination of many plants, and suffer from pesticides and insecticides despite being beneficial to the environment), and our entire planet as we know.

Our Solution:

Due to the nature of global agriculture, which has increasingly focused on cheap food production over sustainability, our world is dying. Coupled with the horribly quick extinction of pollinators, we are in an **environmental crisis**. However, our solution, the TrHIVE system, is the first step in the right direction to solving the crisis. Pollinators already contribute more than **$200 billion** each year in ecological services globally (US Fish and Wildlife Service), and according to the Virginia Farm Bureau, **⅓ of all the food** we consume was produced with the help of honeybees. Additionally, "Pollinators affect 35 percent of global agricultural land, supporting the production of 87 of the leading food crops worldwide, and pollination-dependent crops are five times more valuable than those that do not need pollination," (UNFAO).

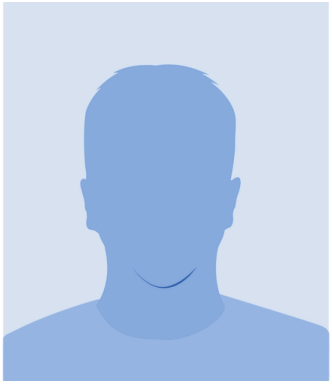
Pollinators are already a **sustainable** form of agriculture, and solve food insecurity and help reduce reliance on unsustainable methods of agriculture. Therefore, in order to create a system of mutualism between farmers, researchers and bees, we created the TrHIVE system. The TrHIVE system helps us track bee locations and pollination rates in real time using a TrHIVE portal. However, this isn't all. Using machine learning and cutting-edge artificial intelligence, we can use this data to additionally learn the approximate **location** of hives, environmental and plant **health**, **pollutants**, plant **toxins**, bee **preferences** and **biodiversity** of the local ecosystem. Another benefit is that, with access to these resources and metrics, consumers can also improve their agricultural practices, output, identify invasive species and ensure a clean environmental footprint with additional resources. The data provided by our invention has numerous applications and remains fluid and dynamic, able to adapt to many situations and overall be a net good for both the environment and society, helping farmers maintain output, supporting growing populations and ensuring biodiversity is protected in today's fragile world.

Our system aims to support them by providing accurate, real-time and affordable alerts and systems to farmers, wildlife researchers, and environmentalists by using a network of sensors to **see and support** these creatures that have long been crucial to our survival. With this invention, we will be able to help the world **thrive**, one bee, one hive, one farm and one country at a time.

Mission Statement: Saving Our Hives So That We Can All Thrive.

Vision Statement: Healthy Hives, Thriving Lives

Letter of Introduction



Atharv Chiravarapu:

When I was young, we used to go to India every 2-3 years. In my grandmother's house, I would learn about my father's life as a farmer. As the son of a farmer myself, I learned about my ancestors, values and history through my father's and grandmother's stories. However, 1 particular experience drove me to join this project.

One day, we were playing with the cows in my grandmother's back shed. Then, a huge bug came out of the roof, where it had made a nest. It scared me and my sister away. Crying, we went to our grandmother, and described the terrifying bug and how it had kicked us out and if she could come kill it.

"Why? That is her home," She replied.

"No, it's your home, grandma! How are we supposed to play with that thing always around, it might sting us!"

"That 'beast' you describe has been here with its ancestors as long as I have, and has helped this land far more than I have. It is a mother like me, a grandmother like me, and a pacifist like me. It protects its land from you because you are new, and have disturbed the peace. It is nature, and we must respect and protect it. No matter what we think inside."

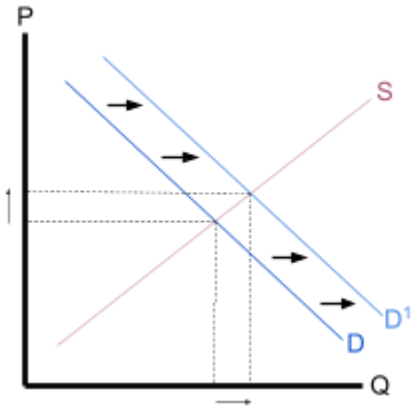
When the opportunity came to me to join this project, I immediately accepted because I've lived by those words of my grandmother for the past 10 years. I truly want to help protect nature and believe that this is the way to do so. And so, it is with great passion that I present to you this innovation which our team has spent countless hours working on, dedicated to making this world a better place. One hive at a time.

Innovation Visualization

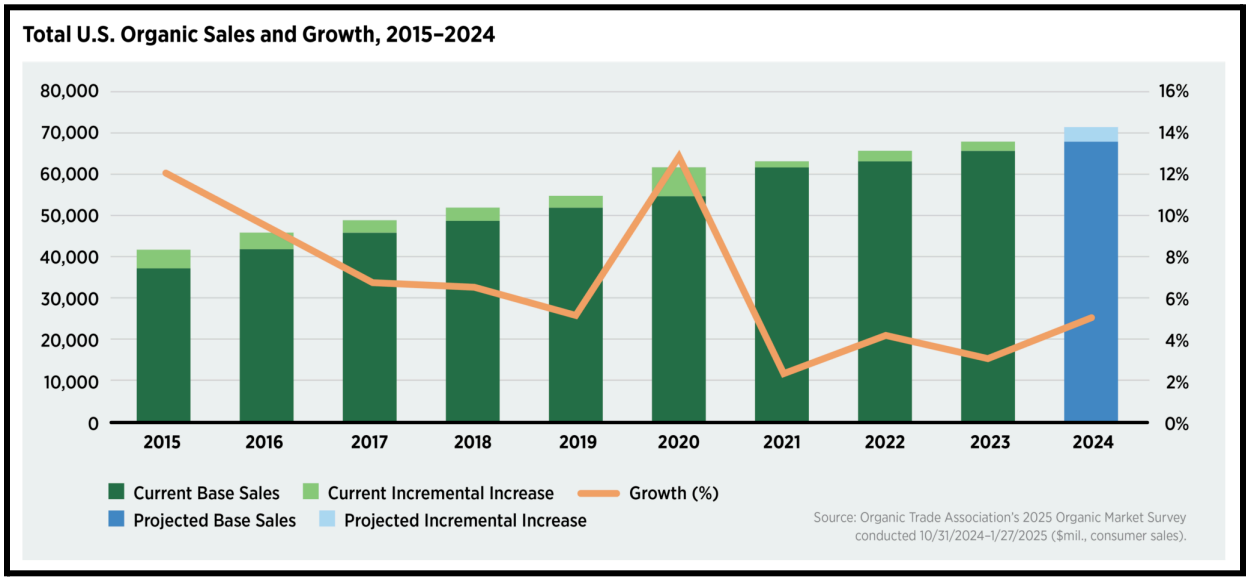
Business Model:

Marketing

Market Status Quo:



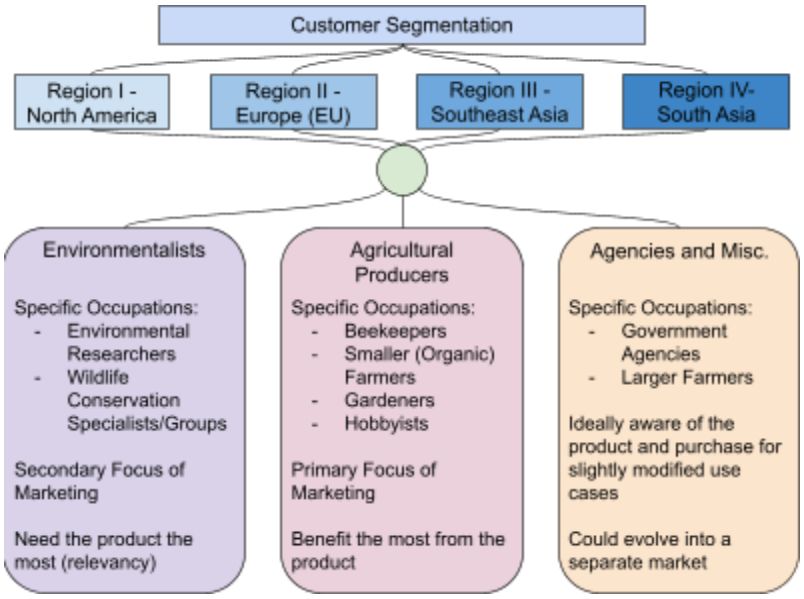
The market for organic crops has grown significantly in recent years. Particularly, organizations like the European Union and consumer trends (particularly in newer and more technologically literate generations like Millennials and Gen Z) have popularized the usage of organic crops over traditional ones that use chemical fertilizers, often harmful to the environment, in the interest of public health and sustainability. Specifically, the European Union themselves have set a goal for 25% of all farmland to be organic by 2030 (a 10% increase from current rates). Additionally, organic sales reached a record $71.6 billion in 2024, and have been growing steadily since, expanding 5.2% in 2024. However, the one problem with organic farming is that it produces a lower yield compared to more conventional methods like using pesticides, herbicides and fertilizers, which is the main thing preventing the organic market from growing more, and also happens to be one of the problems solved by our product. As demand for organic products increases in the market, basic economic knowledge dictates that the quantity of organic products produced will continue to increase in tandem, and price will increase too (making the market overall more profitable for farmers and, by extension, our company.



As seen in the graph above, the market has been steadily growing since 2021, and growth is projected to increase even more, showing an upward trend from 2023 that will continue in years to come as our world becomes more environmentally active and aware through tools like social media and various studies.

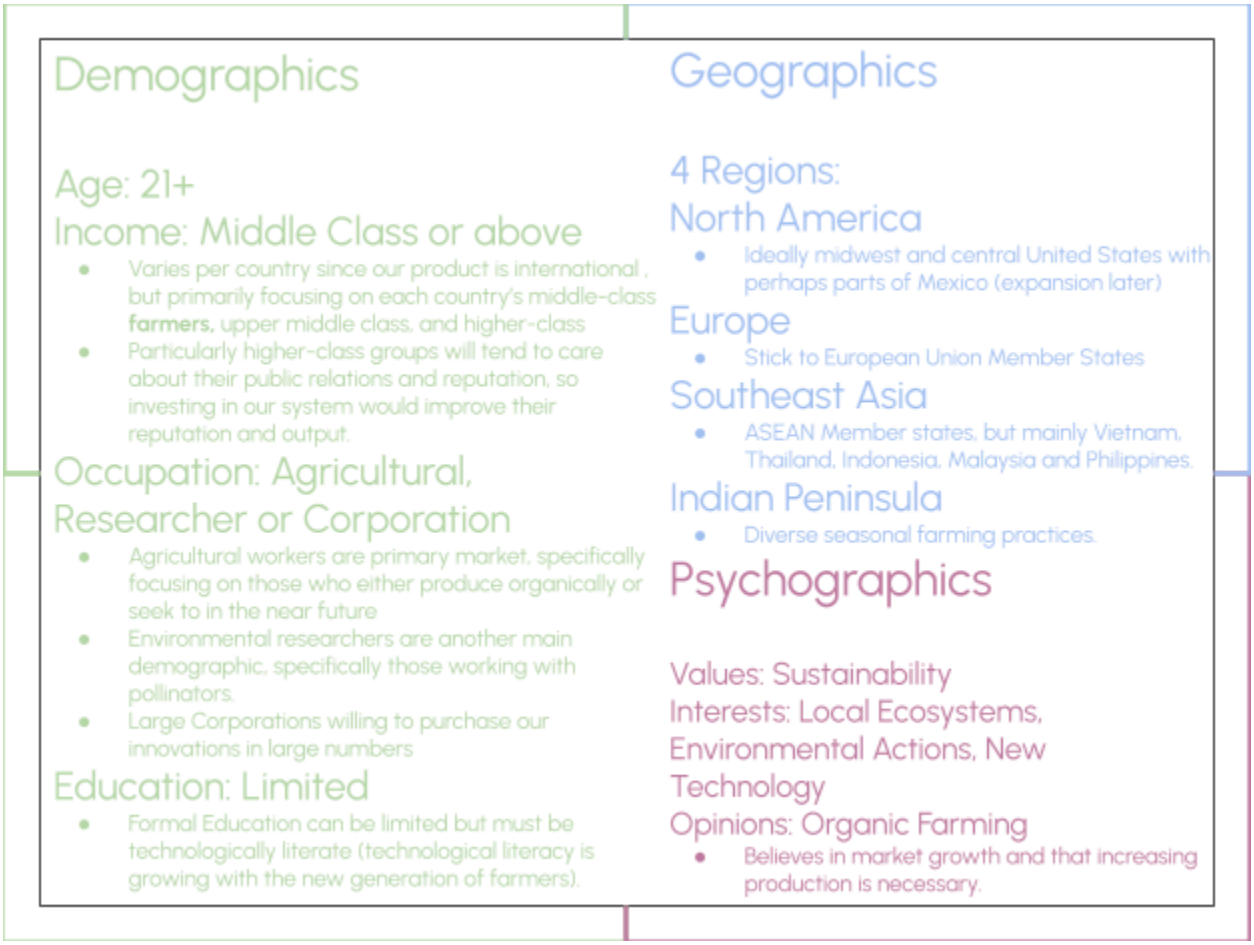
As a result, through market research and economic analysis, we can see that now is a time to take advantage of the growth and enter the market to make a positive impact on both farmers and consumers. Additionally, as globalization trends shift, farming is particularly becoming more prevalent in some regions of the world like Southeast Asia and Europe, making them prime locations for expansion of our product in the future (please look at the timeline for further details). Overall, these market trends have shown numerous reasons as to why the organic agriculture industry is sure to be profitable, holding great potential and promise for our business: the TrHIVE System, to enter.

IMarket Segmentation:



There are numerous separate markets for our products, but we've divided the primary ones by 2 categories: Demographics and Geographics. Specifically, our geographics are split between 4 regions, each with different entry times and strategies built of previous knowledge, with our first debut in North America (exclusively the US) and last* expansion into the Indian Subcontinent and China. During each expansion we plan on marketing **through various channels** to 3 groups: the Environmental Demographic (mainly focused on preserving the biodiversity and managing bee populations over a large area, generating a high demand for our products), Agricultural Producers (mainly focused on entering or gaining a greater market share of organic agriculture and seeking increased production), and another miscellaneous category for those more likely to order in large quantities (for example, environmental or wildlife protection agencies, large farmers with over 5,000 acres, etc).

In terms of geographics, each region of our expansion is further analyzed and chosen strategically. The United States midwest and great plains are known for their huge farms and have historically suffered from a lack of biodiversity (dust bowl), making it so that they will see the value of our product in protecting their fields. In Europe, the European Union's policies indicate an increase in organic food production, as described by Ceres Research, "As organic farming's benefits and viability have become clearer, many governments and industry bodies have set ambitious goals to scale up organics. Europe leads the charge: the EU's flagship target aims for 25% of farmland to be organic by 2030, a dramatic increase from roughly 10% today (Mohring, 2024). Several European countries are already well ahead – for instance, Austria has about 27% of its agricultural land organic (the highest in Europe), and nations like Denmark, Sweden, and Germany are pushing toward 20–30% organic land in the coming years. This growth is propelled by strong policy support: from conversion payments and farm advice programmes to consumer education and procurement policies favouring organic produce." In India, dense but large farms provide wide pollination grounds that can be monitored easily using our systems, and a population that is open to new technologies.



