Report

Tile Insectarium

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Acknowledgement

Glossary

Abbreviation	Description
EPS	European Project Semester
ISEP	Instituto Superior de Engenharia do Porto
USB	Universal Serial Bus
SWOT	Strengths, Weaknesses, Opportunities, Threats
B2B	Business to Business
LOHAS	Lifestyle Of Health And Sustainability
DESTEP	demographic, ecologic, social, technological, economic, politic few of environment
EU	European Union

1. Introduction

As the population of our planet is growing, in the future need for new sources of nutrition will grow even more – an innovative way to grow food is necessary. Our team aims to provide every household a possibility to grow their own cheap recurrent food in a really unconventional way. Growing insects is green, simple and doesn't take much room nor time. It's a great source of proteins which you need for your body to function properly. The electronic devices which change temperature, lighting, aeration are really easy to use and they consume very little energy. The shelter for insects by Insecto is the perfect place to grow your future food, either for your fishing activities, pet food or why not yourself.

1.1 Presentation

We have got a great pleasure to introduce to you our team. We are a group of young, creative but most of all hardworking people that are going to work together with devotion for the next few months. Our team consist of 6 people, each of us is a specialist in different field and from different country and

thanks to this diversity we can provide creative and solid solutions. Our team members:

- Carina Bentin - **Germany** - *International Marketing and Purchasing in Engineering*
- Anthony Fountain - **Belgium** - *graphic design and digital media*
- Paloma Fernández De Toro - **Spain** - *Building Engineering*
- Bartosz Kuron - **Poland** - *Computer Science*
- Eughan Davies - **Scotland** - *Electrical/electronic engineering*
- Kristjan Suits - **Estonia** - *Environmental Engineering*

1.2 Motivation

Our team agreed that European Project Semester is a great source of knowledge and helps to develop many important skills. All of us believe that it is a great opportunity to work in a group and meet other culture. It is also a chance to make interesting project and improve language. We hope that our project will be a source of knowledge to both laymen and professionals. However, motivation is also a personal thing.

Bartosz Kuron: *“I ve choosen EPS because I would like to take part in international, multicultural project where I can improve my teams skills and find my strongest and weakest sides. I would like also bring something new to the market and impove my languages skills.”*

Anthony Fountain: *“EPS is a chance to gain experience abroad, learning other languages, meeting new people and being independent. One of the main reasons is to move my own boundaries to improve my confidence an projectskills.”*

Kristjan Suits: *“I choose EPS because I was thinking that this could be something really different and maybe get some kind of new skills to apply in my field of study. Aswell improve my spoken language.”*

Paloma Fernández De Toro: *“I've choosen EPS because I want to do a different project than the one that I would have done in my university and I want to put my knowledge in a different project, even if it is with insects”*

Carina Bentin: *“ I choose EPS as an alternative to my bachelor-thesis. I like to get to know new people, know the city, enjoy the new experiences and improve my english for my future in the company. Furthermore I decided for the Insectarium because it was imaginable and i had a little idea how it could look like. And another point is of course, that the project makes sense, which is usable in the future and we have the chance to finish it completely with our knowledge. ”*

1.3 Problem

The Insectarium looks at solving the issues of how to produce food to feed the world's population in the future.Recent figures imply that there are more than 200 million insects for each human on the planet,the challenge of our project is to build an enclosure with the appropriate conditions to grow Meal worms. The Insectarium should be low cost, effective and have a dynamic and functional design.

1.4 Objectives

Design and construct an insectarium with the appropriate conditions to grow insects.The insectarium must be inexpensive, productive and have an elegant and functional design.Our team must stick to a strict budget of 100 euros and must complete the project within a limited time scale of 4 months. The Project requirements are the Insectarium must :

*Look Elegant for the Market

*Have an efficient and functional enclosure which is built with the correct conditions to grow insects such as Mealworms

*Use low cost hardware solutions such as Arduino software for the programming of our control devices.

*Have exceptional control devices which are effective in monitoring and controlling Insects such as sensors.

*Be economical and well designed.

*Be as sustainable as possible.

*Use software such as open source and freeware to reduce costs.

*Comply with the following EU Directives:

*Machine Directive (2006/42/CE 2006-05-17);

*Electrical Safety: Low Level Voltage Directive (2006/95/CE 2006-12-12);

*Restriction of Hazardous Substances (ROHS) in Electrical and Electronic Equipment Directive (2002/95/EC 2003-01-27);

*Mandatory adoption and use of the International System of Units (The NIST International Guide for the use of the International System of Units).

1.6 Use Cases

The Client wants :

*A functional and elegant design - we aim to meet this by designing an Insectarium with a name,logo and instruction manual which will be tested to ensure it meets the demands.

*Use of Low cost hardware solutions - we look to meet this by using Arduino software for programming Electrical devices such as sensors and automatic feeders which will be designed and tested.

*An insectarium with appropriate conditions - we intend to do this by having plants and Sand and ensuring the Mealworms are in the correct temperature and humidity to make the insects feel comfortable which will be tested.

*A sustainable Insectarium - We aim to do this by ensuring our Electrical devices such as Sensors,Automatic feeders,motors and Timers use low power and by making the enclosure efficient and appropriate for the environment the insects live to reduce the use of these instruments as much as possible, this be tested to check the daily power usage of the insectarium.

* Something extra which we aim to execute by having a timer and an automatic feeder circuit which feeds the insects at a particular time of the day to ensure they are looked after,this will be tested .

We aim to have different sections to allow the insectarium to automatically remove the Insect defecation by using a motor to turn a net and having a sophisticated layer of woods,nets to ensure all the insect defecation is successfully removed to allow the insectarium to be reasonable clean automatically,this will also be tested.

1.7 Functional Tests

Devices

Humidity and temperature sensor - This device will be tested on breadboard before soldering onto a circuit board once we know it is working and ready.

LCD - Used to display the temperature and humidity - this display will also be tested on breadboard.

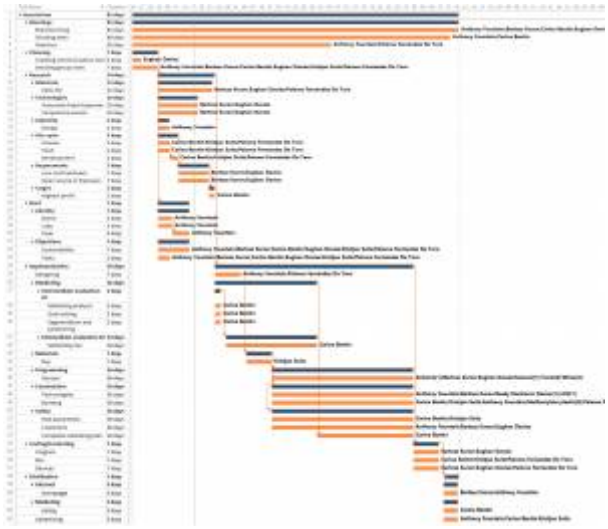
cooling fan - This device is part of the Temperature control system we are using and will be tested to ensure it activates when the temperature in the Insectarium is too high.

Electric Heater - This device is also part of the temperature control system and will be tested to ensure it activates to increase the temperature if the insectarium is too low.

Arduino UNO - Arduino Uno is what we are using to programme the temperature control system ,this will be designed and tested in the university workshop .

1.8 Project Planning

Gantt Chart



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1.9 Report Structure

This is the structure of our reports of our project:

Task	Description
Introduction	the introduction contains the description of our project, why we used it, so the motivation, a presentation of a problem and the project plan
State Of Art	see the existing devices and possible competition
Project Management	here we mention the scope, the time designation and also the lost and quality we decided for our project
Marketing Plan	included by a marketing analysis by considering the market, furthermore the segmentation, strategy and marketing mix
Eco-Efficiency Measures	discuss about the sustainability and energy, also how we can be environmental, economical and social, in the past also in the future
Ethical And Deontological Concerns	regarding to the ethics in marketing, engineering, academic and environment for being social and moral
Project Development	is about our architecture and design of our product with the corresponding explanation, also the tests and functionalities

2. State of the Art

2.1 Introduction

In this section of the report our goal is to look into the viable technologies used in the insectariums, the information about the mealworms life-cycle and the methods that have been used forehand to grow mealworms. Although the insectarium can be used for different insects because of the controllable temperature and humidity we are now focusing on mealworms in the state of art because mealworms can be eaten by animals aswel as for humans. This is because of the high level of protein and the easiest way to grow them compared to other insects.

