



Provisional Business Plan

Contact: felix.s@igem-graz.at



Table of Contents

EXECUTIVE SUMMARY	3
Business	3
Market	3
Finances	3
Future	4
THE BUSINESS	4
Business Structure	4
Registrations	4
Legal Structure	4
Organisation Structure	5
Location	5
Products and Services	6
<i>Approval of science</i>	6
<i>Methods of action</i>	6
<i>Proof of scalability/ safety</i>	6
Patents	7
Business model	7
Unique selling proposition (USP)	7
Minimum Viable Product (MVP)	8
SWOT analysis	9
Risk Assessment	10
MARKET ANALYSIS	10
Market Segmentation	10
Customers	11
Stakeholder Analysis	12
Competitors	12
Value Chain / Supply Chain	13
<i>Marketing</i>	13
<i>Packaging</i>	14
<i>Distribution</i>	14
THE FINANCES	14
Financial Plan	14
THE FUTURE	15
Expansion	15
Vision Statement	15
Business Goals	15
Milestones	15
APPENDIX	FEHLER! TEXTMARKE NICHT DEFINIERT.
REFERENCES	16



Executive Summary

The executive summary should include a summarised version of each component of the business plan. The purpose of the executive summary is for investors or professionals to quickly understand your business. A quick overview of the problem your business solves as well as, the current phase of your business (start phase, growth stage, etc).

Business

We will include a brief overview of the business including your business's product, competitive advantage, mission statement, location, patents and the product. Could include details about the team members past professional experience and background..

Market

There are around 1,000,000 beekeepers in the Western world excluding South America. Clearly only a small fraction would buy the Beeosensor, due to the already existing methods of detection and emerging methods of prevention.

The main competitors are beekeeping laboratories, which offer the service of testing samples with a microbiological method.

More dangerous are indirect competitors: emerging companies, whose products aim to prevent the outbreak of AFB and therefore could reduce the danger of AFB and the need of detection tools.

As the method is new, there is a big potential for marketing but also the need of reaching out to beekeepers, who don't even think of this possibility. Due to the clear target group and organized structure of beekeeping purposeful targeting is possible via already existing means as e.g. journals. The task of convincing the beekeepers of the reliability of the product will be challenging.

Finances

Summarise the financial analysis including revenues, expenses, sales margins, turnover, breakeven point, amount invested in the business and any other important metrics.

Future

Our main goals are to build a reputation for Beeosensor to gain a lead over potential competitors. By this reputation we also will expand our sales, because the acceptance of the method increases. A further possibility is to enter the business of AFB-treatment with our expertise with Paenibacillus phages.

The Business

Business Structure

This section includes details of the company such as date the company was founded, company address, etc. This can be formatted into a table.

Company Name	Beeosensor
EBN (European business number)	ATxxxxxx
Founding Date	2019-12-24
Company Address	Brockmanngasse 15, 8020 Graz
Contact Information	felix.s@igem-graz.at
CEO	Felix Schweigkofler