Additionally, since this technology could be modified to identify other insects too depending on frequency (we have already conceptualized detectors for other insects like Cicadas), tertiary market segmentation could be used to develop new and customized products for various consumers. Therefore, further research and development, when coupled with the principle of a product life cycle and our very unique market segmentation, means that new products could be made **using the same innovation** and principle for different use cases to appeal to different markets and maintain a profit and a stable environment for our consumers. This overall has developed our markets significantly and resulted in opportunities for our business to make its debut into the real world, changing lives one farm at a time.

Marketing Plans*:

Our marketing strategy is very unique, as we have a few factors to keep in mind:

1. Not all farmers are as interconnected to the rest of the world due to rural living conditions
2. The product must be marketed as eco-friendly, durable and affordable to gain the trust of consumers
3. Past efforts and statistics must be used to emphasize the effectiveness of the product and how it can improve productivity

Therefore, our main marketing strategy will consist of 3 parts to reflect these and the various details of our demographics, including both Environmentalists and Agricultural Producers

I. **Social Media Marketing** will occur specifically through channels such as YouTube, Instagram and Facebook since they are primarily used by farmers and also will easily reach out to Environmentalists who tend to be connected to others digitally and take part in digital marketing and campaigns for their own purposes. This will help us reach the majority of our environmentalist market. Additionally, environmental research communities exist on other platforms like Reddit and LinkedIn, allowing us to make more professional connections, gauge interest and take in feedback in 2 way communication channels that double as marketing channels to some of our biggest markets.
II. **Cable and Television/Radio** marketing and older forms of advertising are often popular with farmers, so getting on a station or getting a TV advertisement would be great for extending reach to rural areas, but also reach some of our Environmentalist segment of the market. Specifically, rural communities often do not have access to the most cutting-edge technology, and it is worth

acknowledging that their hard-to-reach market may still use physical deliverables or Cable/Radios, making those a crucial part of our marketing strategy to appeal to our largest customer base.

III. **Magazines/Print Advertising** will be very effective in reaching rural areas since studies show that numerous farmers actively purchase magazines and similar, physical forms of media. Getting into one of these could allow us to introduce ourselves to farmers and become popular with them, while also acting as a way to promote ourselves in a familiar method to a market. As such, this marketing method will be used to reach the majority of our Agricultural market segment. Additionally, entering business insider magazines would allow us to appeal to the hard-to-reach third market of agencies and large farmers, making this by far one of the most important ways of advertising.

One of the main principles of international business is change. When entering a new country, one must completely change their approach to marketing and finance, and as such none of these marketing ideas are set in stone and are designed to be in a dynamic state, often changing and adapting to all the countries we plan on entering in the future. These are, however, the marketing methods that we believe will have the highest impact and chances of success among all our respective markets, providing our business with a balance of marketing when combined with passive marketing.

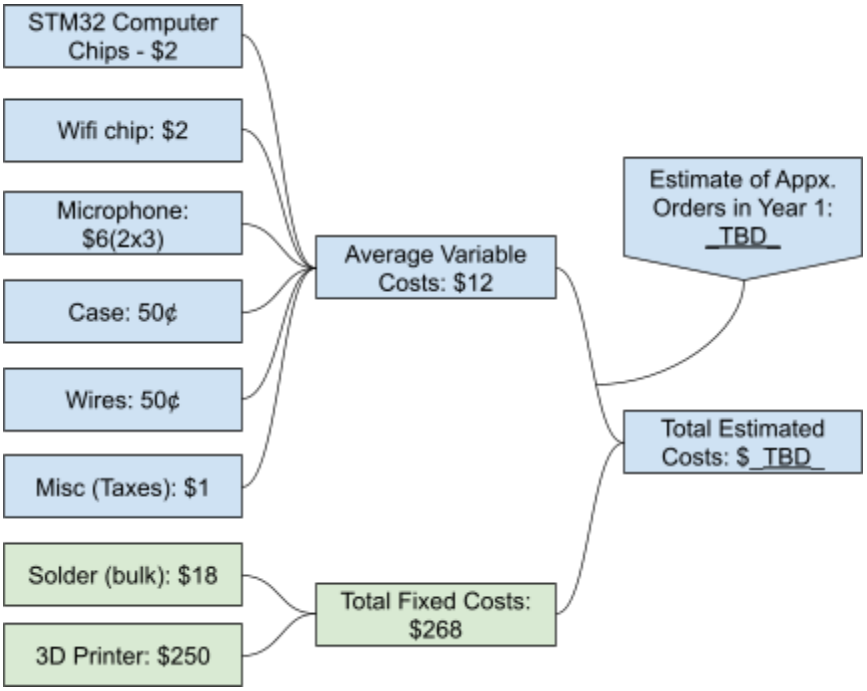
Example Marketing Deliverables:

Social Media Post (right) and Magazine page (left).

*Subject to Change as product develops

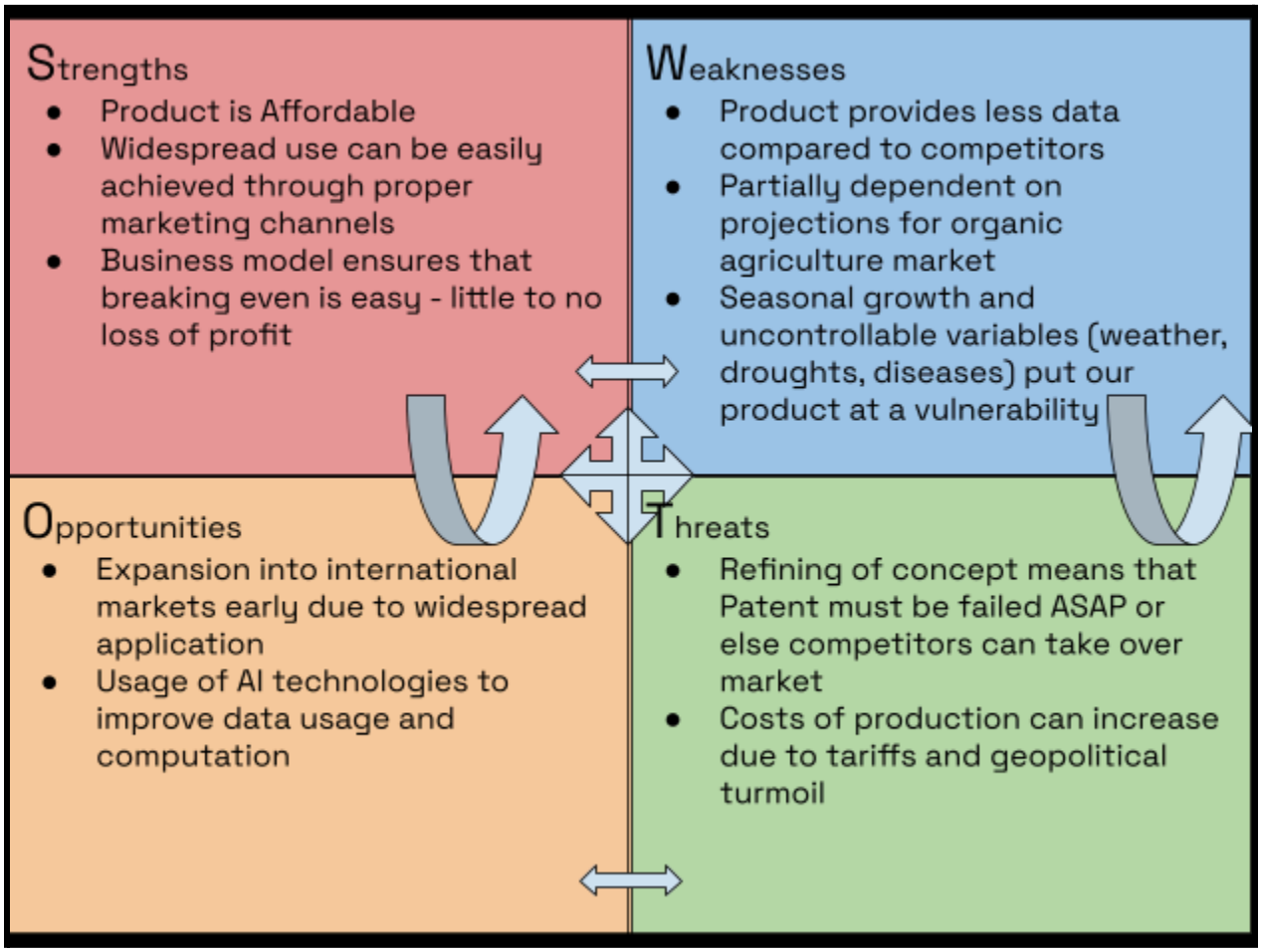
Production and Finances

Unit Production Details:



Our product is designed to encompass many components, so we have taken the liberty of calculating our costs. In total, each unit costs $12 to make and sells for around $25, giving us a profit of $13 per unit (not including fixed costs) and a profit margin of almost 52%. All of these prices are, of course, subject to change and hard to determine in the current geopolitical market. Therefore, we have allocated additional funds in case prices increase and are also wary of the current market, as all the prices shown are up-to-date before the Conrad Innovation Challenge Innovation Summit. However, with this profit margin, it means that we would have to sell a minimum of 21 units to break even (not including revenue from additional revenue from subscriptions and insurance).

Product Analysis



Revenue Streams

Currently, our product will be generating revenue in 3 specific ways:

1. Sale of Kits
2. Sale of Individual Units + Upsells
3. Yearly subscriptions to software

Sale of Kits and Product Bundles:

Due to the unique nature of our product, consumers will need to purchase a minimum of 3 units to initiate the system, and those 3 units will cover a circular area with a radius of approximately 10-20 feet. This means that 3 units will cover approximately somewhere between 315-630 square feet and will therefore be sold at a

pack price of $45 for 3 sensors. These packs will be necessary and ideal for starting the system and since they are sold at a cheaper per-unit price than buying individually, they will be ideal for starting out. From there on, expansion packs of 5 for $75 will also be sold and be our primary source of revenue. Each system functions through the creation of a system between individual TrHIVE units, and can be managed using the TrHIVE portal. We have priced out 2 kits specifically for these purposes. Using the marketing principle of product bundling, each sells units at a lower price than purchasing individually ($45 for 3 = $15/unit, $75/5 = 15/unit, normal price per unit is $25). Overall, these will be the main driving factors of our business and will make up a significant portion of the profits. As the product continues to change and grow, with new models being introduced and the business develops, product bundling will continue to be a staple of the company, allowing us to incentivize sales.

Sale of Individual Units + Upsells:

In order to maximize profit and keep our bulk/pack orders a feasible option, we'll be selling each individual unit for $25, a strategic price since it is too expensive to constitute purchasing over the package deals when more than one is necessary, but cheap enough that it will be the ideal option to purchase to replace an already broken unit or if a user wants to extend their area. This way we also have a way to sell all of our excess units-assuming we reach excess capacity-and give them a great value. Price deals can also go as low as $15 while maintaining profit, making future opportunities for deals and discounts possible. Additionally any seasonal discounts or further deals would significantly increase demand. This way, it is a secure and profitable secondary stream of revenue and profit for the company.

However, that's not all. The TrHIVE unit is accompanied by a series of upsells that function primarily as incentives. These work because the TrHIVE Sensor Units are designed to be modular, and this allows for us to design a business model around upgrades and additional products to increase durability, longevity, sustainability, and accessibility of the product. These will be either sourced low-cost (dropshipping) or constructed without being a major aspect of the product, but will be uniquely designed to work in tandem with the TrHIVE Unit. So far, these are the upsells we have come up with:

1. TrHIVE Manual
2. TrHIVE Bee-Attraction Pheromone Spray
3. TrHIVE Unit Hardcase +
4. TrHIVE Unit Solar Power Extension
5. TrHIVE Unit Hardcase S (Case for solar panels)

6. TrHIVE Holding Rope Hooks

Additionally, more TrHIVE units and differing models can come out in the future, and the modular design of our system allows us to continue expanding the product catalog.

Yearly Subscription + Insurance

Because of the nature of agricultural products and how they tend to be relatively seasonal in terms of demand, our product will need to gain some source of revenue during the winter months, which will be solved through a subscription. This subscription will cost $25 per year and an additional $5 will be added per TrHIVE unit connected. This subscription is meant to be purely as a subsidiary to any seasonal losses we may incur during the winter months due to lack of purchases, and allows us to also charge for access to the app/website that is being developed alongside the TrHIVE units. The subscription gives the user access to the TrHIVE portal, the virtual space where they can view all the data their TrHIVE units have stored over their lifespan. Access to this portal is a must, as it allows consumers to access pollination distribution rates, identify hive locations, have an idea of where there are environmental problems or pollution that hurts pollinators, and identify bee population preferences depending on location, plant species, climate and more! As a result, this will act as a back-up stream of revenue that will support our business during its toughest times. Most agricultural companies have a tendency to experience seasonal demand and profit increases and decreases due to the nature of their industry. Although international expansion helps with this through the entry into other agricultural markets that all operate over overlapping schedules covering our losses), this subscription (which is paid biannually during months with the least growth) subsidizes our losses.

Additionally, we will be offering a monthly subscription for damage against all natural causes that provides up to 5 reciprocal units per year (in case a few break, only if due to natural causes), which will be very useful during the winter season for maintenance and revenue with a similar policy, costing $20 but increasing by 1 per unit used. This is meant to, once again, be an affordable way for us to maintain profits during tough economic times, while also allowing farmers to ensure their products remain safe and ready for the next growing season.

Product Catalog

Item Name	Item Cost (USD, Pre-taxes)
TrHIVE Portal Subscription	$25* per year, charged biannually

TrHIVE Sensor Unit - Normal	$25
TrHIVE 3-Pack Sensor Units-System Setup	$45
TrHIVE 5-Pack Sensor Units-Expansion Pack	$75
TrHIVE Insurance Package	$20* per month
TrHIVE Manual - Everything you need to thrive!	$25
TrHIVE Bee-Attraction Pheromone Spray	$5
TrHIVE Unit Holding Ropes	$15 (3 ct)
TrHIVE Unit Hardcase +	$11
TrHIVE Unit: Solar Power Attachment	$25
TrHIVE Unit Hardcase S (for Solar)	$10

*Price may change depending on units purchased

Data Management

Compared to our product, oftentimes competition uses visual data to monitor bee populations. This leads to a data deficit where our product is often given less, making some think it is not worth it. As a result, we have begun to incorporate machine learning and artificial intelligence into our systems for advanced calculations to make our product more effective and efficient. Currently, we only receive data on where bee populations pollinate relative to a TrHIVE unit and during what time they do this. However, using this data and simple calculations we can provide our consumers with additional information and data powered by artificial intelligence.