2.2 Life cycle of the mealworm

The mealworms are one of the viable options to harvest either at a large scale or just at home - in this chapter I will speak about the appearance, habitat and the life-stages of the mealworms.

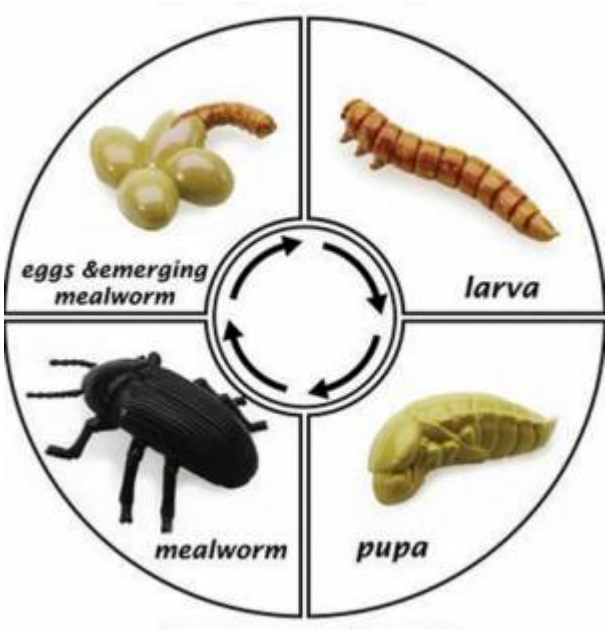


Figure 2: Illustration of the mealworms life-cycle

Phylum: Arthropoda; Class: Insecta; Order: Coleoptera

Appearance (Morphology)

Adult Beetle

• Black with hardened front wings (elytra) • Antennae arise under ridge near eyes • Antennae many-segmented, enlarging near tip • Shape quite variable, from almost parallel-sided to round • Head visible from top, followed by pronotum and elytra about same width • Mealworm (larva) averages an inch in length. They have a tough yellowish brown exoskeleton and are cylindrical.

Immatures (different stages)

• The larval stage (referred to generally as mealworms) is worm-like and somewhat hardened for

burrowing. The egg is white. The pupa is 1.25 to 1.90 cm long., white initially then darkening just before the beetle emerges. Length of the life cycle is 3-5 months. The larval stage may molt 9-20 times.

Habitat Mealworms live in areas surrounded by what they eat under rocks, and logs, in animal burrows and in stored grains. They clean up after plants and animals, and therefore can be found anywhere where “leftovers” occur. Mealworms are the larvae of a type of darkling beetles – Tenebrio molitor, it takes around a year for the bug to go through all of the 4 stages of metamorphosis. The stages are – egg, larvae, pupa and an adult.

Egg The first stage of life is spent as an egg. The white bean-shaped egg is tiny and about the size of a speck of dust. The egg is sticky and is quickly concealed by dirt, dust, and substrate. It will take around one to four weeks for an egg to hatch and the larva to emerge.

Larva The second stage of life lasts about eight to ten weeks and is spent as a brown larva. This is the stage where the insect is a mealworm. When first hatched, it is quite small but will grow to one to one and a half inches long. Since it has a hard exoskeleton, the worm will need to molt and shed its hard outer shell in order to grow. Molts will occur ten to twenty times during this stage of life. A recently molted worm will be soft and white, but the exoskeleton will quickly harden. A mealworm spends its time eating and growing in order to save up energy for the next transformation.

Pupa During a mealworm’s last molt it will turn into a white alien-like pupa. It has no mouth or anus so does not eat. It does have leg and wing buds, but they do not function. The pupa is quite helpless and the only movement it can do is wiggle. This stage of life will last one to three weeks as the pupa transforms its organs and body into an adult.

Adult The final stage of the insect’s life is as the darkling beetle and lasts one to three months. The beetle will be white with a soft exoskeleton. As the outer shell hardens, it will turn brown and then black. The beetle does have hard wings, but it is unable to fly. After about one to two weeks of adult life, beetles will begin to mate and reproduce. A few days after mating, female beetles will burrow into soil or substrate and lay eggs. Darkling beetles are prolific breeders and females can lay hundreds of eggs during their adult lives. (4)

2.3 Raising and breeding

Figure 3: Example of an insectarium.

Container

The container should have a large surface area and smooth sides. The sides of the container only need to be a couple inches higher the substrate in order to prevent the worms from escaping. An aquarium, terrarium, plastic box, or Sterilite container will make an excellent home. The container will also need a screened lid to prevent other insects and creatures from getting in and to allow airflow. Good ventilation is needed to prevent the container from getting to warm and to prevent the buildup of humidity and mold growth. If you are using an aquarium, there are screened lids available. For a plastic box you can cut away most of the lid and attach some window screen.[13]

Food Substrate

The substrate of the container will be the food. You can use wheat bran, oatmeal, cornmeal, wheat flour, Wheaties, Cheerios, ground up dry dog food, or a mixture of these dry foods. Fill the bottom of the container two or three inches deep with the food substrate. You will have to add more food regularly since mealworms are big eaters.[13]

Water

Slices of potatoes, apples, carrots, lettuce, cabbage, or other fruits and vegetables can supply water to your worms. Potatoes are often preferred since they last a while and do not mold quickly. Do not use a bowl of water since mealworms will crawl in and drown.

Temperature, Lighting & Humidity

The ideal temperature for growing your colony is around 298.15-300.15K (25-27 degrees Celsius) . A heat emitter may be necessary if you are in a cold climate. You will want to keep the container away from windows and direct sunlight to prevent it from becoming too warm.

Light is not necessary. A normal day and night cycle of light will be fine. You colony of mealworms will reproduce more quickly with a higher humidity, but for most areas the natural humidity in the air will be sufficient. If you live in a dry climate, you can place a smooth glass or bowl of water into the container to raise the humidity. Make sure the water container is tall enough to prevent the worms from crawling in.[13]

Maintenance

Any dead worms, pupae, or beetles should be removed from the container regularly. If the container begins to smell like ammonia or becomes moldy, it is time to clean the container. You will need to remove all of the mealworms, beetles, and pupae, discard the food and waste, and clean the container. Once clean, replace the food substrate and return the insects to the container.

It is helpful to have a second container to aid in raising mealworms and keeping them odor free. After your colony is going strong, you can move any beetles to the second container where they will begin a new colony. By the time the second colony is established, the original container should have very few mealworms. You can move any remaining worms to the second container and the original container can then be cleaned and prepared to repeat the cycle.[13]

2.4 Insect breeding market

Insect breeding is a fairly old trend for the Asian countries, but for the Western society it's relatively new. There are some mass-scale production companies that work on providing insects for either animal or human consumption, some of the companies work on providing insect protein flour aswell. For our product there are some competitors which are working on the same product - a DIY insect farm, where you could grow your own food.

Farm 432- insect breeding

This product is focused on breeding the black soldier flies larvas. The specifics of the flies have been taken into account and the design is very fashionable. But this product is more difficult to use for other types of insects.

Figure 4: Farm 432 product

http://www.kunger.at/161540/1591397/overview/farm-432-insect-breeding

Tiny Farm DIY

This is a company which sells different kits that are easy for the users to complect at home and they are insect-specific, consumers can buy different insectariums for different species.