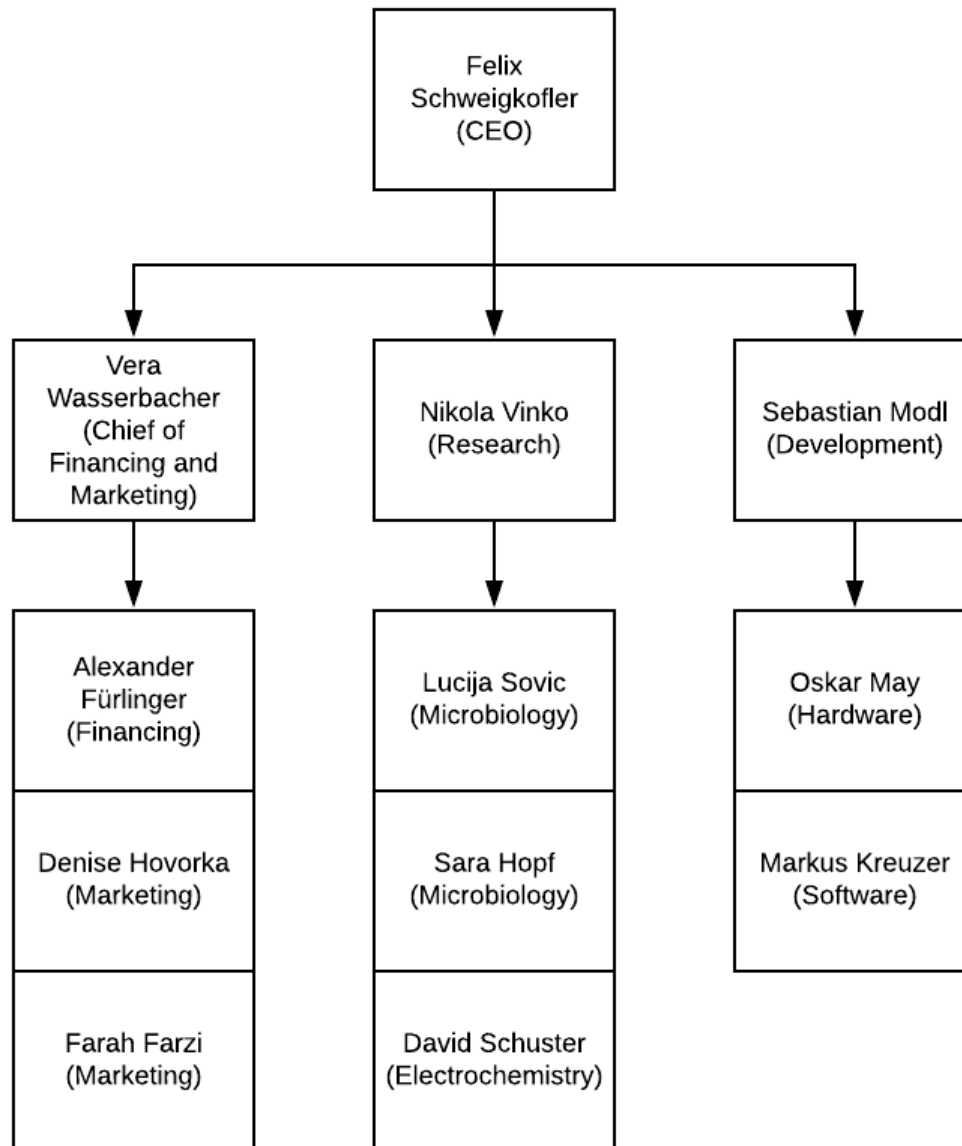
Registrations

Currently we are not registered.

Legal Structure

The most suitable legal structure of the business would be a partnership, to avoid high costs of starting the business. As we still are students, we would run the business parallel to our study and would develop the product further in cooperation with the university. As several people are involved in this phase, a sole trader is not in our interest and a full company requires too much work. For the beginning we want to focus on the improvement of our method with ongoing test with beekeepers and beekeeping institutions, which does not require a lot of investment, but primarily the will of investing time and effort.

Organisation Structure



Felix Schweigkofler, Nikola Vinko, Vera Wasserbacher, Lucija Sovic, Alexandern Furlinger, Denise Hovorka, Farah Farzi and Sara Hopf have a Bachelor's degree in molecular biology
 David Schuster has a Bachelor's degree in chemistry
 Oskar May and Sebastian Modl have a Bachelors degree in Biomedical engineering
 Markus Kreuzer is starting his Bachelors program in Telematics

Location

Our business will for the beginning be located in Graz, ideally close to the universities. This is due to personal reasons as well as strategic, as we already built connections with the local beekeeping institutions and universities, so that we can now focus on the further development of our method.

Products and Services

We will produce and sell a Device for EIS-measurements and electrodes, which are prepared with *Paenibacillus* phages.

The device can initially be produced cheaply in one of the hardware-companies located in China and shipped to Europe. Later, the production could be located in Europe as well. The electrodes will first be prepared manually as the initial phase still is heavily research-based. A few selected beekeepers will get the device and be required to share their data in order for us to improve our method.

As the beekeepers need to get an advice for handling the measurement, a customer support will be installed in a later phase.

Approval of science

Very early data shows, that the impedance changes by 500Ω , when an 10^6 cfu/ml spore solution is measured with the prepared electrode, relative to the prepared electrode without the sample. This sensitivity can be further increased by optimizing the preparation of the electrode. We participated in the iGEM-competition 2019 with this project and one of our members won the *ÖO Leistungspreis*¹ (performance/achievement award of Upper Austria) with the project. Publications show clearly, that a phage based biosensor is possible and very sensitive. Our task is to adopt the measurement to *Paenibacillus* larvae and create a functioning and easy method so that the test can be performed by non-professionals.

Methods of action

The device is first produced in hardware companies in Chian, later we might relocate that production to a different place. The phages will be produced in facilities in Europe and the electrodes will also be prepared here. Both are available in our online-shop and are also distributed by beekeeping associations and beekeeping specialist jobs.