All of this data would be distributed through each consumer's TrHIVE Portal, justifying the costs of our subscription and adding value to our product. Firstly, using the information about where bees pollinate, our system can use the data to essentially estimate locations of the hive using Bee Lining and the assistance of a user. This allows us to essentially provide additional information and value to our consumers, and opens up new use cases for our product (it could be reworked in future models to essentially locate invasive bee nests and help farmers destroy them.

Secondly, the TrHIVE system can also notice areas with abnormally lower rates of pollination, which could be considered a sign of toxicity or pollutants in the area. Using

data analysis, we can identify these lacking areas and assist users in improving farm and ecosystem health and efficiency in a single approach.

Lastly, the TrHIVE system could also use the data and machine learning to understand the preferences of bees and how they're affected by climate, temperature and more based on current statistics and situations. That isn't the limit though, once we have data on hive location this opens an entire door for research on completely new information. For example, one can use the data of honey through a process called HoneyDNA to identify where bees travel and invasive species in the area and other factors that may affect the pollination of plants and production of honey. All of this goes to prove that the possibilities are truly endless!

Overall, through effective data analysis and management we can transform the TrHIVE unit into something that not only helps us see our buzzy friends, but into a cutting edge piece of technology that helps us save local ecosystems and helps the world, one hive at a time. This increases value of our product and differentiates us from our competition, as we can provide more data and information about hives at a cheaper rate despite actually having comparatively less access to information and data, allowing us to outperform competitors and maintain a good relationship with consumers and the public as we help in research using cutting edge technology.

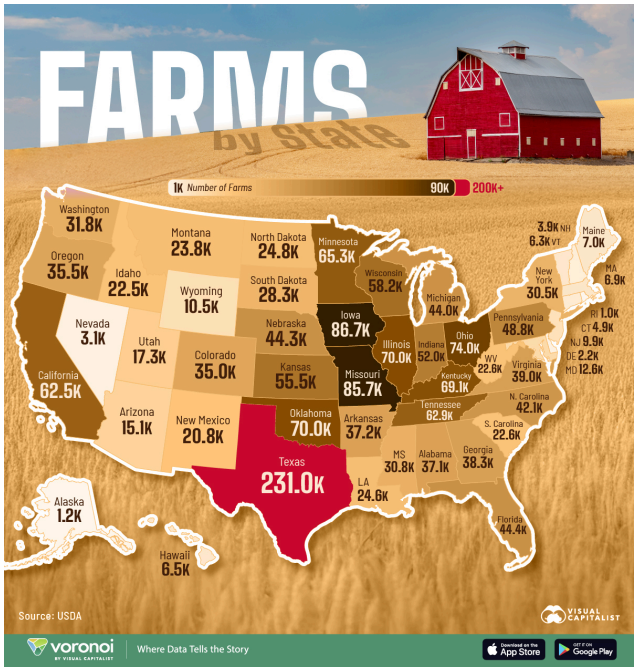
Timeline and Forecast

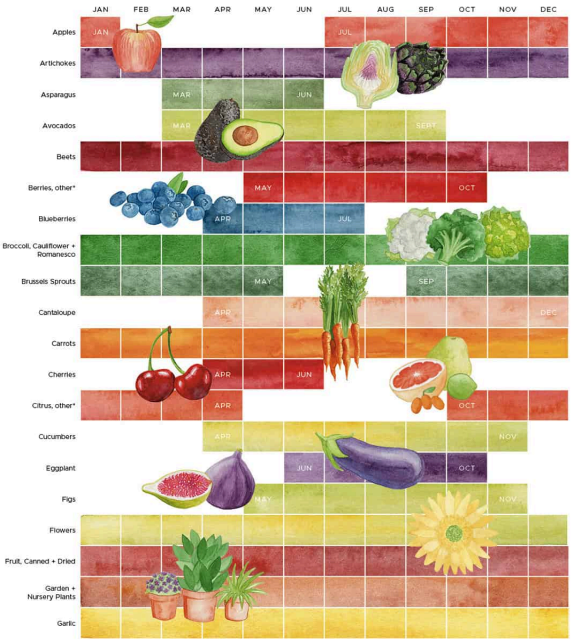
Since this business is currently in the development phase, we are currently not ready to start. However, we do have a detailed timeline for our goals and dates, specifically regarding marketing campaigns and entering new markets. However, like any good company, our timeline is subject to change, and is structured around being both ambitious and realistic, with dynamic dates and schedules for entries into new markets. This timeline has been drafted using information on agricultural seasons from all of the countries we plan on exploring and entering:

- **Region I: North America (Specifically USA)**
  - There is always a period of preparation between growing seasons, which is when our product should be introduced to the market:
    - "Once the fields have been harvested and the combines have been stored, things get a little quieter on the farm. Farmers use this time to review yield maps, and make the decisions on how they should proceed the following year. This is also the time of year when

budgets are set and supplies are purchased for the next planting season." - ThunderStruck

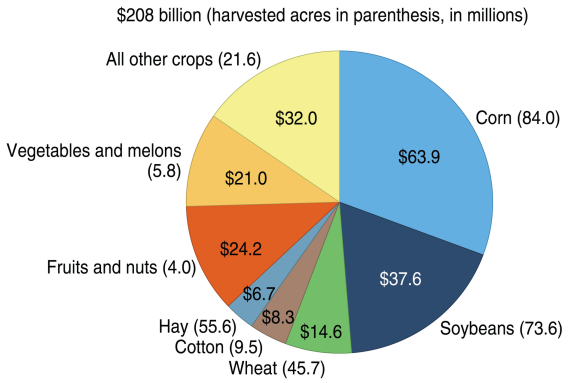
- The prevalence of agriculture varies per state but most farmers are located in the central and western parts of the state, with a significant amount located in the Midwest, Texas and California.





- The top crops produced in the United States happen to mostly be ones that could be positively affected by increased pollination and often rely on bees:
  - Corn
  - Soybean
  - Hay
  - Wheat
  - Cotton
  - Sorghum
  - Rice
  - Barley
  - Canola
  - Peanuts
    - Of these, Bee pollination can assist with all non-cereal crops (which do not make up a majority but still are a significant portion of the US's agricultural output.

2011 crop cash receipts ($ billion)



Source: USDA, Economic Research Service.

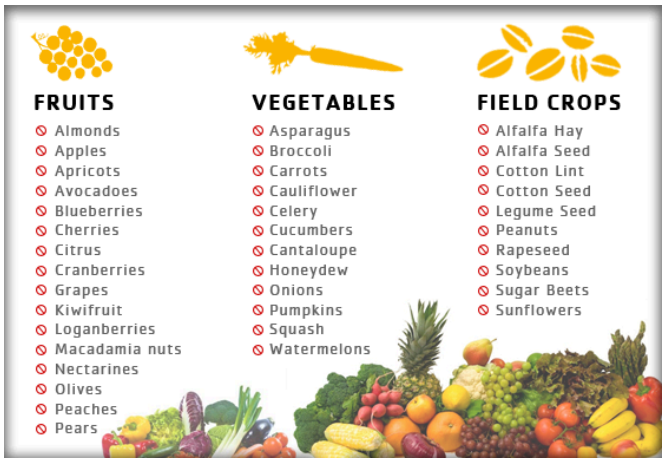
➢ The United States relies significantly on crops like vegetables, fruits, nuts, and soybeans (all of which are known to be affected by bee pollination, which make up almost $83 Billion industries, creating a prevalent and ecologically important market for our product that also retains a high demand.

➢ There is a wide reliance on pollination depending on crops, and some may find it more crucial to growth than others, making regional studies important during market entry in the US. For example, Georgian farms that produce peaches may rely more on our product and pollination services in general compared to Floridian citrus farms (although Floridian farms still may have a reliance on our product, just not as much compared to Georgia). This explains the necessity of establishing a strong supply chain in the Region I market.

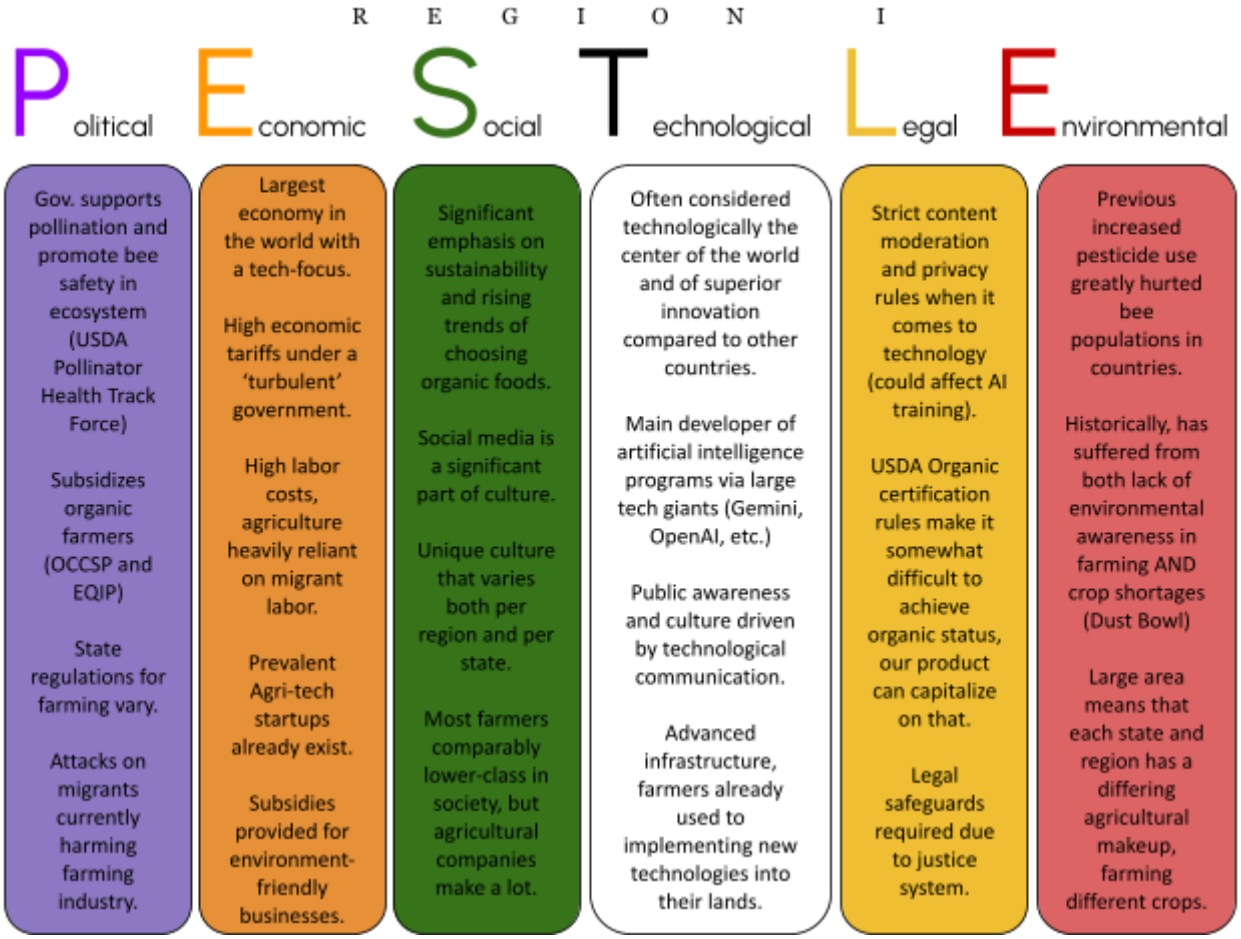
How dependent are foods on pollinator insects? Our World in Data

No dependency Yields are not affected by pollinators	**Cereals:** wheat, maize, rice, sorghum, barley, rye, millet, oats **Roots and tubers:** cassava, potatoes, sweet potatoes, carrots **Legumes** including lentils, peas, chickpeas **Fruit and veg** including bananas, pineapples, grapes, lettuce, pepper **Sugar crops:** sugar cane and sugar beet Also includes: areca nuts, asparagus, cabbages, castor oil seed, cauliflower, chicory roots, dates, garlic, hazelnuts, jojoba seeds, leeks, olives, onions, pistachios, quinoa, spinach, taro, triticale, walnuts, yams.
Little dependency Yield reduction of 0% to 10% without pollinators	**Fruit and veg** including oranges, tomatoes, lemons, limes, papayas **Oilcrops** including palm, poppy seed, linseed, safflower seed **Legumes** including beans, cow peas, pigeon peas **Groundnuts** Also includes: bambara beans, chillies, grapefruit, persimmons, string beans
Modest dependency Yield reduction of 10% to 40% without pollinators	**Oilcrops** including sunflower seed, rapeseed, sesame, mustard seed **Soybeans** **Fruits** including strawberries, currants, figs, gooseberries, eggplant **Coconuts and okra** **Coffee beans** Also includes: broad beans, karite nuts, seed cotton
High dependency Yield reduction of 40% to 90% without pollinators	**Fruits** including apples, apricots, blueberries, cherries, mangoes, peaches, plums, pears, raspberries **Nuts** including almonds, cashew nuts, kola nuts **Avocados** Also includes: cucumber, buckwheat, nutmeg, anise, fennel, coriander
Essential Yield reduction greater than 90% without pollinators	**Fruits** including kiwi, melons, pumpkins, watermelons **Cocoa beans** **Brazil nuts** Also includes: vanilla, quinces

Sources: Marcelo Aizen et al. (2019) and Alexandra-Maria Klein et al. (2006). Icons sourced from Noun Project.
OurWorldinData.org – Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Hannah Ritchie.



➢ This graphic dives more into depth on species and plants of fruits, vegetables and field crops that rely heavily on pollination and are grown in the United States, representing opportunities for our product to grow. Specifically, the fruit market appears to be diverse and rely heavily on pollination, making that a crucial factor in entry. Particularly, it opens up numerous markets for us to enter.

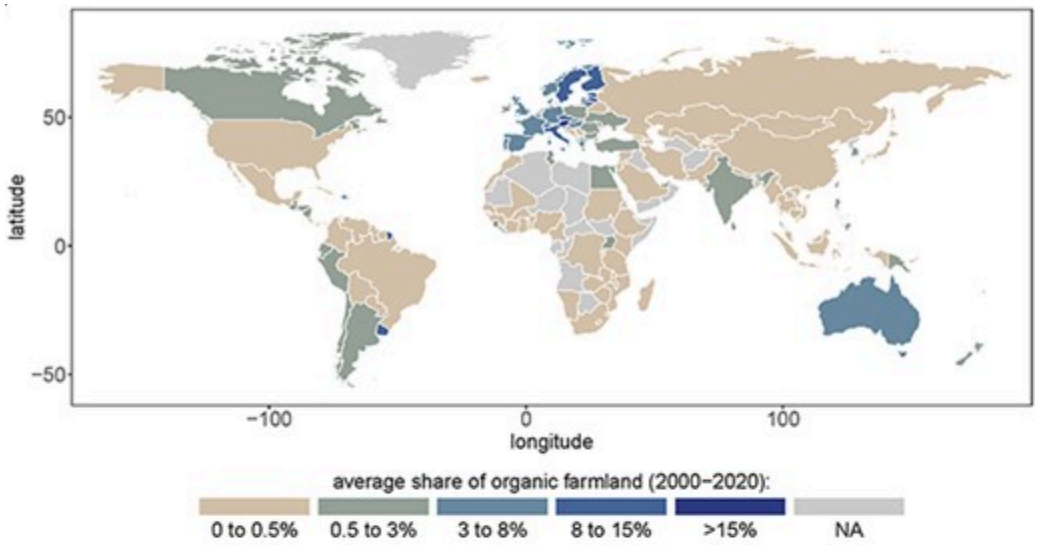


❖ **Region II: Europe (Specifically European Union member states + UK)**

➢ The European Union has already begun to support organic farming and the setting of strict laws about the establishment and management of environmentally-friendly farming practices.