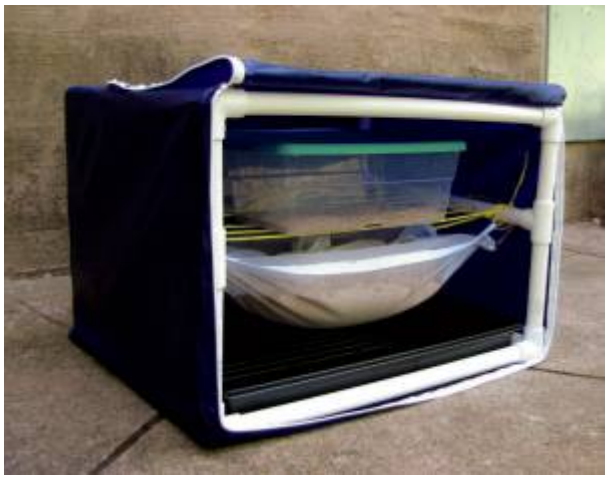


Figure 5: Open bug farm by tiny farms

http://www.tiny-farms.com/

The biggest competition is the Do It Yourself farmers, as there are plenty of guides on making an insectarium from simple household items.

Also there are different companies like Ynsect, Next Millenium Farms, Big Cricket Farms, Protix which provide insects and products made of insects at a mass scale, also they take orders to create insectarium for specific species and have a large range of expertise in the field of growing insects.

2.5 Conclusion

There are many products on the market which are more or less related to insect farming. The more complex products are all oriented to a single species of insects - none of them has the flexibility to grow different types of insects by monitoring the environemntal conditions. To amp up our chances on the market a good monitoring system within the product is a necessity. The price to quality ratio will also be a major concern to be a countable competitor on the market.

3. Project Management

3.1 Scope

Scope management(5) involves looking at the project as a whole, defining tasks and goals and then deciding who’s responsibility each task or goal is. Our task is to build an insectarium That means that it is a sor of aquarium to farm insects for animals aswell for humans to eat in a efficentn, easy and simple way.

The requirements of the project are to reuse provided components or low cost hardware solutions and to use open source and freeware software.

These goals are: defining the tasks, deciding who will be in charge of each task and finishing the final

report and presentation.

The project contains a Gantt Chart which is designed to help with rationing the time wisely.

• Justification: A brief statement regarding the business need your project addresses. (A more detailed discussion of the justification for the project appears in the project charter.)

our company has a hole in the market when it comes to farming insects and the future of it. Insecto will fulfill this hole by farming insects cheap food for animals and humans in the future. An insectarium that is adjustable for every insect and culture.

• Product scope description: The characteristics of the products, services, and/or results your project will produce.

We are planning to create an insectarium that is sustainable and low cost produced with high renewable materials. The main goal of out insectarium is help people farm insects at their home,zoo and petshops for their animals but also in the future for themselves when it’s more socially accepted. The insectarium will have a manual ventilation, automatic heater and automatic fan to create the perfect situation for the insects to grow to their peak.

• Acceptance criteria: The conditions that must be met before project deliverables are accepted.

1 manual adjustable ventilation

2 automatic heater with display

3 adjustable temperature control

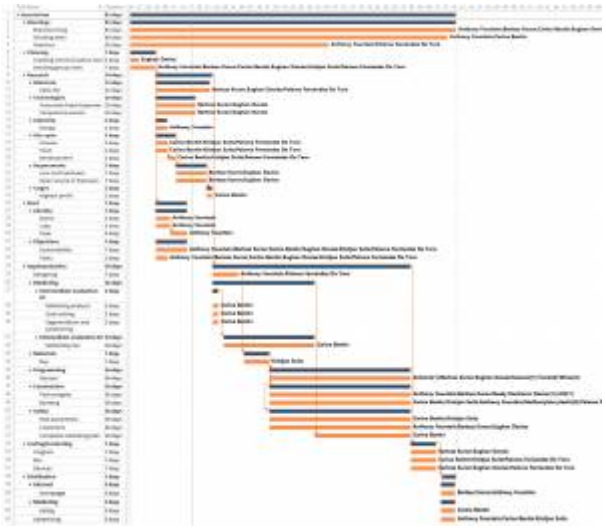
• Deliverables: The products, services, and/or results your project will produce (also referred to as objectives).

• Scope Statement • Progress Reports • Issues Reports • Weekly Meeting Notes • insectarium

Project Success: The project will be determined successful if the insectarium sells.

3.2 Time

Time management involves creating an achievable schedule of deadlines for the aforementioned tasks or goals and then making sure that each person responsible for these aspects of the project is capable of keeping to the schedule.



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3.3 Cost

Cost management involves simply making sure that the project team keeps to the budget given to them. It requires a great deal of planning to avoid costs spiralling out of control and all essential materials, parts or labour must be planned at the beginning of the project otherwise there will be no way to guarantee that the project will remain within budget.

1. Arduino Uno - 22,18 €

2. Humidity sensor DHT11 - 4 €

3. LCD + Keyboard: Itead 1602 LCD Shield - 6,7 €

4. Car mirror heater - 2,29 €

5. Fan - 2,30 €

6. Adapter 230V AC to 12V AC - 6,61 €

7. 2x 10k Ohm Resistor - 0,20 €

8. 2x Relay 5V - 2,40 €

Sum: 46,68 €

(All links are incluced in “Components” part)

3.4 Quality

In order to build a prototype that complies with the initially set requirements and to finish every deliverable in a quality that meets the team members´ expectations and also the EPS standards, every work produced for the project needs to pass a quality control. In quality control there are two dimensions involved: The human aspects consider how well each team member performs on individually allocated tasks, whereas the technical aspects involve how accurate the product is

developed and implemented. In this project the biggest technical quality issues are concerned with the automatic and adjustable devices to control the humidity and the temperature.

3.5 People

People Management or Human Resources is the aspect of project management that aims to keep all members of the project team working in relative harmony. The aim is to reduce conflict and to alleviate any excess stress that the project may be putting on the people working on it. Project management should also involve making sure that all of the team members are doing the jobs that they are supposed to be doing and reprimanding them if they fail to do so.

Anthony Fountain Identity (design of the whole project : presentations , leaflet , instruction movie)

Carina Bentin sales and marketing

Paloma Fernández De Toro Design,materials,building and sketching of the insectarium (prototype)

Eughan Davies Electrical devices and programming them.

Bartek Kuron Electrical devices and the programming of them.

Everyone Wiki and building of the insectarium itself.

To be cooperative and get connected to each other, it is important to carry on several activities besides the university. That's why we do teambuilding. at specific dates we organise to have dinner, go out,explore the city. Just to have a more fun and less stressfull way of talking about the project. it's also positive for the connecting feeling of the group.

3.6 Communications

Communications Management pertains to the systematic planning, implementation, monitoring, and control of project communications activities.

The purpose of the Communications Management Plan is to describe the methodology that will be used for managing communications within the project. The Communications Management Plan is an output of the Communications Management process that details the specific communications products, events, recipients, timelines, frequency and other pertinent communications information. Project management deliverables can also be considered principal communications tools. In most cases, Communications Management is a straightforward delivery-enablement process using a relatively standard toolkit. However, in major change and business transformation initiatives, communications and engagement may represent the main focus of the project and a significant proportion of the project work effort.

The objectives of the Communications Management process are as follows:

- Define the communications needs of a project;
- Conduct a stakeholder analysis to identify stakeholders, their roles, interests, how they will impact or will be impacted by the project, and develop a stakeholder management plan;
- Define required messages, appropriate media and channels, task assignments and timings for

communications delivery that will enable the project to meet these needs; and
- Ensure that the right people receive the right information at the right time to meet their needs and to achieve project objectives.

(3)

communications_matrix.xlsx

3.7 Risk

The aim of this chapter is to figure out the risks of our project and get some knowledge of how to better manage the risks.

Figure 4: Risk management scheme.

Risk management is the process of identifying, quantifying, and managing the risks that an organisation faces. As the outcomes of business activities are uncertain, they are said to have some element of risk. These risks include strategic failures, operational failures, financial failures, market disruptions, environmental disasters, and regulatory violations.