Proof of scalability/safety

When we expand our business, there will be a need to set up a facility, where phages are produced on a large scale with a cell free system to avoid any risks stemming from working with *P. larvae* and because cell free systems are more easily scalable and less sensitive to irregularities in timing. Possibly, we could use our connections to the Munich team 2018 and with their help set

up the production there, as it is a central spot in Europe and therefore strategically fitting, as the electrodes need to be shipped across Europe.

Patents

We are working together with the TU Graz to apply for a patent. The TU Graz has a special institution for that, the F&T house, where patent attorneys check all the research on the University for potential patents. The patent will cover at least the EU and US, but also other states should be considered, as e.g. Argentine. The price of several ten thousand Euro will be advanced by the university.

Business model

Two different models are currently competing.

1. The device needs to be bought and the price contains the development plus production costs and a small profit. The electrodes also need to be paid and the price consists of production costs and the main profit margin.
2. The device is given out for free and the price of the electrodes must compensate for all the costs and the profit. The problem with that model is, that it would limit the distribution of the device to a few selected organizations and groups, as most beekeepers only have a few hives and would not use more than a few electrodes per year, which could not cover the cost of the device.

A combination of both is possible, with the device given to beekeeping institutions and maybe even local groups for free and beekeepers able to buy it, if they want one for themselves.

Additionally we can offer a return system for the used electrodes. Beekeepers give back used electrodes and get new ones for a lower price, which contains the depreciation of the electrodes and the costs of preparing them anew.

Any data gained from the measurements could be shared via a beekeeping app, which is interested in our data, either for money or solely for the purpose of popularity.

Unique selling proposition (USP)

The bee disease AFB is difficult to treat, once it has manifested clinically. The only way for the beekeeper himself to recognize the disease is when there are already clinical symptoms.

Alternatively he can send samples to a laboratory for bee diseases, which means he shares



sensitive information about his hives and many beekeepers still want to avoid that.

Furthermore, tests after a clinical diagnosis need up to two weeks and in that time the colony can infect other colonies, which could be prevented by a fast measurement.

There are quick test kits, which share the property, that the beekeeper himself can do the test, but have a low level of detection and are not quantitative. Therefore they have not been very successful and probably won't be. The lab method is specific and sensitive, but requires a lot of infrastructure and acceptance by the beekeepers. It's advantage is the governmental approval, which is based on the reliability of the method which we can achieve too.

Minimum Viable Product (MVP)

The minimum viable product is rather close to the final product and consists of a prepared electrode and a functioning measuring device plus the necessary redox solution. The design might be changed and some additional features added, such as a Bluetooth-module for connecting the device with an app. The MVP could be distributed as a kit while the consumables (electrode and redox solution) can be bought to replace the initial kit's content.

The prepared electrode is the core of our product and therefore is part of the MVP.

The measuring could also be done by a common impedance spectroscope, which can be found in electrochemical labs. As beekeepers have no access and beekeeping laboratories have at best a very limited access to these spectroscopes, we need to provide them with the necessary tool to do the measurement. This means that we need to include the device into the MVP, even though the prepared electrode could be enough for a person with access to such a lab. The device needs a primitive interface which enables the beekeeper to start the measurement and get the results via LCD-screen.

The redox solution, which is needed for the measurement, might already be available or could otherwise be purchased easily by beekeeping laboratories, but is certainly not readily available for beekeepers. The need to buy it separately would probably reduce the willingness to purchase our product. We also would need to attach a sufficiently accurate pipette to the kit.

SWOT analysis

<p>Strengths</p> <ul style="list-style-type: none"> - Good solution for AFB - Small group of committed people - Connections to the University of Graz (strong in bee research) 	<p>Weaknesses</p> <ul style="list-style-type: none"> - Small and unknown - Funding needs to be ensured
<p>Opportunities</p> <ul style="list-style-type: none"> - The existing solutions for the detection of <i>Paenibacillus larvae</i> are inferior and leave the market rather open - Beekeeping has a good infrastructure in Europe, therefore collaborating with those institutions to reach customers is possible . - The method can be governmentally approved and subsidized, which would make it more attractive for beekeepers and veterinarians and beekeeping laboratories. 	<p>Threads</p> <ul style="list-style-type: none"> - Already established biotech companies could become rivals - Competing ideas could reduce the strength of AFB (e.g. preventive phage therapy) - Legal and strategic mistakes when starting the business

Risk Assessment

	The risk and the likelihood (1-10)	How to avoid the risk?
External factors		
Economic factors	2	
Political factors	2	Bild good connections
Social factors	4	Understand beekeepers, their thoughts and their needs
Technological factors	1	
The market & customers	6	
Competition	6	Be quick to establish
Internal factors:		
Organization & human resources	3	Build a good working climate
Production	4	
Finances	5	Finding a business graduate for our company

Market Analysis

Market Segmentation



Our market is very specific and yet very international.