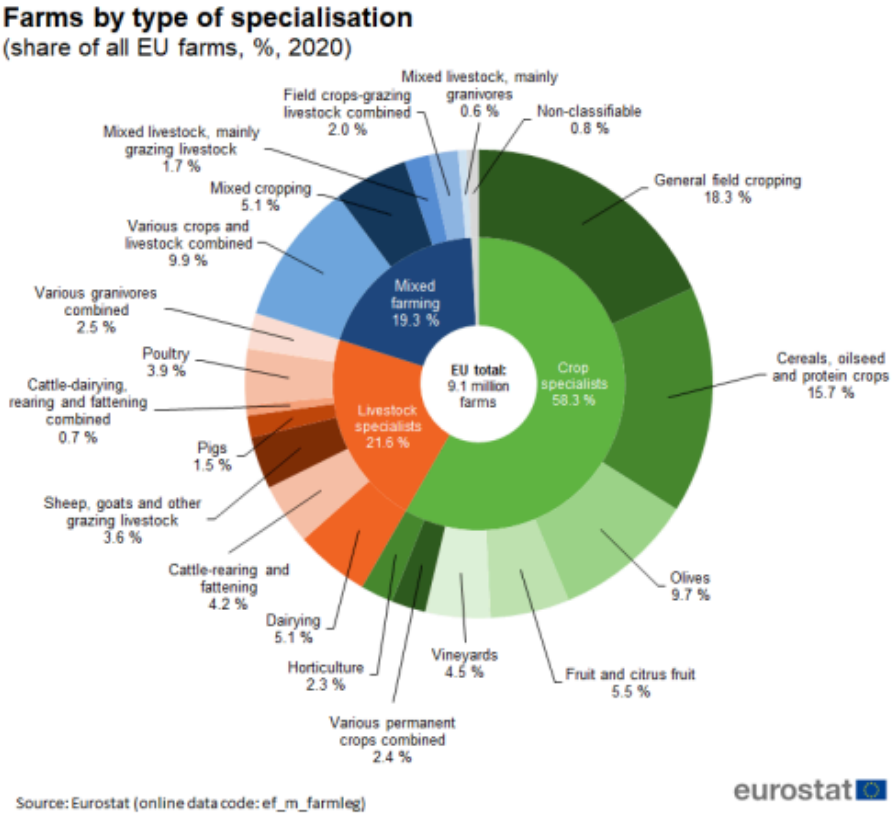
- "Europe leads the charge: the EU's flagship target aims for 25% of farmland to be organic by 2030, a dramatic increase from roughly 10% today (Mohring, 2024). Several European countries are already well ahead – for instance, Austria has about 27% of its agricultural land organic (the highest in Europe), and nations like Denmark, Sweden, and Germany are pushing toward 20–30% organic land in the coming years. This growth is propelled by strong policy support: from conversion payments and farm advice programmes to consumer education and procurement policies favouring organic produce." - Ceres Research
- Organic farming is still scarcely practiced outside of Europe, but Europe hopes to spearhead the development and has already made

significant strides towards going organic. Specifically, the Nordics have some of the highest rates of organic farming in the world.



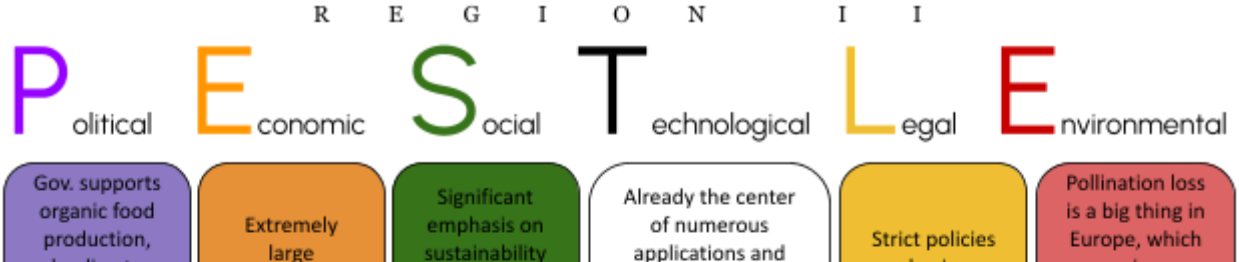
- A majority of European Union agriculture is based around crops, of which a majority are cereal, but **there is a significant portion** of fruits and other plants that could benefit from pollination. This diverse might seem like a comparably small market (particularly when compared to other regions), but is actually a very profitable

and ripe market for our product because of a few reasons:

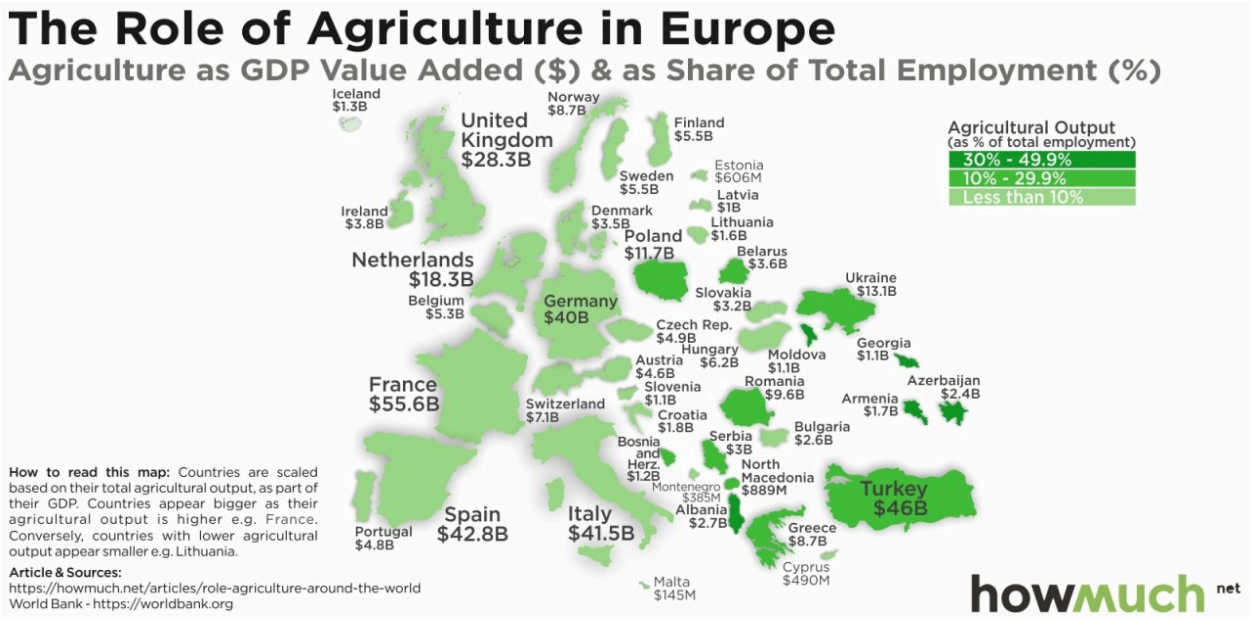


- Firstly, the livestock market of Europe should not be overlooked. The crops grown to feed livestock are often referred to as Alfalfa crops, and remain extremely important for the European Union's agricultural sector and also happen to rely heavily on pollen, often benefiting immensely from pollination and having good reciprocal effects on the livestock they feed. This opens up a completely new and unique market and use case for us that also makes our AI tools that analyze data and detect anomalies in bee pollination patterns and possible pollutants and toxicity more useful to farmers (like those who are raising animals).
- Secondly, the European Union's recent political actions and orientation lean heavily toward sustainability, and their proclamations of increasing the portion of organic farmland leave much to be desired (since compensation in output needs to occur), which our innovation can help fix.

➢ Overall, this makes Europe an open and profitable market for us to enter!



➢ Particularly in the EU, some countries produce more agriculturally than others. According to our research, our top contenders for primary introduction remain Germany, France and Italy. Additionally, despite not being in the EU, the UK is also an option for expansion (though it has had less public statements about increased organic crop production.



❖ **Region III: Southeast Asia (Specifically the Philippines, Indonesia, Thailand and Vietnam)**

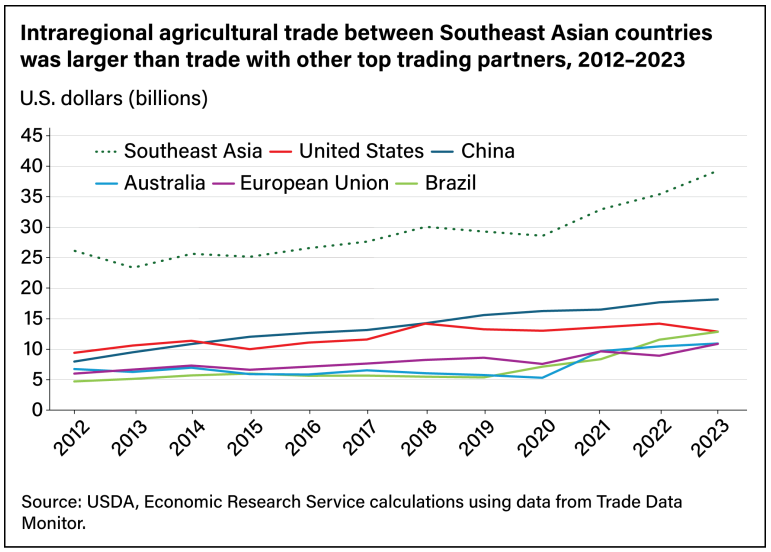
➢ Southeast Asia is home to 8 out of the 9 known honeybee species in the world, and suffers from significant conservation difficulties that often are under-publicised compared to those in other continents. Particularly, they suffer from predators, diseases and parasites, and remain poorly protected against the numerous human threats they face. Additionally, they are crucial to the local ecosystem and are poorly-documented, making their conservation of the utmost importance - something our innovation can help with.

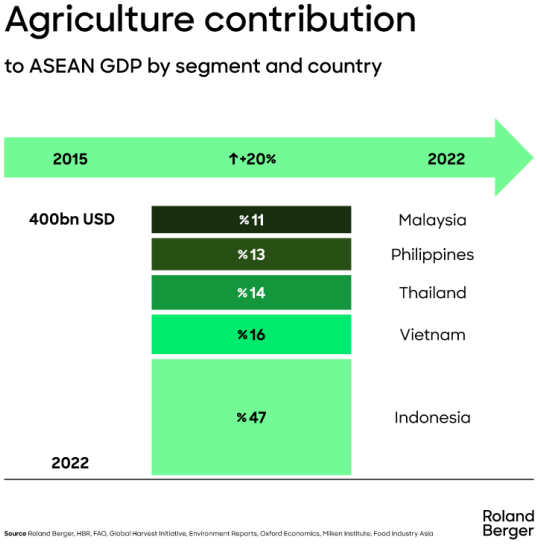
- "While some crops can be pollinated by several species, other crops are dependent on a specific bee species. The Asian giant honey bee, Apis dorsata, which has the unique ability to forage at dusk, is essential for the pollination of crops and trees which bloom at night, such as the dragon fruit (Hylocereus undatus). [...] A collapse of native honey bee populations could have cascading effects on the biodiversity of Southeast Asian ecosystems." - German Green Foundation in an article on the importance of southeast asian honeybees to ecosystems and the environment.

- Southeast Asian honeybees are also culturally significant, as ‘honey-hunting’ is a major source of income for many and the honey provided by these bees are major parts of cultural medicines and rituals in southeast asian countries.
- Threatened by deforestation, agriculture intensification (increasing plantation space at the expense of natural land), pesticides/insecticides, climate change, and destructive honey hunting
    - Honey-hunting can be either destructive or constructive, but greed and scarcity have increased destructive practices while honey-hunting.
    - Lack of documentation over this species makes our entry into the market perfect for environmental researchers, local honey-hunters and more, creating a stable market.

➢ Large fruit and floral producers exist in the region, but efforts for marketing and entry will mainly be directed towards honey-hunters and conservationists, as it offers the most for them in the region.

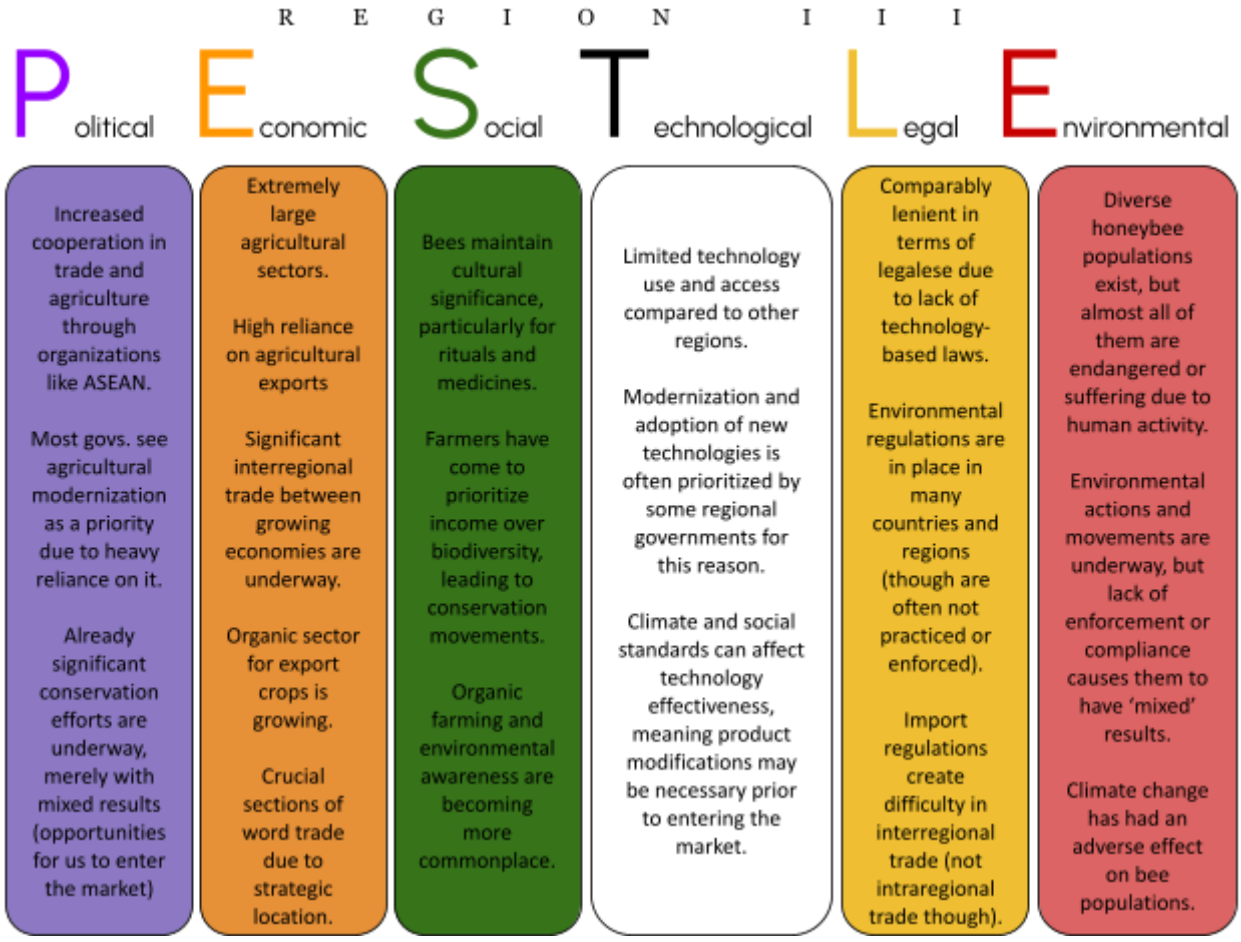
➢ Southeast Asia already has an interconnected, regional trade partnership through bilateral agreements and multilateral organizations like ASEAN when it comes to agriculture (right).