Risk is a statistical concept that is measured using statistical concepts that are related to the unknown future. Almost all investments are exposed to it. Risk management involves identifying the types of risk exposure within the company, measuring those potential risks, proposing means to hedge, insure or mitigate some of the risks and estimatin the impact of various risks on the future earnings of the company. While it is impossible that companies remove all risk from the organisation, it is important that they properly understand and manage the risks that they are willing to accept in the context of the overall corporate strategy. The management of the company is primarily responsible for risk management, but the board of directors, internal auditor, external auditor, and general counsel also play critical roles. Risk can be managed in a number of ways: by the buying of insurance, by using derivative instruments as hedges, by sharing with others, or by avoiding risky positions altogether.[14]

For Insecto the main sources of risk are:

- Overexceed the budget (Our budget is only 100euros and we have a lot of things to buy)
- Bad choice of materials (We have no experience in such field that is why we can choose bad materials)
- Late in deadlines
- Material quality is not as expected

3.8 Procurement

We should follow few rules during purchasing our materials.

- location: order materials from Portugal
- quality: control and find the best quality
- availibity: check availability of materials in stock
- time: check the time of delivery
- communication: how we can order materials (internet, phone, etc)
- costs: cost of product and transport should be as small as possible

3.9 Stakeholders management

Stakeholder management is a critical component to the successful delivery of any project, programme or activity. A stakeholder is any individual, group or organization that can affect, be affected by, or perceive itself to be affected by a programme.[1]

Effective Stakeholder Management creates positive relationships with stakeholders through the appropriate management of their expectations and agreed objectives. Stakeholder management is a process and control that must be planned and guided by underlying principles.

Stakeholder management within businesses, organizations, or projects prepares a strategy utilising information gathered during the following common processes.

1. Stakeholder Identification

2. Prioritize Your Stakeholders

3. Understanding Your Key Stakeholders

4. Engaging and Communicating with Stakeholders

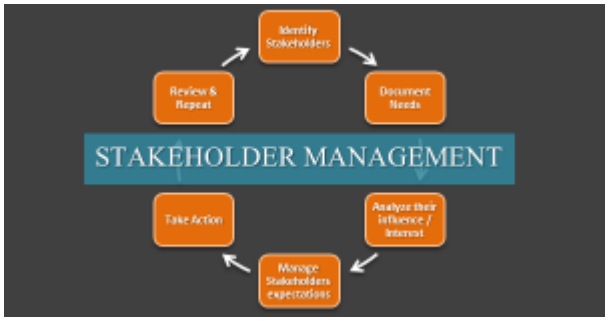


Figure 5: Stakeholders management scheme

stakeholders.xlsx

3.10 Conclusion

Our task is to build cheap, good and sustainable product. To do that we have to responsibly manage our project and we can't forget that project management consists of many parts such as time, people or quality. To achieve success we have to be strong one-minded group and have clear goals and roles in project. To provide best efficiency and best time management we prepared gantt chart with all important deadlines and milestones which are assigned to people. Thanks to that we know who is responsible for what and when it should be finished. We also prepared costs list because it is very important to know how much money we are going to spend. Our budget is equal to 100 euros and our calculations show that we are going to spend about … euros because we want to build fully automated system. To provide excellent quality we did a lot of research and choose the most efficient, suitable and only original materials. We spend half of budget on electronic devices and half of budget on shelter. Of course to provide good quality also people are very important, thanks to belbin test we were able to find our strongest sides and it helps us to divide roles and share work in team it helps us to find our leader – Anthony or plan maker Carina. We can't forget about risk connected with every project that's why we prepared risk management and we found that we can fail because of many factors. For example our budget is small and there can suddenly appear unexpected costs, we can also miss our deadlines or materials can have less quality than we expected. During project management we need also to define our stakeholders in our case it is simple because our stakeholders are mainly supervisors, teachers and team members.

4. Marketing Plan

4.1 Introduction

The aim in this chapter is to analyse our market first so we know for which users we can provide our product. This part is very important in the present age, where we have much of demanding customers. Every market has to use the right practices to get importance and attention. Then again a company can be profitable and grow. When we have our target-group we can decide more or less, which strengths, weaknesses, opportunities and threats we have (SWOT). Than we decide the strategy for our objectives, and that function after we segmented our market. Then it is possible that we´ll be ready and prepared for our positioning in the market and we pattern a adapted marketing-mix for the highest exhaustion. Before we start we have to check the budget we have and how (so strategy and controll) we go further with our marketing. In the end our conclusion.

"Marketing is the process of planning and executing the conception, pricing, promotion and distribution of ideas, goods and servives to create exchange that satisfy individual and organisational objectives."

(definition of marketing from Bennett in 1988)

First of all we want to clarify our aims on which we build on in the following:

Aim: Making the food healthier

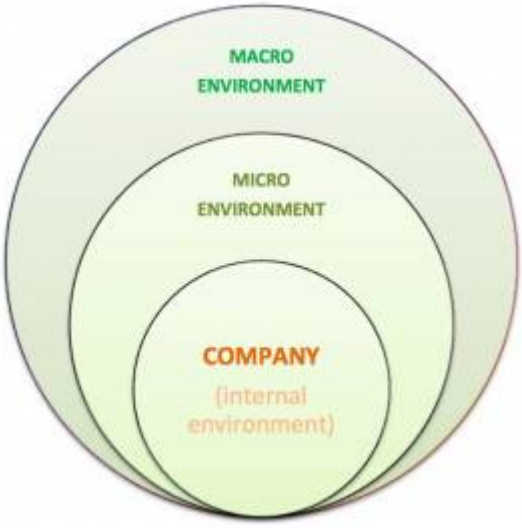
Mission: Making the food production more sustainable for animlas also for healthy and happy pets.

Company aims: Development of new insectarium (personalized), that enable high income and profit distribution.

Marketing aim: publicity of about 15% inside Europe in two years or less.

4.2 Market Analysis

Figure 1: relationships in environment



This is a small general description of the relationships between the different environments as related to the company.

Figure 1 [16]

Our product in 2015 will be an insectarium in which one can breed mealworms. Our aim is, to build something innovative, something new and from what people know, why they are going to need this. They should like it because of the beautiful design, it could be a decoration for the habitation but also act as a fedding station in zoos for animals. Furthermore the insectarium is going to be very sustainable with little power, do not need much space and is very easy to handle. There is no need for a continuous custody or maintenance. Moreover the product is extensible with some gadgets one likes or needs to have. Initially the insectarium is just to grow mealworms to feed animals with it. But certainly it is possible to put other insects in it if the environment is like the same. It should be provided to smal farmers, zoos and private persons but also to litte pet-houses.

At this point of time we are the only one in the European market, that are going to produce a product for mealworms to grow. Because of the location, where we plan and develop our product, it is sensible to provide the insectarium in the European market at first. If the demand will increase in the future we are able to sell it in other countries, after we made a new competitor-analysis for the new environment and market we will go into. But first we will have a look at the appropriate market and its environmental influences in the following.

4.2.1 Environmental-Analyses and -Arediction

4.2.1.1 External Consideration:

The goal is to realize the chances and risks of the market and constructing on that to create a prediction of the prospective development:[30]

- competetion analysis

- industry analysis

- analyse of the micro- and macroenvironment

4.2.1.1.1 competition analysis:

1) identify the competition companies

→ other companies, that offer comparable or the same producs, for the comparable/ same prices and servises. Also companies, that offer the products for the same using.[30]

2) realize the goals of the competition

→ why are the competitiors on this market? → which are their motives?

3) see trough the competitions´ strategies

→ the similar the strategy, the immediate the competition. We must have a look on strategic groups of a company, that pursue the same strategy on the same target-market. It is also important to see the competetive relations inside the strategy groups.

4) form an opinion about their strengths and weaknesses

→ based on the secondary data, personal experience and hearsay inside a sector.

5) assess possible reactions of the competition

→ it is better to know the business-mindset for assessing the reaktions and actions of our competitors.

6) determine competitors whose position should be assaulted

4.2.1.1.2 industry analysis:

analysis of the five competetiv-strengths (rivalry between the existing companies inside a section, bargaining power of the suppliers inside a section, bargaining power of the customers inside a section, hazard of newcommings inside a section, hazard of substitution-products) these points have to be analysed in detail and carefully. [30]

Analysis of the market entrance and escape barriers for example high capital demand or a permanent customer loyalty.