There are over 600,000 beekeepers in the EUⁱⁱ and over 200,000 in the USⁱⁱⁱ, which would be the primary markets. Including other European countries, Canada and Mexico gives a number of around 1,000,000 beekeepers, which we could reach in the Western world excluding South America.

Clearly only a small fraction would buy the Beeosensor.

Beekeeping laboratories and veterinarians also are potential customers, if the method is governmentally approved.

The main direct competitors are beekeeping laboratories, which offer the service of testing samples with a microbiological method.

Indirect competitors are emerging companies, whose products aim to prevent the outbreak of AFB and therefore could reduce the danger of AFB and the need of detection tools. As the method is new, there is a lot of potential for marketing but also the need of reaching out to beekeepers, who don't even think of this possibility. Due to the clear target group and organized structure of beekeeping purposeful targeting is possible via already existing means as e.g. journals, but it requires a lot of effort.

Customers

Our customers will mainly be beekeepers and some veterinarians, therefore we are focused on a rather precise group.

Many beekeepers are elderly which must be considered, when we reach out to them and advertise our product. They are mainly male, but this does not play a big role, besides a possibly lower technical affinity of women at this age.

Beekeeping is agriculture and as every agriculture it is located in rural areas, which makes it harder to reach directly, for marketing purposes as well as for delivery purposes. Urban beekeeping is growing, but still much less important than rural beekeeping.

Beekeepers who are facing the threat of AFB are located everywhere from Europe to America and even further^{iv}, but initially our focus lies on Europe and the US. In a later stage we could expand worldwide.

Beekeepers are rather open for new technical possibilities to improve their beekeeping practice and are as practitioners ready to manage new tools and work on their own.

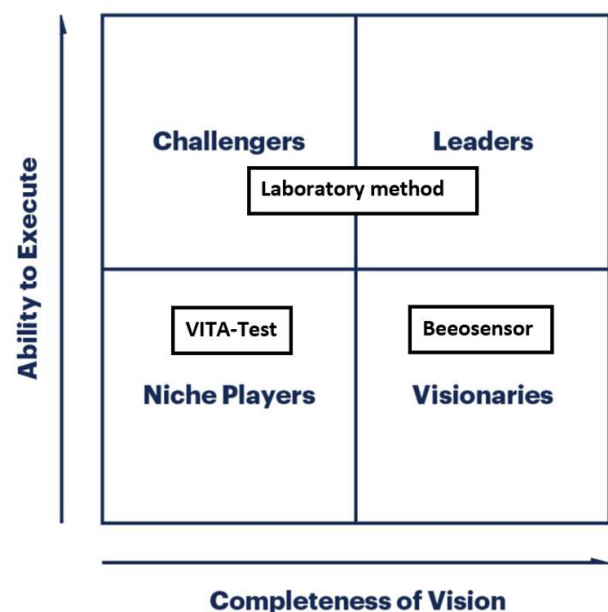
Stakeholder Analysis

Potential stakeholders are the same as for every Biotech-Startup. At the moment we don't have stakeholders and we have no concrete plan about our future stakeholders. The beginning will be financed by grants, the university and venture capital. A more detailed plan will follow.

Competitors

Name	Product Description	Market Cap	Strength's	Weakness's
VITA	Antibody based test for <i>P. larvae</i>	/	Cheap and easy	Unreliable, not quantitative, not governmentally approved
Beekeeping laboratories	Testing samples in microbiological laboratories	/	Reliable, governmentally approved, partially subsidized	Slow, more expensive, data is shared, could use our method instead
			Potential of reducing AFB drastically, so that	Still in development, not a detection method but a treatment

Competition is not very high in the field of *P. larvae* detection and there is not much innovation going on. The main competitors are beekeeping laboratories such as the Beekeeping institute in Dol near Prague (Czechia) which uses the microbiological method. Quick tests are much more unreliable and less sensitive, so that we don't expect much competition from them. On the other hand, these institutions could use our method too and by that becoming our partners rather than competitors, as they can still maintain the infrastructure, but use our way of testing instead of their current method.



Value Chain / Supply Chain

Our technological readiness level is currently 2 according to these guidelines, with the critical function or proof of concept not yet established. We are still in the phase of applied research, while we already are building components, which are not directly attached to the biological research. Therefore a business model and a rough vision of how the production is going to look like are already being developed.

Our value chain depends on the final optimization of Beeosensor, but will very likely have the following components:

- Producing or buying cells as a basic component of a cell-free system.
- Buying components of the optimized buffer for the cell free system.
- Producing and cleaning phages
- Binding phages onto electrodes
- Packaging, storing and distribution

The Device will be produced by another company and shipped to Europe.