➢ Particularly, the countries we will enter first will be Indonesia, Thailand, Vietnam, the Phillipines, and Malaysia for 2 main reasonsl

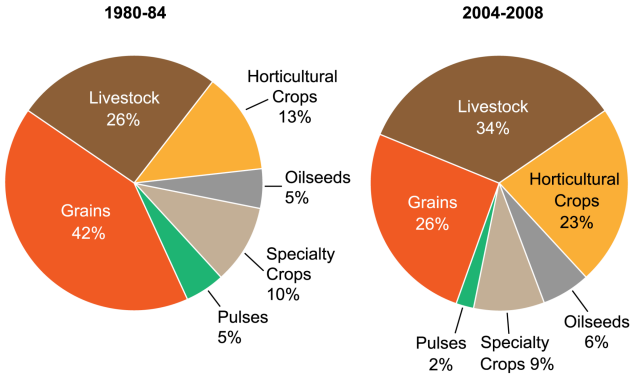
- These countries make up the most out of ASEAN’s agricultural contributions, signifying a developed and growing agricultural output that has been increasing since 2015 (see left)
- These countries all have access to strategic ports and naval trade routes for international trade and distribution, making them valuable for future expansion as well.



❖ **Region IV: South-Central Asia (India and China)**

- ➢ China remains a key international player, controller of important trade routes, and the world's number 1 exporter. This creates a secondary regional market, which we won't focus on or cover due to political complications that may arise in the future. Additionally, the use case of our product in China remains limited compared to these other markets.
- ➢ India has 3 growing seasons, each focused around the growth of different crops and creating a constant supply of agricultural activities in the country, creating a large and sustainable market.
  - ■ "Lack of product development and innovation" is listed as a problem the Indian government recognizes their farmers have.
- ➢ India is also home to some of the bee populations in Southeast Asia, and often suffers more from urban problems (creating a larger environmental problem for us to help solve, i.e. creation of a new market). As research-based industries grow, so does demand for our product in India.

Agricultural output shares from livestock and horticultural crops in India



Source: USDA, Economic Research Service estimates

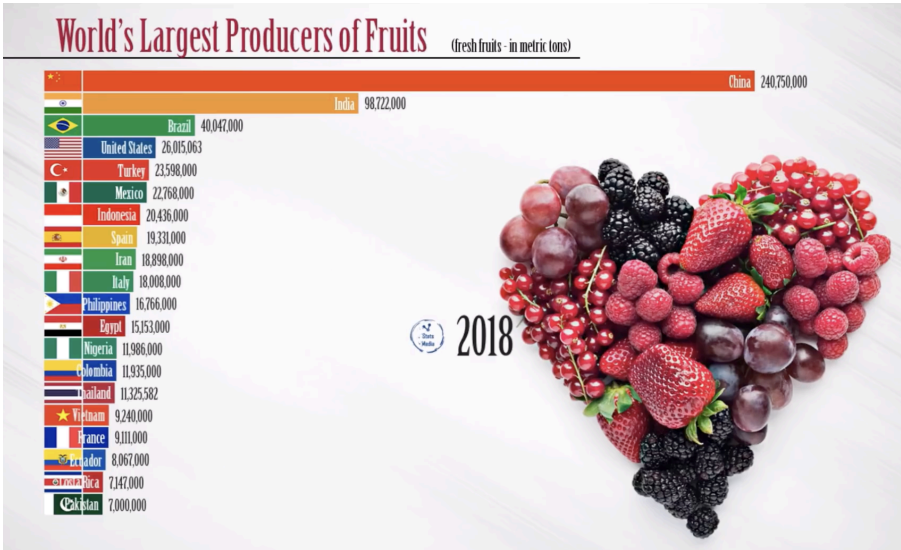
➢ Maintaining a presence in India is also important for other expansion too, since it remains one of the largest global producers of crops. Specifically, it is the largest producer of pulses, and the second largest producer of spices and fruits/vegetables, all of which benefit significantly from pollination, which means our product has good means of expanding in the Indian market.

➢ Indian crop production remains diverse, however a significant portion of these are affected by pollen. Specifically, most horticultural crops remain highly reliant on bees for pollination, creating a large market of almost ¼ of the entire agricultural industry. However, oilseeds also rely on bees for pollination and pollination can improve the health of pulses. Lastly, alfalfa crops for livestock also benefit from bees and pollination, creating a large market for our innovation.

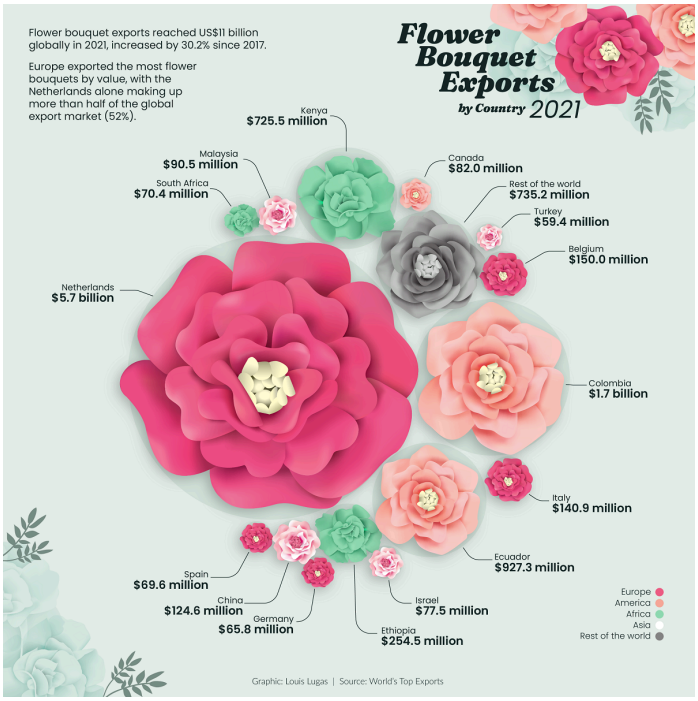
R E G I O N I V

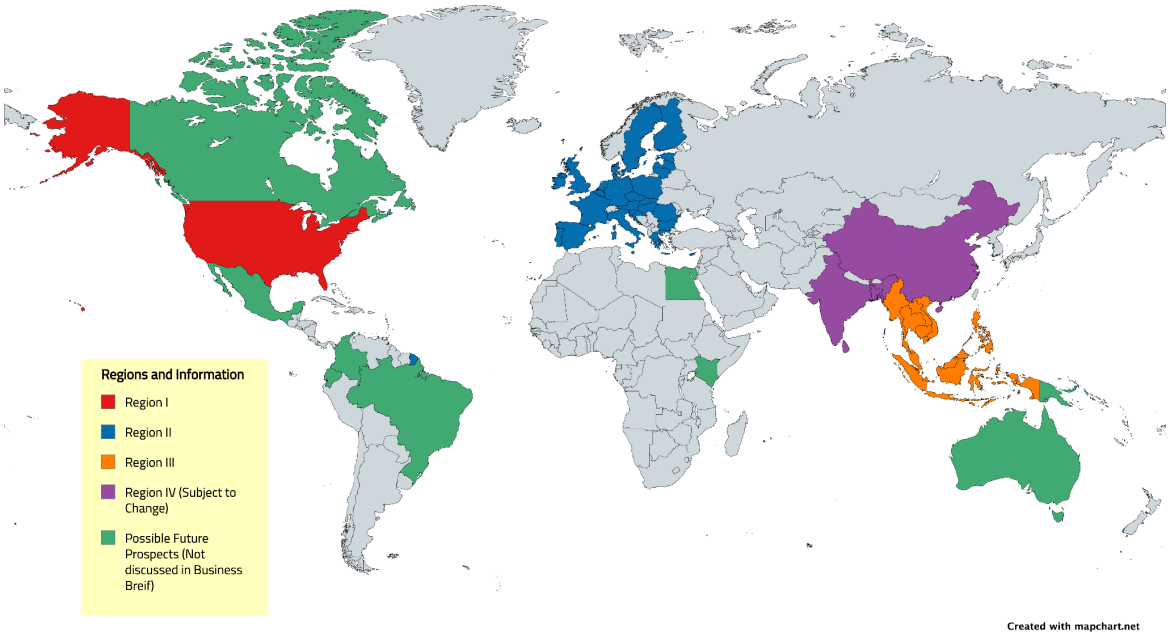
Political	Economic	Social	Technological	Legal	Environmental
Govs. sees agricultural modernization as a priority due to heavy reliance on it. They often focus on agribusiness and support Agri-tech companies. Ministries have, in the past, expressed their immense support for innovations based on sustainable farming.	Extremely large agricultural sectors. High reliance on agricultural exports Large technological hub with a growing economy. Organic sector for export crops is growing. Crucial sections of word trade due to strategic location.	Farmers have come to prioritize income over biodiversity, leading to conservation movements. Organic farming and environmental awareness are becoming more commonplace. Bees and natural pollen have traditional significance in specific farms. Increasing environmental activities.	Modernization of technologies is often prioritized by some regional governments. Climate and social standards can affect technology effectiveness, meaning product modifications may be necessary prior to entering the market. Strong resources and a growing, tech-literate future generation that will be more open to products like ours. Technology is not evenly distributed nor accessible to all.	Comparably lenient in terms of legalese due to lack of technology-based laws. Growing tech industries leads to growing government regulations. Environmental regulations are in place in many regions (though are often not practiced or enforced).	Pesticides ar often overused, causing catastrophic issues to local ecosystems. Environmental actions and movements are underway, but lack of enforcement or compliance causes them to have 'mixed' results. Climate change has had an adverse effect on bee populations.

- Overall, these 4 Regions have been specifically designed to provide our product with the best reach and chance of success. Particularly, in designing these we ensure our product will be open to some of the largest producers of pulses, fruits, vegetables, spices, oilseeds, flowers, and more worldwide. Particularly:
  - Of the world's Top 20 largest producers of fruits, we include direct access and target the regions which include 9 of them (India, US, Indonesia, Spain, Italy, Philippines, Thailand, Vietnam and France).



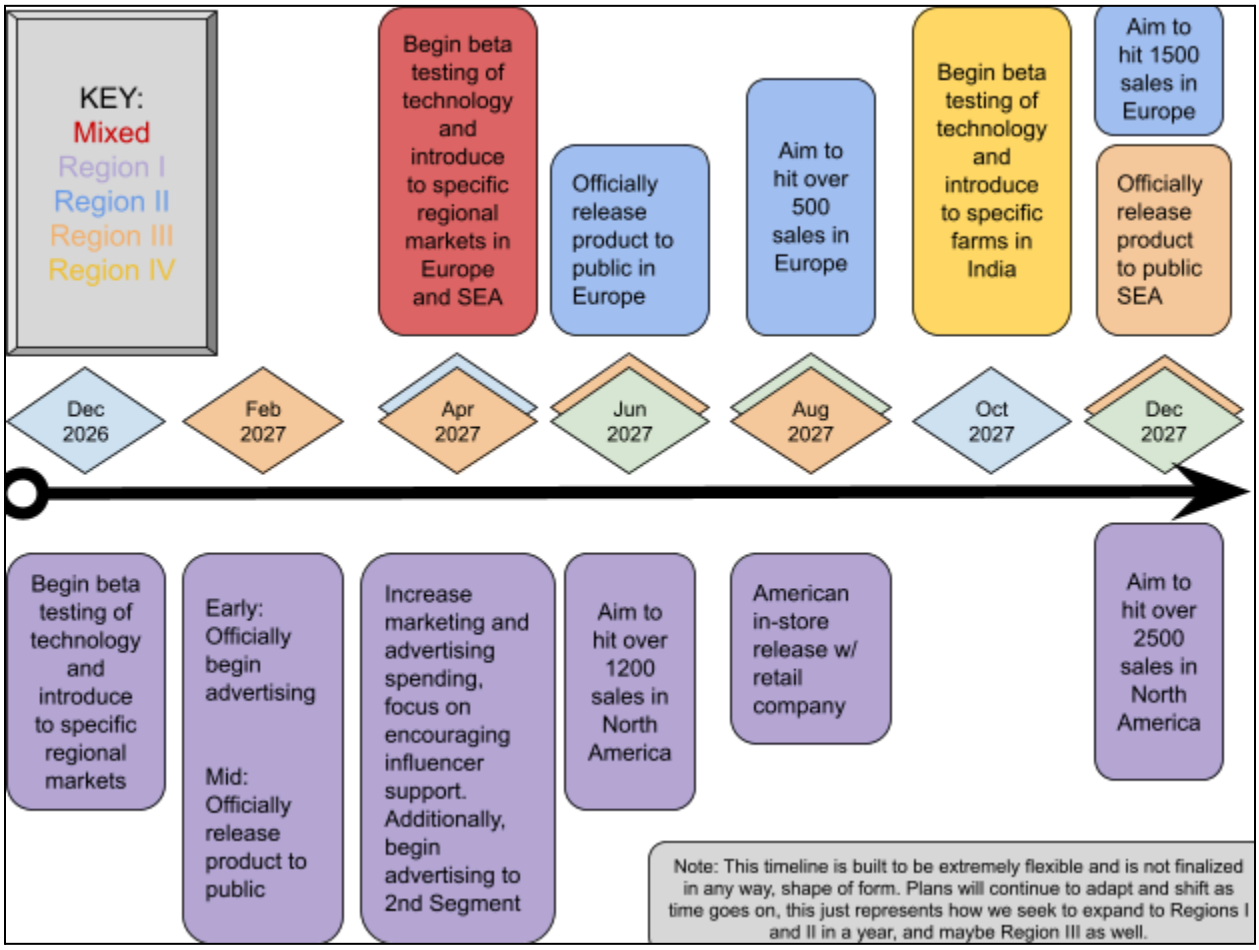
- Of the world's top 15 producers of flowers, we include 6 of them in our various regions
  - Although this may seem like only a few, the market of their flowers is more than enough to get our business started and allow us to build up momentum.
  - Additionally, all of these countries were chosen for strategic purposes, whether they be for political, social, economic, geographic, or environmental.