4.2.1.2 Internal Consideration:

The goal is to reveal the captive strenghs and weaknesses for being successful within the scope of the today´s and prospective situation:[30]

- value chain analysis

- strengths- weaknessesprofil

- experience curve analysis

4.2.1.2.1 value chain alaysis:

the value chain shows the steps of the production in a organized string of activities. As a controlling- and planningtool we use a portfolio-analysis and last the SWOT-analysis advancement of the strengths-/weaknessesprofil.[30]

4.2.1.2.2 strengths- weaknessesprofil:

the profil is segmented in three stages:[30]

1 - determination of the critacal recources: included are the following points, that should be assessed: location, space, financial situation, marketing, assortment, logistics, quality of the personal, leadership, organisation

2 - determination of the specific responsibilities: of the strengths- ans weaknessesprofile one can read out now the specific responsibilities of a company, but also the weaknesses.

3 - determination of the strengths and weaknesses: Strengths and weakneeses are not absolite bulks and it is only possible to determine them by a comparison. That means, that the strengths- and weaknessenprofil contains a competition-analysis for the selected competitors.

4.2.1.2.3 experience curve analysis:

The most important base for information provides the operational accounting. There again above all the cost accounting, the annual accounts (balance,profit and loss statement) and the operatingstatistics. The effect of the curve is a measurable empirical phenomen and the avarage costs and therewith the product minimum level decrease with raising experiences. The experience curve is regarding to a few causes:

learning process of the personal and better organisational processes by raising experiences

usage of low cost technologies thats investionvolume will be profitable with a high number of pieces

fixed cost degression. So the fixed cost distribute on a high number of pieces thus the fixed costs of just one piece will decrease.

decrease of the running costs. For a higher number of pieces a higher bargaining power towards to the suppliers. [30]

4.2.1.3 Micro-Environment:

The environment of a company pretends the parameters for the activity of the commercial undertaking. Set by the parameters of a high amount of systems and arrangements. They are

especially consist of five components:

4.2.1.3.1 internal perspective

Every company has an internal perspective which refers to the internal environment of the companys´ organization. So in our case we are a “company” of 6 students from difficult countries and with different facultys. In this way, every member gets tasks and manages this parts for one´s own for making it possible to realize the product in time. [30]

4.2.1.3.2 customers

After analysing the taget and prospective market, we classify the potential customers we are going to approatch. The product selling is more individual, because our target market are short farmers and short stores with some expensions, that makes it individual for the customer.

Against the backdrop of having no serious competitiors, we do not have a need on looking after customers in Europe, whose behaviors and reasons, why they are interested in other companies products, that are nearly the same like we are going to offer.

Thus we are trying to convince new and potential customers with a good surface impression for the new sustainable product on the relatonship towards the futures market. To feel certain to be fixed in the heads of the humans, so that if competitors are going to attect us, we are a better known and confidential company at all. For beeing a formidable opponent and build a save standing.

Concerning the background, that we already have a product and have to search for the customers than the other way round, like normal, do we have to search for customers who have the needs that we offer. We are like to adress our insectarium to customers by internet, leaflets and promotions. For instance by going to potential stores and hand out the leaflets for anyone interested. In the run-up to the election of our target group here are the first possible customers we want to approach:

Table 1: possible target customers for the direct distribution

company	country	task field
Jardim Zoológico	Portugal	Zoo
Bellendorf	Germany	butchery

Table 1 [27]

Table 2: possible target customers for the oblique distribution

company	country	task field
Zooplus AG	Germany, Munich	food and complements
Fressnapf	International	food and complements
Zoetis	International	animal health

Table 2[25][24][26]

Figure 2: choosen distribution channels

Figure 2 [Skript TVVS]

We would like to reach our consumers per direct distribution on the one hand but on the other hand also per oblique. Per direct distribution we offer our product for private persons with pets oder for little farmers in the internet on a homepage, which is also orderable there. That enables a customer contacts but also obligation. Which is turn to a confidencial and the result is loyality.

Per oblique distribution we think of Franchising (a company gets the law to sell the product of another company). We sell our insectarium to little pet-stores via B2B (Business-to-Business). The advantage for them is on the one hand to feed their pets healthier and cheaper, on the other hand they have the chance on profit by selling our product more expensive. So they can be motivated to be our customer. [Skript TVVS]

4.2.1.3.3 intermediaries

Intermediaries have nothing or less to do with the product itself. Rather with the question, how to distribute on which market. In instance if a company has a bad infratructure or just a few Know-How about the market they will join intermediaries could be very helpful. Also for getting a better proximity to the market and to the customers. But for our product and our notion to distribute, itermediaries are not making much sense- at this point of time- when we will take a look into the future we have to pass time to think about further distribution.[30]

The only kind of intermediary are the retailer, that are coincident our customers. They can use the insectarium for a better, cheaper food or resell it to further customers. But this approach is only defined as an intermediary, if they resell it and the endconsumer bought our new product.

4.2.1.3.4 suppliers

Apart from the ISEP University we do not have any suppliers right now. But for the future we thouhgt about a kind of cooperation with healthy and sustainable oriented companies to save money and for providing the product cheaper. We know which devices we installed so we can look after ecological suppliers. Furthermore our companys´ aim is to be sustainable therefore we also have to chose suppliers that are fulfill these claims as well.

4.2.1.3.5 competitors

At this point of time we do not have serious competitions and every company could become a customer or a competitor for us, according to the aims of the companys if they want to coorperate or to compete. The once who offer insectariums are producing in the western world, which is not our target location and we are not a part of their environment at first. When we have a look into the future it is possible, that our product becomes more attractive and the periphery increases which

requires a new market analysis including a new competition analysis. But at this moment insectariums are only produced and built by the customers´ own which we can describe for one competitor. If people only want to grow little insects, not particularly mealworms, and put no value on design or special keeping, they might buy insectarium that were built by private persons with a bad construction on the cheap. They order their selv-made insectariums for example at Ebay, which are also individual items. But we think that customers only bought it in the past because they have no idea and time to make it for themselves. But mainly because there is no existing market right now and the costs for a beautiful sustainable one are not much higher than an unattractive and inefficient one.

So in the best case, but not our aim at first, to get a monopol on this specific kind of market.

If we consider the other side of the insectarium there are suppliers that provide also food for animals. Only another kind like corn or hay. Perhaps there are suppliers in the world but it is another kind of animal food and not comparable with ours. Because of that we focus on farmers and pet stores that appreciate healthy food for animals. It is not our aim to reach other customers.

Table 3: possible target customers of other forage producers:

company	country	area
For Farmers	NL	international
Agri Firm	NL	international
Agravis	Ger	international
Denka	Ger	international
Bröring	Ger	international
ATR	Ger	international

Table 3 [29]

4.2.1.4 Macro-Environment:

The macro-environment influences a companys´ development vastly, but conversely the macro-environment couldn´t be influeced by the company. Thereby an analysis of the ruling and future environmental conditions have influence on the appeal of different strategies, it reveals chances and risks. Regarding to our insectarium project there are a few affects that will be explained in the following:

4.2.1.4.1 demographic- environment

The demografic component comprises aspects like the population development, geografic distribution, age distribution und birth- and death. An example is the trend of the continual aging population, that influence the market for the pension plan. [19]

Regarding to our project we do not involve the trend of the aging population, but the trend od the increasing importance of healthy. Evermore people put emphasis on their food to feel better. The older ones, reagrding to the animal feed are not interested in giving their animals good food like the people today. From the beginning younger population pays more attention which quality comes out of the animal for example eggs even the meat from the cow for example. The younger generation will

not increase, but the market for these are big enough for our aim.

Another point is the geographical allocation. We start in Europe, because in this is a better location for the market entry furthermore insects are more used as animal food. In other sections more for humans, and that is not our aspiration.

4.2.1.4.2 economic- environment

The economic component comprises factors like buying power, income distribution, saving rate, monetary assets, living costs and jobless rate. An example would be the adaption of the own assortment to the buying power and the monetary assets of the own target-group. If the company is bounded on a region it would make no sence for example to provide a luxury product on the market, if the buying power is too low for the purchasing of a product. This analysis should also incorporate some forecastings.[19]

The buying power will not be very high because the market is too smal at this time. Also the income distribution will not have a high effect on buying the insectarium, because there is not much money needed for buying and enyoing the product, if anything-people could save money by feeding their pets with insects, that are self-made at home which need nothing to grow, just once at the first time. And that is the purchasing. So we need not keep an eye on this topic of analysis.