Together as a kit or the separate components will be delivered to specialized shops or the customer directly.

Marketing

Our target group is clearly defined and very specific. The only group interested in Beeosensor are beekeepers, beekeeping institutions on every level and beekeeping laboratories such as national reference laboratories. In Europe there is a strong infrastructure connecting these elements, which we are going to use to promote our product.

One element of this strategy is building a network of people with key roles in beekeeping institutions such as the Styrian beekeeping association, from where we can reach the highest ranks without very much effort. We will then try to convince those people of our product, so they can promote it in their subordinate organizations.

The second element are journals, which happily write about new possibilities and developments in the field of beekeeping. We already launched an article in a professional journal. Beekeepers can also be found on social media, therefore the social-media department would need to produce articles in different languages to reach people with posts on Facebook and other social media platforms and inform them about AFB and Beeosensor.

Furthermore we will rely on the word-of-mouth advertising.

Convincing the beekeepers of the reliability of the method will be challenging. According to our survey this is the most important property and therefore needs to be addressed properly.

Packaging

Paenibacillus phages are only pathogenic for *P. larvae* and do not cause any disease in humans nor do they affect the human microbiome. By using a cell-free system we also exclude the possibility of any *P. larvae* remaining on the product. No special packaging is required and the product can be shipped with little problem, at least inside the Schengen-area.

Distribution

The distribution from our facilities will be done either by online-shopping and delivery services or by local specialist shops, as the one connected to and located in the building of the Styrian beekeeping association.

The Finances

Financial Plan

At our current phase of applied research we cannot give any information about costs of the final product, operational costs or payroll costs. Furthermore, many components as well as the laboratories used during research were provided by the University. The amount of chemicals used during research also varies drastically compared to the final product.

Despite the fact that the cost of key components such as phages and redox solution cannot be determined at the moment, the cost of sensor components and structural components can be roughly evaluated.

Depending on the order size, the electronic components such as the circuit board and LCD screen costs (.....) Housing of the device, which would most likely be made out of plastics (preferably biodegradable materials or sustainable plastics derived from plant starch) would also be in the price range of under 5€ per piece. Therefore we can state that the non biological/chemical parts of the device are very cheap and easy to obtain.

For attractiveness of the product the device itself if purchased by the beekeeper should lie between 100 - 200€ preferably even under 100€. The Kit containing the chemical and biological components need to be purchased continuously since one electrode can only be used for one measurement. This is a key feature of our device that has great impact on the financial plan.



Affordability is again the focus here. The price cannot by any means retain the beekeeper from buying and regularly using our product. A low price would result in reduced cash flow derived from low product sales in early stages of business.

This section will need much more attention in the future, when we develop and calculate our business model and know more details about the different costs.

The Future

Expansion

Expansion will mainly be driven by marketing and increasing the reputation of Beeosensor. Furthermore, we could go into the treatment of AFB and provide solutions for both detection and treatment. An American company started recently with producing bacteriophages for the treatment of AFB.

Vision Statement

We aim to sell 5,000 to 10,000 devices, which will probably be used by groups of beekeepers. Our goal is to accelerate and improve the detection of AFB. Another vision is the inclusion of a Bluetooth-module to connect the device with the smartphone.

Business Goals

We seek to reduce the cost of producing the electrodes by scaling the production up. The price of the device will remain rather stable, but we will add extra features in order to make measuring easier and safer. We will gather feedback and data from the early adopters to make changes to the device. The customer's satisfaction will be ensured by a support system, which will help beekeepers with the measurement via video-chat. Building on this reputation and further marketing as well as the inclusion of the method in the list of the approved diagnosis methods we hope to gain the trust and acceptance of the beekeepers to strengthen our position and gain an important lead over potential future rivals.

Milestones

Our first milestone is the founding of the company.



The second milestone will be the first sold Beeosensor.

The third milestone is the setup or use of a facility to produce the electrodes.

The fourth milestone will be the selling of the 1,000th Beeosensor.

This business plan has been created using the UNSW iGEM team's business plan scaffold. For more information please visit: https://2019.igem.org/Team:UNSW_Australia/Collaborations

Approved By:

Felix Schweigkofler

References

ⁱ <http://www.oee-leistungspreis.at/bildung-wissenschaft/>

ⁱⁱ <https://www.stat.si/StatWeb/en/News/Index/6674?AspxAutoDetectCookieSupport=1>

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

^{iv} <https://www.oie.int/doc/ged/D13697.PDF>