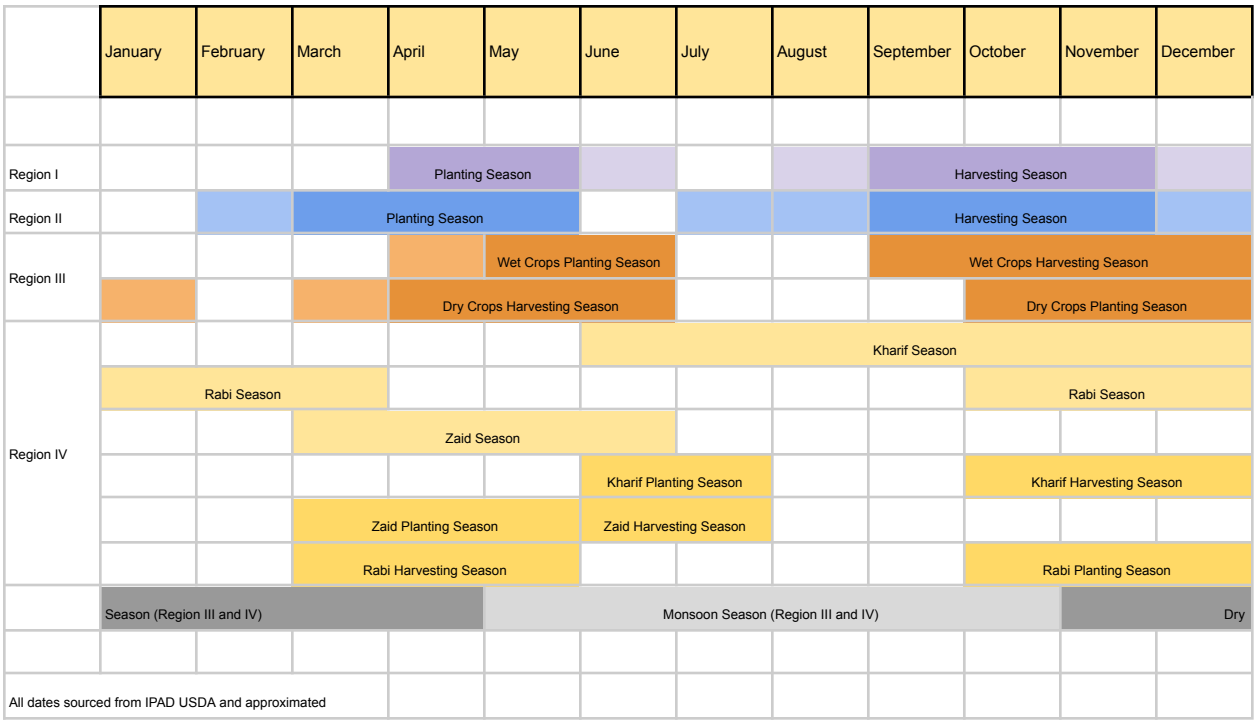
Above is a custom-made map describing regions, not all of which are discussed in this or finalized. All these plans are subject to change depending on how events unfold.

Rough Timeline**:



**Subject to EXTREME change.

Agricultural Calendar by Region



As seen by the calendar, the regions we have chosen will affect the demand for our product. In general, agribusinesses and agritech companies tend to suffer from seasonal demand, which is why going international is so important. By entering the international market, we essentially maintain a constant demand for our innovation through seasonal differences, meaning that when demand falls in one market it will rise in another due to overlapping crop seasons, allowing our product to maintain sales.

Metrics For Success

Due to the unique nature of our product, there are 2 main types of metrics for success: data amassed and business statistics. In terms of data amassed, this can be measured in GB, TB, or any other form of data and represents the amount of data relating to bee behavior that we have amassed. In terms of business statistics, those can be represented by the number of upsells sold, number of kits sold, or total profit in dollars. These statistics act as a measure of our success and help us track our progress in quantitative data, and will therefore allow us to understand how popular our product is in various markets and regions, and how to proceed from there on. These metrics will be carefully tracked by our company and used to change the approach on marketing, finances, logistics, distribution and overall business operations based on their status.

Particularly, our business will do better the more our AI model is trained on data, and regional profits will also be analyzed deeply to further understand consumer behavior and change the product as we go on, ultimately allowing us to increase sales each year as our product, catalog, and image grows with the public. By maintaining vigilance, monitoring our success, and being tenacious, we believe that our product can save not only the lives of bees, but also ecosystems, farmers, and help save this planet that buzzes and breathes, just like us and our pollinating friends!

Research and Sources:

ARS Honey Bee Health

World Bee Day 2025: We all depend on pollinators

Bolstering Bees in a Changing Climate | Tellus

World hunger facts: Causes, stats and solutions

USDA Food Security Report Highlights Startling Hunger Crisis in America

What is Food Insecurity? | Feeding America

New Report: Food System Impacts on Biodiversity Loss

Environmental Impacts of Food Production - Our World in Data

Nonpoint Source: Agriculture | US EPA

EAT-Lancet report: Three key takeaways on climate and diet change - Carbon Brief

Pollinators benefit agriculture | U.S. Fish & Wildlife Service

Honeybees pollinate 80 percent of our crops

UNFAO - Why Bees Matter

The birds and the bees (and how they connect to agricultural economics)

Major Cropping Seasons in India | PDF | Cereals | Agriculture

Exploring Climate-Driven Mismatches Between Pollinator-Dependent Crops and Honeybees in Asia - PMC

Tropical fruit production depends on wild insect communities: bees and lychees in Thailand | Journal of Tropical Ecology | Cambridge Core

Beekeeping in Vietnam - Issuu

Stingless Bees Pollination Increases Fruit Formation of Strawberry (Fragaria x annanassa Duch) and Melon (Cucumis melo L.) - PMC

(PDF) Plant-pollinator interactions in tropical monsoon forests in Southeast Asia

Flowering Phenology and Evaluation of Pollination Techniques to Achieve Acceptable Fruit Quality of Red-fleshed Pitaya (Hylocere)

What's In Season in California (Growing Season Timing Chart)

How much of the world's food production is dependent on pollinators? - Our World in Data (Pollination dependency by plant)

Why are bees and wild pollinators so important (List of crops reliant on pollinators)?

40 maps that explain food in America | Vox.com

Mapped: The Number of Farms in Each U.S. State

Ranked: America's Top Crops by Acres Harvested in 2023

Organic September Spotlight: How Far Organic Farming Has Come (and What's Next?) - Ceres Research(European Situations on farming and agriculture).

Organic sales hit $71.6 billion in 2024, setting new record (Growth of Organic Industry in the past few years).

Bee Lining: The Oldtimers' Way to Find Wild Beehives.

Farmer's adoption of organic agriculture. (GLOBAL)

LinkedIN article - (Top Agricultural producers in Europe)

Farms and farmland in the European Union - statistics

Native Honey Bees of Southeast Asia and Conservation Challenges | Heinrich Böll Foundation

About the German Green foundation

Agricultural output shares from livestock and horticultural crops in India | Economic Research Service

Indian Ministry of Food Processing Industries Report 2024-25

Agriculture in Southeast Asia: Investment Opportunities | Roland Berger

Southeast Asia: Growing Potential for U.S. Agriculture | Economic Research Service

Fruit Production by country (1960-2018) | FAO

Visualizing the World's Flower Bouquet Export Market

Foods that bees pollinate • Friends of the Earth

🐝 Lean Canvas

1. Elevator Pitch (150 words) Pitch the innovation, along with its impact, customers and business potential.

2. Team (150 words) ▪ How did the team form?
▪ What role will each team member play?
▪ What motivated the team to create the innovation?
▪ What special capabilities, resources or experiences does the team members bring?

3. Opportunity (300 words) What issue or pain point does the innovation address?

4. Key Metrics (750 words)
▪ Describe the innovation, its design and its technology. How does it work?
▪ What is new or proprietary about the innovation? ▪ How does it meet needs and resolve pain points?
▪ What impact does the innovation create for individual users and humankind? Describe this qualitatively and quantitatively.
▪ How can new or proprietary aspects be protected and made valuable by one or more methods such as a patent, trade secret, copyright or otherwise competitively defensible configuration?

5. Validation/Progress (450 words) ▪ How have you validated the innovation, technology, or processes?
▪ What progress has the team made in developing the innovation?

6. Market (300 words)
▪ Describe the customer and the target segments.
▪ What is important to them?
▪ What is the size of the opportunity?
▪ Is the buyer or payer different from the customer in this market?
▪ Describe the industry ecosystem.

7. Competition (300 words)

- What competes with the innovation and how does the innovation compare?
- What are the advantages and disadvantages of the innovation?
- What is the positioning?

8. Go-To-Market (150 words)
- How will the team attract and sell to customers?
- Who are the best initial or pilot customers?
- Is the market best served through direct sales, distribution, licensing, strategic partnerships or other strategies?

9. Business Model (300 words)
- What are the key revenues and costs?
- What are the pricing and costs to deliver one product or service unit?

10. Fundraising (150 words)
- What funds are needed to get started and how will those funds be used?
- How much will it cost to develop the product and roll out?
- What different sources will be pursued for funding and why are these a fit?

📋 Drawing Board and Questions

Our team will contribute the initial seed money, and create a kickstarter for pre-ordering. After production begins the profits will cover the marketing budget, materials for the future production, employee payroll, and R&D costs.

Banana Drawing Board

Light pollution -> making a shield for street lamps, leds and more
Blue light -> low-cost filter or coating that shifts blue light toward warmer tones without reducing brightness. Could retrofit existing LEDs.

Soil mapping -> robot that takes salinity, ph, moisture, temp. Etc with a robot

Poachers ->Ai tracking system to detect and alert rangers of poacher presence

Animal/Bird sound mapping -> Maps out environments based on sounds (chirps, etc)
-
Sound mapping -> bees;
What bee sound tracking would do --

1. Bee sounds
2. How bees affect human

Bees' wingbeat frequencies (~200–250 Hz, depending on species) and colony buzz patterns vary with:

- Species (honeybees, bumblebees, solitary bees)
- Behavior (foraging, swarming, defensive buzzing)
- Colony health (healthy vs. stressed/hungry/queenless hives)

Mapping bee sounds can give insights into:

- Pollinator density in landscapes
- Habitat quality and floral availability
- Colony health & stress detection
- Impact of urbanization or pesticides

Activation stage:

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-Focus on innovation: Judges are looking for unique and innovative solutions to the selected challenge. Be sure to think outside the box and come up with a solution that is creative and impactful.
-While the first two stages of the Challenge are free, there is a fee of $499 for the Innovation Stage. If your team is selected to advance to the final Power Pitch Stage and the Conrad Challenge Innovation Summit and/or the accompanying virtual events, you will need to pay for registration, travel and accommodations.
-Any and all students who will be 13 to 18 years of age between August 2025 – November 2026 are eligible to participate in the Conrad Challenge. Teams can consist of 2-5 students, with no limits on where you are collaborating (break the boundaries, it's more fun that way!)

• Assemble teams of 2-5 students
• Select a coach
• Complete registration
• Brainstorm ideas
• Select Innovation and Category
• Prepare a Lean Canvas

-An AI-powered audio sensor system identifies bee species and hive health by analyzing wingbeat frequencies and colony buzz patterns, providing real-time, non-invasive monitoring.

Our team will contribute the initial seed money, and create a kickstarter for pre-ordering. After production begins the profits will cover the marketing budget, materials for the future production, employee payroll, and R&D costs.

*If we need to work on it

Questions:

***1. High-Level Concept:** What is the tagline of your innovation, in 10 words or less?

Healthy Hives. Thriving Lives.

2. Problem: What is the customer need your innovation will address? Is there a social or environmental challenge you aim to take on?

Bees are vital pollinators that support 35% of global crops. However, nearly 40% of colonies are lost annually. This crisis threatens food security and economic stability. Current hive monitoring is inefficient, slow, and expensive, making it difficult to protect pollinators.

Bees are vital pollinators responsible for 35% of global crops about 40% of colonies die annually. This issue poses a serious crisis food security and economic stability. Current hive monitoring is inefficient/slow, and expensive, making it difficult to protect pollinators.

https://www.weforum.org/stories/2019/12/protect-pollinators-food-security-biodiversity-agriculture/

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3. Existing Alternatives: How is this problem solved today? Consider other products in the market.

Today, most beekeepers rely on manual solutions. Smart sensors like Arnia ($400-$600) and BroodMinder ($200-$400) monitor temperature/humidity and provide some information about bee activity, but only limited behavioral insight, leaving hive stress and colony decline often undetected.

https://broodminder.com/

https://www.arniaperfetta.it/en/

Provide details about how your innovation meets the needs of your customers. Focus on what's unique about your process, assembly, or technology.

4. Solution: What are the key characteristics of your innovation?

We utilize microphones, ultrasounds, AI, and pollination frequencies to measure stress/activity. Data from hives map pollination activity, track population trends, and deliver real-time alerts, reducing manual inspections and creating an affordable network, strengthening food security and protecting hive health.

5. Unique Value Proposition: What makes your innovation different from what's already in the market?

Our innovation stands out by using auditory hive monitoring telemetry, a method rarely applied commercially. Unlike expensive competitor systems, we offer live health insights and pollination tracking through sound analysis- making hive management simpler, smarter and cheaper for customers.

6. Sustainable Advantage: Why will it be difficult for others to copy you?

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Our system is revolutionary as it incorporates auditory technology and machine learning, trained on specific pollination frequencies (200-250hz). Our product uses sensors, optimizes efficiency and builds a continuously evolving database that other devices are incapable of, setting us apart.

Our sustainable advantage lies in our AI model trained on specific pollination frequencies (200-250hz), enabling precise information and updates. Combined with a low cost, modular design, and interconnected data-sharing network, our system is scalable, adaptive and difficult to imitate.

7. Customer Segments: Who is the target audience who is served by your innovation? Describe them.

Our audience includes farmers, beekeepers, food companies, agencies, conservation groups, and researchers – commercial and research sectors reliant on pollination health, forming one market focused on sustainable agriculture through wider adoption that supports scalable models focused on affordability, accuracy, and sustainability.

8. Early Adopters: Who will be your very first customers? Describe them.

Within your target customer segment, who are the very first customers you will target? For example, you may target specific geography or a social group you have a preexisting connection to.