4.2.1.4.3 ecological- environment

The ecological component comprises trends and changes of the ecological nature for example the environmentalism, the scarce resources, the public environmentpolitic and the increasing pollution. An example would be the ecoconscious car driving with different drive engineerings, that function with renewable energy.[19]

This a point we must have a look on. Thus the scare resources and the increasing pollution our product gets a high assessment aginst this process. Especially in Europe the importance of the environmental pollution increases and with that the value of alternative ressources. Of course, our view lies only on the animals, but that is, what it could start with. If everyone would improve its own area, the environment would get benefit out of it. And the sustainable feed for animals improves: the environment by producing the food without any chemicals, by a better living room for the animals, the nature ressources, no changes of the ecological nature and a natural breeding. So we do not need to be stressed or careful with operating this product, also not in the Europes future.

4.2.1.4.4 technological- environment

The technological component consideres the circumstances of the technological nature. Also the duration of the product life cycle, the requisite expenses for researches and development, possible innovation fields but also regimentations of the laws, that occurs constraint in the technical development. So the product life cycle of a car for example is getting lower and lower. Earlier the cars were produced up to nine years, nowadays only four to five because the humans expect innovations and specials.[19]

We do not have a product that has or needs a short product life-cycle. It is not a kind of product, people want to have because of a luxury requirement and for their state, like a car, where everyone is

best, who drives the newest and most expensive brand. We offer a product that is for a better quality of living. Of course one can extend some devices on it, so it would be a bit more technical but that was it. We do not need a high standard of technic, the product can be built with the easiest devices that already exist for a long time and which make the handling with the insectarium without a big fuss.

4.2.1.4.5 political- environment

The political component deals with regulatory influences like competition-law, anti-trust-law and consumer protection. An observing trend is the increasing influence of the EU-law, that constainly develop new regulation according to which the companyies have to fit to.[19]

The increasing influence of the EU-law is not that bad for our distribution because, as in the economic part said, we have a sustainable and nature product on that is no danger by and for anyone. Rather there is a possibility that we will get any support because of the production of something good. So we have influences of the political environment nowhere.

4.2.1.4.6 social- cultural- environment

The social-cultural component is concerned with society by itself. It describes the core values like work, marriage/ family and fairness. But also the relationship of the humans to themselves, to fellow human beings, the nature and institutions. Furthermore culture and subculture. An example is the visible trend of the social-cultural of the LOHAS ([L]ifestyle [O]f [H]ealth [A]nd [S]ustainability). Here increase the need of healthy food and fitness. For example fast-food-companies increased offer biological food. Also employer are evermore interested in health of their employees.[19]

The main point in this chapter is the culture for sure. In Europe it would not be the deciding point to buy our product, like in the western, where the humans consume of insects is much higher than here. It has not a high meaning, only in a way of culture that describes the good behavior against the worlds´ environment. Furthermore during talking about good behavior, some people or farmers care about the animals health by a good handling an a species-appropriate husbandry. And if farmers care about the happiness of their animals, they are also interested in good, healthy and inexpensive food. That is why these persons are our target group. Maybe it would have impact on other farmers, that we do not reach for the first time, adapt themselves. We stand for the fair farmers and animal breeders, who are already mentioned as the choosen customers in the distribution.

conclusion:

The DESTEP-analysis is an important tool for the marketing- analysis however it is insufficient for the deciding for or against the market entrance. The SWOT alalysis for example can be an added tool or analysis for being on the save side. So the DESTEP-analysis is important but insufficient alone. For a reliable and suitable marketing analysis a mix of several tools should be choosen.

4.3 SWOT Analysis

The SWOT-analysis is a tool that identifies the **S**trengths, **W**eaknesses, **O**pportunities and **T**hreats of an companys´ organization. The analysis assesses what an organization can and should not do as well as its potential opportunities and threats. The method of SWOT analysis is to take the information

from an environmental analysis for our product and separate it into **internal** (strengths and weaknesses) and **external** categories (opportunities and threats) that will be mentioned in the following:[Skript TVVS]

Picture 2: shows the strainghs, weaknesses, opportunities and threats

Picture 2

4.4 Strategic Objectives

To develop a strategic marketig plan on that we can measure our past, future and competition it is necessary to frame the strategic objectives that can decribe by aims or milestones of the product for at most the next five years:

Table 4: The objectives

time	decription
2015	get ready the production of the whole insectarium including all possible devices
2016	sell at least 5 insectariums inside Europe with no special ditribution
to 2018	get a publicity of about 15-20% of the humans
to 2020	increase the amount of green farmers and the resulting nourishment of about 10%
2020	more than 25 customers of all sorts for the insectarium

Table 4

further objectives:

- development of new insectariums for other insects, that could not grow in the planned product

- more personalisable by special designs or devices

- increasing benefit through the years

- stay the most-known producer of insectariums

- customers satisfaction

4.5 Segmentation

Definition:

“Market allocation in buying-groups with different needs, characters or mode of behavior, that require different products and a nuanced Marketing-Mix.”

Regarding to our product and its market analysis like the adjusted SWOT analyses we can look further with the market segmentation. By reference the SWOT analyses we can adress our customers specifically when we segment them into different market sections.

We already had a look at the micro-environment criterias we listed like geographic-, demographic-, psychographic- and behaviour-aspects:

Summarized:

Location: We are located in Europe, which is a big location but especially for the beginning in Portugal. Portugal has round about 10,5 millions inhabitants, Europe 742,5 million. [31][32] There is a different climate in each stage of a year, but in all, Europe has no country with much different climate zones. Furthermore we focus on humans age of about 20 years up to 35. Preferably that are private, in animals and food interested young people,young farmers or zoo holders. There are no requirements on the income of each customer, because there is no need of much money for our product. There is also no need on a high knowledge or a special certification. But it is possible, that some people get a problem regarding their moral or ethics, to eat creatures. The lifestyle of the customers have to be value-centered, if they should care about their and the animals´ healthy also the better environment by pollution reduction. Furthermore they have to be innovative and open for new experiences for instance by tasting animals. Our customers have special purchase-reason, more or less, becasue regarding to the normal thinking and handling people there is no action by improving the environment or the better food for animals for again getting a better results for humans. That would be first-time, not regular buyer, which require no high customer loyalty. The approach to the insectarium will be positiv most, for a few of them hostile.

Thus, we move in a sector that pays attention on the healthier life and better environment firtly regarding to the animals. Preferably for small customers, so small farmers and smal zoos.

segmentation-features:

So regarding these points we initially segmentate on the bases of the demografic-psychographics-features for consumer-goods because its highly probable the market with the highes influences. In other words based on ethics, social class, lifestyle and personality like the open for new. A multistage segmatation is presented. The challenge we have for an efficient segmentation is the measurability. It

is difficult to measure something, that do not exist, so we only can measure, when something is implemented, when we talk about the insectarium by itself. But we can measure the need for the animal food each farmer or zoo would need for the efficient feed. In expample:

Figure 4: Feedingamount with insects

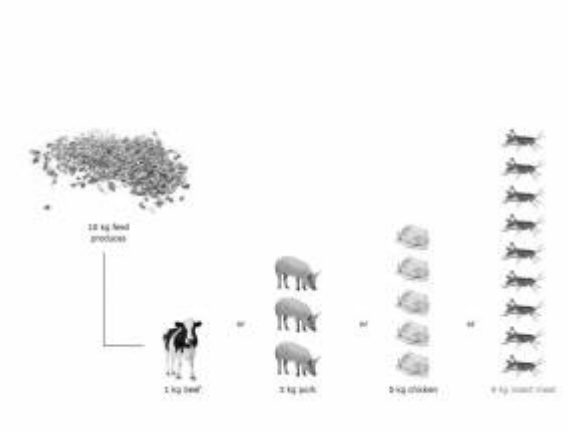


Figure 4

4.5.1 four types of market segmentation:

- **high-volume-marketing:**

Undifferentiated speech of all market segments like " one size fits all "

- **target-group-marketing:**

Adaption of the product-offer and the Marketin-Mix for one or more market segments

- **niche marketing:**

Adaption of the product-offer for narrowly defined market segments

- **micro-marketing:**

Offer of individual products and personalized Marketing-Mix like " One-to-One-Marketing "

Decision:

In reflection of these options we decided for target-group-marketing. The explanation for that are various aspects that were mentioned above. We can offer our insectarium for more and wide segments and there is no need or requirement for special adaptions for customers. With the only different that we do not really adapt the product-offer, but the possibilities we have, to modify the insectarium, is for one or more segments interesting.

The advantage is that we have opportunities to get a supporting by companies that are interested that are coincident our customers. Furthermore we have no political trade barriers or kinds of laws that prohibit or restrict our commerce. A further advantage is, like mentioned in the SWOT analysis, is that we may can use the knowledge of each team member what concerns the "home" market for a better entry when it is time.

4.6 Strategy/Positioning

assessment of taget markets:

We choose our merket by reference to the assessment of our target markets. There is an attractive market segment in the accrual rate of the humans. And regarding the food, the relation increases disparate. So the food will become more important for the human increasing beacuse of its scarcity. With that we can use the accrual as an advantage.

Figure 5: determination of the operating market segments

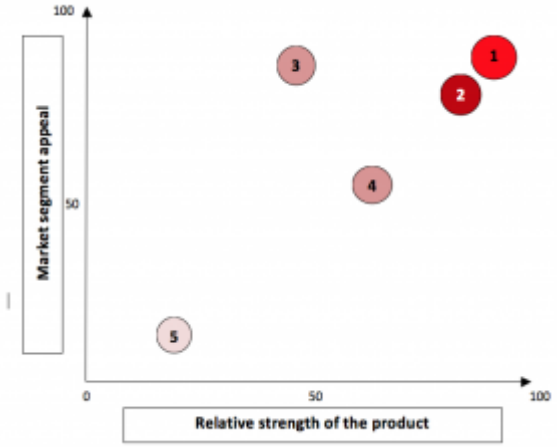


Figure 5

1 - lifestyle segment (value-centered)

2 - social class (who cares about the environment and pollution)

3 - personality (new experiences, innovative)

4 - ethical affinity (ethical to eat creatures for a better healthy)

5 - nacionality (for now it should be an European)

4.6.1 differentation and positioning

Goal:

Adjust the companys´ stengths with the demands and opportunities of the market respectively of the individual segments

Approach in two steps:

- Identification of a customer group, from whose few we have an exceedingly offer and that differentiate us with an advantage against other provider

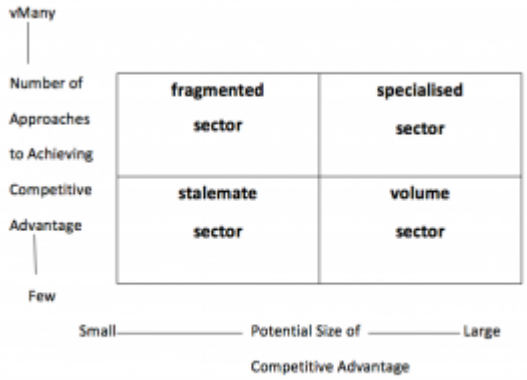
- Positioning of the product in the heats of the consumers.

–> Differentation and positioning have to deliver the answer to the question of the buying prospective buyer “ Why should I by exactly THIS product?”

4.6.1.1 Differentation:

the new BCG- Matrix for the differentation:

Picture 6: Strategic Environment Matrix



Picture 6 [Skript TVVS]

As seen in the picture when we have a look at a high advantage and high potential to competetive advantages, we move in the sector “ specialized”. This is our differentation to be discharged from other comming components in the future.

4.6.1.2 Positioning:

Consequent, straight, clear and unique following of a position regarding to our target-market as compared to competitors´ products.

With the background, that we do not really have a serious competition, we raise these as once, that supply other animal food to the same customers, who we want to reach as well.

These competitors were already mentioned in chapter: 4.2.1.3.5 competitors (Table 3)

- Position of a product is a bunch of emotions, feelings, impressions and sentiments that consumers saved in their head as compared to other products

- Customers define the position of a product by means of the important buying relevant features

- Aim: definable, ideally unique position of the competition in a clear defined market

- Challenge: we are successful, if we are different especially in that way like the customers whish

»Positioning begins with a product, a commodity, a service, a company or even with a person. But positioning is nothing what happens with a product. Positioning is that, what happens with the thoughts of all those interested.« Ries/Trout 1981

[Script TVVS]

4.6.2 Strategic Options of the Positioning:

1. Reinforcement of the present position

2. Finding a vacant position and fill it (with new products)

3. Repositioning

Decision choice and implementation of positioning strategy:

4 steps:

1) For the structure of the intended position we need the identification of possible competitive advantage

2) The right decision of the competitive advantage and positioning features

3) Develop of a positioning strategy

4) Communicate the competition strategy on the market

4.6.2.1 Choice and implementation of a positioning strategy:

Identification of possible competitive advantage:

- Differentiation over the product

- Differentiation over services

- Differentiation over employees

- Differentiation over image

- Differentiation over origin (cult) (cars from Germany)

Regarding to these possible differentiations we identify the competitive advantage with the differentiation over the product.

Table 5: development of a positioning strategy

Scopes for design

price:		**cheaper**	**similar**	**more expensive**
benefit:	**more**	more for less	more for the same price	more for more
	similar	the same for less	“We can do the same as well”	-
	less	less for less	-	-

Table 5

Regarding to Table we position ourselves in “more for more”. We offer a product with a better quality with a beautiful design and with helpful devices for the insect growings. One has to pay more for that, what should be paid for a normal, selfmade insectarium with no devices, not that beautiful and therefor a worse breeding of insects.So one can benefit from our product just by paying a little bit more money.

Table 6: criteria for the meaning of the differences of the positioning

features	what does the difference afford?
important	the difference afford a high added benefit for the customers
distinctive	the competitors do not offer something of the like or the company can deliver it in a unique way
superior	the difference is the best solution for reaching a special goal
arrangeable	the difference can become clear and visible, also explainable for the customers
not imitable	the improvement cannot be copied by the competitors
affordable	the purchaser allow oneself to pay for the difference
economic	the company can market the difference profitable

Table 6

Implementation of the competitive advantage

• Amount of competitive advantages

• Unique Selling Proposition (USP)

• Emotional Selling Proposition (ESP)

• possible mistakes :

- under-positioning

- over-positioning

- unclear- positioning

- implementation of the competitive advantages

Table 7 : Alanlysis of competition advantages

	Technology	**Costs**	**Quality**	**Services**
assessment of the own position (1-10)	8	4	8	2
assessment of the competitions position (1-10)	1	2	2	1
necessity of urgent improvements (big-middle-slight)	middle	middle	slight	slight
bankability and velocity (big-middle-slight)	big	big	big	big
competitors ability to improve themselves (big-middle-slight)	big	middle	middle	big
guidance	bide	bide	bide	bide

Table 7

Currently we have no guidance because of no competition and that is why the competitors abilities

are big. We are the only once, and they can measure themselves on our product.

4.7 Adapted Marketing-Mix

We refer to a Marketing-Mix and adjust each position to our product marketing. The Marketing-Mix is constructed like the following:

Picture: construction of the Marketing-Mix

integrative, analytical consideration of the Marketing-Mix

Picture

4.8 Budget

4.9 Strategy Control

4.10 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

5 Eco-eficiency Measures for Sustainability

5.1 Introduction

There is no universally agreed definition on what sustainability means. There are many different views on what it is and how it can be achieved. for us and our company , sustainability is :

A process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations.

The environment must be protected… to preserve essential ecosystem functions and to provide for the wellbeing of future generations; environmental and economic policy must be integrated; the goal of policy should be an improvement in the overall quality of life, not just income growth; poverty must be ended and resources distributed more equally; and all sections of society must be involved in decision making

5.2 Environmental

The insectarium allows you to grow more food per square kilometre which helps the environment because the human population is growing which makes land more valuable.