Our first customers are conservation networks, beekeeping cooperatives, and smallholding farmer communities in North America and the Indo-Chinese region. Within sustainable

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networks seeking eco-friendly, cost-effective methods, the market will later expand to larger farmers, agricultural agencies, and food companies.

9. Channels: How will you sell your innovation to your customers? How will you deliver it? Think through how you are going to attract the market to your innovation. You'll also need to deliver it to your customers. How will you do that? Will you rely on partners? Will you use the internet? Look into how your competitors accomplish this today.

Our devices are produced using multiple regional manufacturers, all with negligible transportation costs. When distributing, we'll use dedicated e-commerce platforms, distributing via logistics partners. We'll expand through agricultural and environmental collaborations, supported by marketing and demonstrations, to drive usage. -Delivery, we need info!! Expand on WHO in conservation groups

10. Key Metrics: What are the most important numbers that track your success? Think through the most important 2-3 metrics that you will use to measure your success. Often, these correlate linearly with your success. Key metrics could include financial measures and measures of impact or adoption.

Key metrics include number of devices adopted (reflecting user growth), total geographic area managed (demonstrating environmental reach); Improvements in hive health and pollination activity demonstrate environmental impact, while steady profit growth ensures stability and growth.

Our team will contribute the initial seed money, and create a kickstarter for pre-ordering. After production begins the profits will cover the marketing budget, materials for the future production, employee payroll, and R&D costs.

Our device identifies geographic distribution, so the primary metric most representative of our success is total geographic area managed. Profit represents our success as a business, and will positively correlate with the total purchases of our product.

11. Cost Structure: What are your most significant costs?

Think in terms of your recurring variable costs. No need to list everything here: focus on the main drivers. What are the ongoing costs to produce and deliver your innovation?

Our average variable cost is $12 and fixed cost $268 per unit. Each device assembles in under thirty minutes, though costs may rise from labor, tariffs, and transport. Custom chip manufacturing remains our primary optimization opportunity for improving long-term efficiency.

12. Revenue Streams: How will you make money to fund your operations on an ongoing basis?

How will you make money on an ongoing basis to invest back into your innovation? Consider sales, grants, donations, and other streams of cash to your team. Make sure you focus on ongoing revenue from operations and not the upfront funds you'll need to raise to start.

Initial funding will come from sustainability grants, research partnerships, and early investors. Ongoing revenue derives from hardware sales, subscription-based analytics platforms, and enterprise licensing. Licensing our AI to environmental and agricultural institutions ensures recurring income and long-term financial scalability.

Our team will contribute the initial seed money, and create a kickstarter for pre-ordering. After production begins the profits will cover the marketing budget, materials for the future production, employee payroll, and R&D costs.

*We will generate ongoing revenue through direct sensor sales, subscription-based data analytics for hive monitoring, and licensing our AI sound recognition technology to agricultural partners. Additional funding will come from environmental grants and partnerships with conservation and research organizations.

https://govinfo.library.unt.edu/npr/library/reports/ag02.html

-Device deployment (number of active AI audio sensors in the field)

-Hive Health improvement (reduction in colony losses among participating users)

-

→ Agribusiness startup competition (https://www.grow-ny.com/)

Hack Club Blueprint sponsor up to 400 dollars for initial cost if we show 40+ hours of product R&D in CAD

Overview & Outline

Problem :

- Bee Population Shortages
- https://www.sierraclub.org/sierra/one-third-our-food-supply-relies-very-sick-species-honeybees -> One-Third of Our Food Supply Relies on bees
- ⅓ of food supply relies bees; bee population are collapsing due to (habitat destruction, pesticides etc.). Farmers, beekeepers and many more people lack real time, scalable and mappable measures to monitor pollination acitivty
- they pollinate about 75% of the world's flowering plants and 35% of the world's food crops

Solution :

- Bioacoustic monitoring system that listens to bee sounds and translates them into data with geospatial mapping systems.

Audience:

- ☐ Ecologist -> use data to monitor biodiversity among bees, ecosystem health, pollination decline
- ☐ Farmers -> directly correlates to pollination decline; optimize crop yield
- ☐ Agencies of Agriculture -> To protect national interests on food security (**food security planning**)
- ☐ Beekeepers -> hive stress, increase honey production
- ☐ Food companies -> To sell more & profit while being sustainable

-***Advertizement***:

- https://www.farmjournal.com/?
- (IDEAS) https://farmonaut.com/blogs/agribusiness-advertising-best-farm-ad-examples-2025

-3.83 billion people rely on agrifood systems, which include farming, for their livelihoods -> Link
-Approximately two-thirds of Africa's population rely on farming and the broader agrifood sector for their livelihoods, with millions of smallholder farmers producing the majority of the continent's food.
-

The new FAOSTAT offering gives useful insights on what is the world's largest labor sector, employing close to 1.3 billion people, or 39.2 percent of the global work force. It also sets the stage for more detailed monitoring of trends at a local level going forward. *Link*

Business Overview

Name: TrHIVE Systems

Slogan: “Saving the Hive to help us Thrive”

Industry: Agribusiness

Problem (Q2): Bees are beneficial to the world for agriculture. However, there is a significant lack of knowledge of hive health, as many are threatened by habitat destruction, pollution and invasive species. Our system seeks to solve that through innovation and interconnectivity.

🖊️ Resources and Plan

Plan, Prototype

Prototype -
-I have a rode nt1 mic at home(probably just going to use arduino mics for $9 a piece(4))
-Access to Gemini Pro (with Gem support cause of student plan)(probably wont be neede for code
-8 bands in backup(like 8 grand in money or what are we talking)
We need a mic and a raspberry pi(Arduino i have) ideally. Add to this:

>> Sensors Listen
Small microphones are placed around fields, hives, or natural areas. They record buzzing sounds and send them to a central system.

>> Detect Hive Health
Healthy bees buzz in predictable patterns. If their buzzing suddenly drops (too quiet), becomes irregular (stress), or gets unusually loud (swarming), the system notices. This gives early warnings before beekeepers even see a problem. →code an ai to learn distinct traits between bee sounds and see what they mean.

>> Map Pollination Activity
The sensors are spread out like a grid. The system compares how much buzzing each sensor hears. If one part of a farm has lots of buzzing, that means good pollination. If another part has little or no buzzing, it means flowers there aren't being visited by bees. Farmers can literally see pollination coverage on a map. → sound hits one microphone first calculate the distance before its the other mic and then you find the area covered. Use triangulation with the different audio receptor thingies

>> Estimate Population Trends
By tracking buzzing levels over weeks and months, you can see if bee activity is rising, stable, or dropping. That lets ecologists and agriculture agencies measure long-term population health. →based on sound we can see activity level

Based on all the information above we can provide real time alerts

>> Provide Real-Time Alerts
Beekeepers and farmers get an app/website with a simple color system:

-- Green = normal buzzing (healthy hive / good pollination)
-- Yellow = warning signs (possible stress, lower activity)
-- Red = serious problem (possible hive collapse or extreme drop in pollination)

>> Contribute to a Global Data Network
Every device sends its data into a shared map. Governments, scientists, and food companies can see where bees are thriving and where they're struggling - like a worldwide bee health radar.

Competition Resources:

- ★ Student Guide (2025-26)
- ★ Conrad Competition Challenge
- ★ ICS Conrad Information
- ★ Rules and Regulations
- ★ Student Innovators
- ★ How to make a Website Conrad
- ★ Student Guide (2023-24)
- ★ Other Competitions

Prototype Resources

- [ ] **Audio Recording**
  - [ ] PyAudio
  - [ ] Microphone
- [ ] **Sound Feature Extraction**
  - [ ] Librosa
  - [ ] Raven Lite
- [ ] **Audiovisual Mapping**
- [ ] **Web Development**
  - [ ] Lovable.ai
  - [ ] Wix.com
  - [ ] Google Sites as a last resort
- [ ] **Programming**
  - [ ] ~~HTML, CSS, JS~~
  - [ ] ???? (what goes here bro)
- [ ] **Artificial Intelligence Training**
  - [ ] Teachable Machine
  - [ ] Scikit-learn
  - [ ] Edge Impulse
  - [ ] Raven Lite
- [ ] **Model Deployment**
  - [ ] TensorFlow Lite
  - [ ] Raspberry Pi 3 (Model B+)
- [ ] **Cloud/Data Storage and Management**
  - [ ] Firebase
- [ ] **Model Rendering**
  - [ ] Tinkercad
- [ ] **Other Necessary Resources**
  - [ ] Solar Panels
  - [ ] Hive Tracks **?**
- [ ] **Bee Research**
  - [ ] Bee wingbeat frequency in temperature changes
  - [ ] Be Behavior by Harvard
  - [ ] Dena J Clink - Contact?
  - [ ] Stefan Kahl - Contact?
  - [ ] Importance of Honeybee Sound
  - [ ] Cornell Bioacoustics Department

💰 Purchase List

Purchase:
https://www.adafruit.com/product/1713

-$11 production ~~
-
STM32 board 2 dollar per unit
WeAct BlackPill STM32F411CEU6 STM32F411 STM32F4 STM32 Core Board Learning Board Development Micropython - AliExpress 7
Arduino nano $1.55 >100 no need
https://electroslab.com/products/esp-01-esp8266-serial-wifi-module?variant=22176905101412&country=LB&currency=USD&utm_medium=product_sync&utm_source=google&utm_content=sag_organic&utm_campaign=sag_organic&srsltid=AfmBOoojCKB4psmI19IIIuz2qeEOBdRSI0GQITce59s8v6xKbV8Th1uvnPM
Wifi $2

https://www.aliexpress.us/item/3256806282307219.html?spm=a2g0o.detail.similar_items.5.7338SNFsSNFsRg&utparam-url=scene%3Aimage_search%7Cquery_from%3Adetail_bigimg%7Cx_object_id%3A1005006468621971%7C_p_origin_prod%3A&algo_pvid=0df946c6-e189-491e-9619-4fd5b99988f4&algo_exp_id=0df946c6-e189-491e-9619-4fd5b99988f4&pdp_ext_f=%7B%22order%22%3A%22478%22%2C%22fromPage%22%3A%22search%22%7D&pdp_npi=6%40dis%21USD%211.56%211.56%21%21%2111.04%2111.04%21%402101cb9c17612385364632656ecfc8%211200003730596054 3%21sea%21US%210%21ABX%211%210%21n_tag%3A-29910%3Bd%3Ad5575443%3Bm03_new_user%3A-29895&gatewayAdapt=4itemAdapt
Microphone 3 $2
Cables $0.50
https://www.alibaba.com/product-detail/Color-DuPont-Cable-10CM-15CM-20CM_1601237276209.html?spm=a2700.galleryofferlist.normal_offer.d_title.6f9813a0KuqI56&selectedCarrierCode=SEMI_MANAGED_STANDARD%40%40STANDARD&priceId=7041551e136e47b793728a6bf2326004
Cables $0.50
Solder, this amount can be used for like 20 modules $17
https://www.homedepot.com/p/The-Harris-Products-Group-3-oz-Lead-Free-Rosin-Core-Solder-327793/309077628?source=shoppingads&locale=en-US
Solder, this amount can be used for like 20 modules $17

Total$11

Start costs
250 dollar 3d printer

https://us.store.bambulab.com/products/a1-mini?srsltid=AfmBOoqI_gI1isA0jCm4gVJJ3iu92o0aY2k75b22ifdL35tcKKV3O3BN

13 dollar soldering iron

https://www.amazon.com/Soldering-Interchangeable-Adjustable-Temperature-Enthusiast/dp/B087767KNW?th=1

🗓️ Agenda

Meeting Agenda

1. Finalize and discuss details of our goal and idea for the product
2. Research possible softwares and hardwares for the project
    a. Experimentation and decisions between said softwares are to be made at a later date (ideally by September 15-20th)
3. Answer Questions for the Conrad document
4. Prepare a wireframe/draft/format
5. Create a buy list; purchase if needed
6. Discuss platform for coding, and which SBC to use.
7. Adjourn the meeting

0ct 16 meeting

- Cheap sensor vs. good sensors

Oct 19 meeting

- Answer questions
- Make a prototype
- Send a cold emais to professors in relevant fields

Oct 22

- Complete pricing with wholesale prices to be representative of business sales figures
- Complere all Conrad Questions

Oct 24(in person)

- Meet to finalize questions 1-8, proofread and begin submitting questions to Conrad

Oct 27

- Finalize last 4 questions,once reviewed by final team member submit to Conrad

Wacky Schedule

Short Term To-do List (Due in 1-2 Weeks):

- [ ] Entire Document Restructuring Process, THE GREAT APPENDIX
    - [x] ~~Marketing:~~
        - [ ] LinkedIN
        - [x] ~~Market Research (Crops)~~
            - [x] ~~Organics?~~
            - [x] ~~Economics - Growing Market~~
    - [x] ~~Production:~~
        - [x] ~~Patterns + Formulas (Effective Information Management)~~
        - [x] ~~COMPENSATION~~
            - [x] ~~Bee Line~~
            - [x] ~~Environmental Health (Toxicity, Pollution)~~
            - [x] ~~Plant Diversity + Preferences (Climate, etc.)~~
            - [x] ~~HoneyDNA (Identify invasive species and other plants)~~
        - [x] ~~SWOT Analysis~~
        - [ ] Website Wireframe + Scenes
        - [x] ~~Product Differentiation~~
            - [x] ~~Audio + New Info (See Above)~~
    - [x] ~~Timeline + Forecast~~
        - [x] ~~Replace Timeline~~
            - [x] ~~Calendaris~~
            - [x] ~~Simple GANTT Chart~~
            - [x] ~~Simplified Timeline~~
    - [x] ~~Finance~~
        - [x] ~~Metrics for Success~~
        - [x] ~~Price remaking~~
        - [x] ~~Pricing model change~~
        - [x] ~~PESTLE Analysis~~
            - [x] ~~Region I~~

- [x] ~~Region II~~
- [x] ~~Region III~~
- [x] ~~Region IV~~

- [ ] Personal Connections
  - [x] ~~Atharv~~
  - [ ] Advaith
  - [ ] Sai
  - [ ] Ragahav
- [x] ~~M Statement~~
- [x] ~~V Statement~~
- [ ] Innovation Details

- [ ] Video
  - [ ] Review Video Script
  - [ ] Make it Marketing-Focused
  - [ ] Telling Stories
  - [ ] Quotes and Personal Anecdotes
  - [ ] Statistics
- [ ] Differentiate ourselves!
- [ ] Locking In
  - [ ] Lab Support (Most ppl T30)
  - [ ] Professor emails
- [x] ~~Canva Conversion? PLS NO PLS~~
- [x] ~~Sources!~~

Mid Term To-do List (Due in 1-2 Months):

- [ ] Team Picture! Get the goat photographer

Long Term To-do List (Throughout the entire project):

- [ ] Figure out what we're doing 😭

Personal MIA Timelines

(Times we'll be busy)

- [ ]

Conrad Challange Second Stage

Theme	Description
30% **Innovation** Is it unique? Is it impactful?	• **Originality**: Is the idea truly new or a novel combination of existing technologies and does it show creative or scientific inspiration? • **Impact Potential**: Does it transform an industry or deliver real benefits to customers or society? • **Ambition Level**: Is the innovation incremental, bold, or audacious compared to current solutions? • **Verification**: Has an online search confirmed its uniqueness and ruled out duplicates? • **IP Defensibility**: Can the concept be protected (patent, trade secret, copyright, first mover, contracts, ecosystem capture) to secure its value?
20% **Storytelling and Professionalism** Would a reasonable investor want to learn more?	• **Investor Appeal**: Does the pitch spark a reasonable investor's interest to learn more? • **Clarity of Opportunity**: Is the problem, motivation, and value proposition clearly and compellingly described? • **Credibility Boost**: Do the video and website reinforce the team's expertise and trustworthiness? • **Narrative Structure**: Is there a logical, engaging flow across all materials (brief, video, website)? Does it create excitement, curiosity and belief? • **Polish & Consistency**: Are writing, visuals, and organization professional and investor-ready?
20% **Practicality** Will it work?	• **Feasibility**: Can the solution be developed within a reasonable time frame and budget? • **Realism**: Are the chosen technologies or methods appropriate and attainable? Consistent with technological and scientific principles? • **Proof of Concept**: Is viability demonstrated (e.g., tested component technologies, prototype, demo, similar devices, or graphic mock-up)? • **Evidence Base**: Does the submission include data, expert testimony, like applications or research establishing feasibility? • **Next Steps**: Is there a clear plan for further testing or development to validate the concept or begin a pilot?

FREE GOODIE:
https://www.walmart.com/ip/60ml-For-Beekeeper-Bee-Pheromone-Swarm-Attractant-Beekeeping-Lure-Bait-Trap-S2V1/7035363290?wmlspartner=wlpa&selectedSellerId=102480687&wmlspartner=wlpa&cn=FY25-ENTP-PMAX_cnv_dps_dsn_dis_ad_entp_e_n&gclsrc=aw.ds&adid=22222222297703536329 0_102480687_0000000000_21407473164&wl0=&wl1=x&wl2=c&wl3=&wl4=&wl5=1015254&wl6=&wl7=&wl8=&wl9=pla&wl10=5419288456&wl11=online&wl12=7035363290_102480687&veh=sem&gad_source=1&gad_campaignid=21690411341&gbraid=0AAAADmfBIrhXIR75mWDK6FIT30n9swBL&gclid=CjwKCAiA8bvIBhBJEiwAu5ayrLUPd-egAnIomuM16uUCTbJDo_65BQTfsXg5XVZ9-fxHB1q_CrF1nBoCz-kQAvD_BwE

IMPORTANT LINKS FOR PROTOTYPE

IMPORTANT LINKS FOR PROTOTYPE

https://www.reddit.com/r/arduino/comments/cps7r5/triangulating_sound/

RUBRIC

RUBRIC

INNOVATION BRIEF

This is where judges score logic, rigor, and completeness. Each rubric item has ONE main slot.
1. Elevator Pitch
Primary rubric points
Investor Appeal
Clarity of Opportunity
Impact Potential
Ambition Level

2. Team Primary rubric points
Credibility Boost
Polish & Consistency

3. Opportunity
Clarity of Opportunity
Market Insight (early framing)
Impact Potential
NO TECH
4. Key Metrics (MOST WORDS)
This is the technical and IP core of the brief.
Originality
Differentiation
Impact Potential (quantitative and qualitative)
IP Defensibility
Feasibility (technical)
Realism
Verification (prior art search statement)

5. Validation and Progress
Proof of Concept
Evidence Base
Feasibility
Realism
Next Steps

Nothing about market size or pricing here.

6. Market
Market Insight
Ecosystem Awareness
Entry and Adoption (context, not strategy yet)

7. Competition
Differentiation

Positioning
Verification (competitive scan)

8. Go To Market
Entry and Adoption
Investor Appeal (execution credibility)
Do not repeat market size.

9. Business Model
Revenue Projections
Cost Estimation
Financial Viability

10. Fundraising
Primary rubric points
Funding Strategy
Budget Reasonableness
Investor Appeal (again, but financial)

INNOVATION VIDEO
This is belief and clarity, not detail.
Proof of Concept
Credibility Boost
Narrative Structure
Feasibility (explained visually)
Impact Potential (shown, not calculated)
Judges use the video to confirm the brief is not theoretical.

INNOVATION WEBSITE

This is communication and polish.
Engagement Channels
Polish & Consistency
Narrative Structure (cross all materials)
Credibility Boost
Differentiation (simple, public-facing)
No data

Originality: Is the idea truly new or a novel combination of existing technologies and does it show creative or scientific inspiration?
Impact Potential: Does it transform an industry or deliver real benefits to customers or society? Ambition Level: Is the innovation incremental, bold, or audacious compared to current solutions? Verification: Has an online search confirmed its uniqueness and ruled out duplicates?
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Evidence Base: Does the submission include data, expert testimony, like applications or research establishing feasibility?
Next Steps: Is there a clear plan for further testing or development to validate the concept or begin a pilot?
Market Insight: Has the team identified target markets and customer segments? Entry & Adoption: Is there a defined strategy for market entry, growth, or partnership?
Ecosystem Awareness: Does the team understand industry partners, licensing opportunities, competitive landscape, and who the buyers are?
Differentiation: Are the innovation's advantages over existing solutions articulated?
Engagement Channels: Does the website effectively showcase value, tell the story, and attract potential customers?
Cost Estimation: Are materials, components, operating costs, and R&D expenses (e.g., grants, licenses, labor realistically estimated?
Revenue Projections: Has the team outlined plausible revenue models given market and value potential-both per unit and overall?
Funding Strategy: Is there a credible plan for securing development and rollout capital? Budget Reasonableness: Does the overall budget align with the scope and timeline of the project? Financial Viability: Do cost, revenue, and value scenarios suggest a sustainable path forward?

1. Elevator Pitch (150 words)
Pitch the innovation, along with its impact, customers and business potential.
2. Team (150 words)
• How did the team form?
• What role will each team member play?
• What motivated the team to create the innovation?
• What special capabilities, resources or experiences does the team members bring?
3. Opportunity (300 words)
What issue or pain point does the innovation address?
4. Key Metrics (750 words)
• Describe the innovation, its design and its technology. How does it work?
• What is new or proprietary about the innovation?
• How does it meet needs and resolve pain points? • What impact does the innovation create for individual users and humankind? Describe this qualitatively and quantitatively.
• How can new or proprietary aspects be protected and made valuable by one or more methods such as a patent, trade secret, copyright or otherwise competitively defensible configuration?
5. Validation/Progress (450 words)
• How have you validated the innovation, technology, or processes?
• What progress has the team made in developing
the innovation?
6. Market (300 words)
• Describe the customer and the target segments.
• What is important to them?
• What is the size of the opportunity?
• Is the buyer or payer different from the customer in this market?
• Describe the industry ecosystem.
7. Competition (300 words)
• What competes with the innovation and how does the innovation compare?
•
What are the advantages and disadvantages of the innovation?
• What is the positioning?
8. Go-To-Market (150 words)
• How will the team attract and sell to customers?
• Who are the best initial or pilot customers?
• Is the market best served through direct sales, distribution, licensing, strategic partnerships or other strategies?
9. Business Model (300 words)
• What are the key revenues and costs?
• What are the pricing and costs to deliver one product or service unit?
10. Fundraising (150 words)
• What funds are needed to get started and how will those funds be used?
• How much will it cost to develop the product and roll out?
• What different sources will be pursued for funding
and why are these a fit?

The Innovation Video is a 3-5 minute demonstration of the innovation. In the video, teams will give a tour of an Innovation Model. Teams may use sketches, 3D models, storyboards, wireframes, physical prototypes or any other visual artifact to achieve this.

Tab 11

Ok, so for the website- I'm working on the "our story page", how do i make it fit the rubric (Originality: Is the idea truly new or a novel combination of existing technologies and does it show creative or scientific inspiration? Impact Potential: Does it transform an industry or deliver real benefits to customers or society? Ambition Level: Is the innovation incremental, bold, or audacious compared to current solutions? Verification: Has an online search confirmed its uniqueness and ruled out duplicates?
IP Defensibility: Can the concept be protected (patent, trade secret, copyright, first mover, contracts, ecosystem capture) to secure its value?
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Revenue Projections: Has the team outlined plausible revenue models given market and value potential-both per unit and overall?
Funding Strategy: Is there a credible plan for securing development and rollout capital? Budget Reasonableness: Does the overall budget align with the scope and timeline of the project? Financial Viability: Do cost, revenue, and value scenarios suggest a sustainable path forward?). So far I have this- what else do I need? All of us are from India, and that background has
shaped how we see food and agriculture.

We have grown up seeing poverty, not as
distant but as something real.
We have seen families who cannot afford meals
and villages where food shortages are seasonal
and expected.

Many of us are directly connected to rural
communities and we have relatives whose
The only source of income is agriculture. Sometimes,
a poor harvest can determine whether
a family eats properly that year

Because of this, we are deeply aware of the

privilege of not having to think twice about
food. That awareness carries responsibility.

This project began from the belief that food
security should not depend on chance, geography
or fragile systems. Pollution may seem invisible,
but its failure is felt most by those who already
have the least margin for loss.

Our motivation is not just environmental,
It is personal, economic and human.

TrHIVE wasn't created as a project for college, but as a response to a persistent problem that we see in our everyday lives. Rising food costs are not caused by a single factor, but are instead closely tied to the health of pollinators that support crop production. Our perspective on this issue is shaped by our heritage, growing up face-to-face with a crisis we call food insecurity. This project stems from the belief that food security should not depend on chance, geography and fragile systems, but instead on the simple reality that one failed crop means one hungry family.

When we began TrHIVE we did not have access to advanced equipment or a formal lab. Early prototypes were built using repurposed materials, borrowed hardware and basic compliments assembled between school commitments. Early failures- such as us being able to only pick up cricket chirps (instead of bee activity)- confirmed what worked, what did not, and what we would need to improve on.

As the system evolved we transitioned from improvised prototypes to structured designs using open source tools and iterative testing. What began as a simple experiment grew into a scalable monitoring platform focused on data collection and analysis.

TrHIVE reflects our ability to apply engineering and data to a problem that affects food systems across regions. Built by students, but designed with real-world constraints in mind, the project is focused on improving visibility into pollinator health as a step toward a more resilient agriculture.

Our mission is to improve visibility into pollinator health by providing farmers, researchers, and agricultural partners with accessible, data driven hive monitoring technology. By collecting and analyzing real time environmental and behavioral data from bee colonies, TrHIVE aims to support earlier detection of stress, reduce reliance on disruptive manual inspections, and enable more informed agricultural decision making. We focus on building a system that delivers measurable benefits at the hive level while remaining practical to deploy, maintain, and scale within real world farming and research environments.

We have three goals; awareness, visibility and practicality.

Tab 12

Our mission
TrHIVE's mission is guided by three core goals: Awareness, Visibility, and Practicality.

Awareness
We aim to increase understanding of the critical role pollinators play in agriculture. By providing accessible information about hive health, environmental stressors, and pollinator activity, we help farmers, researchers, and the public recognize how changes in bee populations directly affect food security and crop yields.

Visibility
We strive to make pollinator health observable and measurable at scale. Using real time sensors and data analysis, TrHIVE monitors hives in a non intrusive way, producing actionable insights that allow stakeholders to respond quickly to environmental threats, disease, or stress factors impacting pollinators.

Practicality
We focus on solutions that can be realistically implemented in the field. Our system is designed for affordability, ease of use, and integration with existing agricultural practices, ensuring that the benefits of hive monitoring are accessible to farms of all sizes and adaptable across diverse environments.

Our Vision
TrHIVE envisions a world where food systems are resilient, pollinator populations are thriving, and communities everywhere have reliable access to nutritious food. We see a future where technology and nature work hand-in-hand to reduce food insecurity, stabilize crop yields, and lower the costs of agricultural products. By providing accurate, real-time insights into pollinator health, we hope to empower farmers, researchers, and policymakers to make informed decisions that protect ecosystems and ensure long-term sustainability.

We plan to communicate this vision to the world through accessible dashboards, detailed reporting, and educational outreach, showcasing how our technology can track pollinator activity, crop health, and environmental conditions. By sharing meaningful metrics-such as population trends, hive activity, and data on pollination rates-we aim to demonstrate the real-world impact of our platform and encourage adoption by farmers, agricultural organizations, and research institutions.

Through scalable monitoring platforms, data-driven solutions, and widespread adoption of sustainable practices, TrHIVE seeks to bridge the gap between technology and ecological balance. By making pollinator health visible and actionable, we can reduce food costs, enhance crop resilience, and inspire a generation of innovators and conservationists. Ultimately, our goal is a planet where every harvest contributes to abundance, equity, and a secure future for all, measured through tangible improvements in data collection, ecosystem health, and community food security.

Our Values
At TrHIVE, we value curiosity, experimentation, and rigor. Every solution we develop is grounded in data, research, and careful testing. We believe that innovation is most meaningful when it addresses tangible problems, which is why our technology and methods are designed to provide actionable insights into pollinator health and agricultural systems. From early prototypes to scalable platforms, our work reflects a commitment to solving challenges through science, engineering, and creative problem-solving.

We are guided by a sense of responsibility-to ecosystems, communities, and future generations. Protecting pollinators is not just a mission; it is an ethical imperative. We design our solutions to minimize environmental impact, promote long-term ecological balance, and support sustainable agricultural practices. Every decision we

make considers how it affects the environment, the food systems that depend on it, and the people whose livelihoods are tied to those systems.

Our values extend beyond technology; they are about fostering partnerships and enabling change. We work closely with farmers, researchers, and local communities to ensure that our solutions are practical, accessible, and impactful. Success for us is measured not just in data collected or models built, but in the real-world improvements we create-healthier pollinator populations, more resilient crops, and empowered communities. Collaboration and shared knowledge are central to achieving the positive change we envision.

Modern food systems are under increasing strain. Rising food prices, unstable crop yields, and growing food insecurity are not isolated challenges- they are deeply connected. One of the most critical yet overlooked factors is the decline of pollinators, particularly bees, which play a vital role in crop production and agricultural stability. Despite their importance, pollinator health is rarely monitored in a consistent or scalable way. Farmers often lack real-time insight into pollinator activity, leaving declines unnoticed until yields are already affected. This gap makes agriculture reactive rather than preventative, increasing risk for farmers and communities alike.

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Agricultural resilience depends on interconnected biological systems, and pollinators are among the most critical. When pollinator populations decline, the effects ripple outward, reducing crop consistency, increasing reliance on costly inputs, and amplifying risk for producers. These pressures accumulate across regions, contributing to instability in food supply and rising costs. The absence of scalable monitoring tools makes it difficult to intervene early, turning a manageable problem into a systemic challenge.

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