The insectarium uses an environmentally friendly plastic called PMMA which has a long life cycle , can

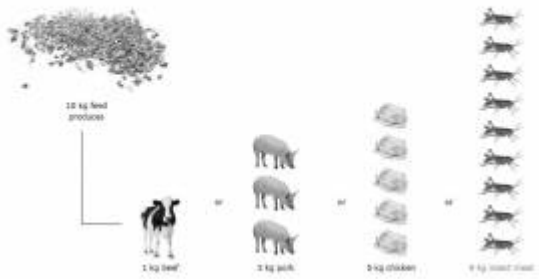
be used many times ,it is 20 times stronger and half as light. The maintainence of the insects is little since it is automatic.The PMMA also has good insulation to allow the insects to remain at comfortable temperature.

It is user friendly since it has an LCD backshield with keyboard which allows the user to set the temperature range that he wants the insects to live in.The system uses low powered electrical programmes and devices to allow the insectarium to be environmentally friendly and cheap.

5.3 Economical

The insectarium is a very good choice economically since it is sustainable using low powered electrical devices and programmes for the automatic control to minmise use of power as much as possible.

The insectarium offers customers an opportunity to grow insects with a high protein content in a small space which offers people an alternative method to having protein than eating fish and meat which are a expensive option. The insectarium is also targeted to zoos and farms in order to feed the animals which shows it offers flexibility in the market and great potential.



This chart shows how the same amount of 10kg will feed a cow which will produce 1kg of meat and insects once fed the same amount of food will produce 9kg of meat, this is nine times the amount of a cow which shows that insects are a very good option economically since they require little food and produce alot of meat.

Our insectarium is under 100 euros which means it offers customers in zoos and farms for example a cheap price with a well designed automatic enclosure with low maintenance.

5.4 Social

SUPPLIERS:

Sustainability in supplier management is of high importance to Insecto. When making procurement decisions, we do not only take into consideration economic, technological and process criteria. In line with our Group’s mission statement and policies, we also place highest value on social and ecological aspects such as the protection of human rights, the fight against corruption, and protecting the environment.

We want to eliminate the risk of having who do not live up to basic human rights. That is why we have meetings with the suppliers where we talk about safety, privacy, respect the working hours and no kids working in those factories.

EMPLOYEES:

Being part of something meaningful is really cool.Every employee is looking to feel good about where they work and make a larger contribution. Through sustainability they can feel better about their role within a company.

And those feelings matter to our company's bottom line. Employees who are the most committed to their jobs put in 57% more effort on the job and are 87% less likely to resign, according to a study conducted by the Corporate Executive Board. (1)(anthony)

Give equal opportunities to both men and women, not depending on gender even if depending on capacity and ability. Our company values families, that is why we aim to make our employees schedules as flexible as possible. Make our employees feel appreciated and valuable, having the opportunity to communicate their ideas to the team and taking part in the company decisions. Provide health and safety training and ergonomically designed workstations to reduce health-related risks and costs.

PRODUCERS:

we want to avoid as much as we can the labor accidents. What we do is to give them courses once a year about accidents that appear while using a machine. We also give them specific training about the new equipment that arrive to the factory. Insecto makes a difference to small farmers and workers. By targeting their income, living, and working conditions, the company aim at the improvement of farmers' and workers' socio-economic situation:

- minimum price and access to pre-financing

- improvement of livelihoods and protection against price fluctuations

- minimum price paid on the top that benefits not only individual farmers, but also their communities

- help women to realize their full potential and to get the respect in their communities that they deserve

- use of environmental friendly production methods

- preservation of traditional farming and agro-ecological practices

DISTRIBUTORS:

here we are going to talk about logistic. Logistic is the management of the flow of goods between the point of origin and the point of consumption in order to meet some requirements of customers.

The product distribution is an important part of the product cycle because we have to make sure that it is properly and safely. Likewise, we consider employees who carry out these deliveries, taking care of their safety and their physical and mental skills required for the job

-Before and after the transportation: We want to eliminate the risks that came from the delivers, like accidents in the road. That is why we are always making revisions to our trucks and making courses

to our employees about the risk on the road and sensitization about accidents.

-During the transportation: handling conditions must be suitable for our employees. They are not going to load more than the recommended weight (20kg) and in case of having to carry more weight, they are going to use machines suitable for this purpose.

-We want to give courses to our drivers about how to drive in an ecological and sustainable way, trying to reduce the CO2 and using less fuel oil.

CUSTOMERS:

Food is essential to life. It also forms an important part of our cultural identity, and plays an important role in the economy. People are aware that the food they eat is an important factor affecting their health aswel as the health for their animals, but what is less well known is the impact producing and consuming food has on the world's resources.

that's why:

we are using materials little dangerous for our clients healthy. We are also giving to our customers a leaflet with the instructions of the insectarium: what to do before, during and after having the insectarium working. We would like to know what problems they have with the insectarium, that is why we are giving them a free telephone number for those incidents. At the time we receive that incident, we study the problem and we register it to avoid similar problems in the future. The food that our insectarium produces is healthy for the animals as well as for humans, because it has a high level of proteins and it is produced without any chemicals compared to the food that we know today.

5.4 Life Cycle Analysis

Life Cycle Assessment (LCA) is a technique for assessing the potential environmental aspects and potential aspects associated with a product (or service), by:

- Compiling an inventory of relevant inputs and outputs
- Evaluating the potential environmental impacts associated with those inputs and outputs
- Interpreting the results of the inventory and impact phases in relation to the objectives of the study[15]

Figure 5: Life-Cycle assessment

Insecto aims to keep our products environmental impact as low as possible in each stage of its life-cycle. Since our company cares about the sustainability of our planet we aim to show a good example to the other companies and consumers in every stage of our products life cycle.

Raw material procurement

The plastics and the electronic components that we chose for the insectarium are high quality, responsibly manufactured, cost-effective and easily recycleable - our suppliers have ISO certificates to prove that. The electronic components have a low energy consumption, which we achieve by testing different types of energy sources.

The electronic components have a low energy consumption, which we achieve by testing different types of energy sources.

For building the carcass of the insectarium we use PMMA- because it has very good temperature and sound isolation, material is very durable and has a long life-cycle also it is very light.

The glue we use has a long life-cycle and is very strong, it is durable to different enviromental conditions.

For the electronics part we chose an LCD Shield with a keypad, which is easy to use, is sustainable and cheap.

12V DC cooling fan is cheap, sustainable, efficient and can be compatable with Arduino.

Temperature and humidity sensor chosen by us– is compatable with Arduino, sustainable, efficient and is cheap.

Manufacturing

In the manufacturing stage we aim to conserve as much material as we can so every plastic that we use will either be used or sent to a recycling facility, we make a lot of investments for material

research and take precautions to minimize the water, air and ground water pollution. Our factory tries to lower its energy consumption when possible, in the production area and the workers area, through well taught employees.

*New products and manufacturing approaches that reduce demand for scarce resources while enabling sustainable growth

*driving development of cost-effective renawable and alternative energy sources like solar and wind power

*utilizing technologies that re-use rather than waste energy in automation systems

*analyzing and re-engineering production systems to eliminate wasted motion,materials and energy consumption

*implementing strategies such as lean manufacturing to drive out waste across al areas of production

(2)

Distribution

The insectarium will be distributed to different parts of the planet according to a thorough research, more will be shipped to the places of higher demand. Transportation is always used according to the customers needs, trucks fueled by biodiesel and ships are the main focus. Packaging choices are made keeping in mind the specifics of transportation but always using as few material as possible(for example packaging of the insectarium has no excess space in it).

Consumer use

The product needs little maintenance due to the simplicity of it. The consumer itselfs becomes more sustainable just by using the insectarium . why is that ?

1. 1. The product launched includes some electronic gadgets which consume as little energy as possible.
2. 2. food reproduces it by itself in the insectarium without needing extras.
3. 3. waste food like carrots,apples,meal can be used as food for the insects.
4. 4. healthy food for animals aswel as for the animals:

- They’re environmentally friendly. A mealworm farm takes up zero useful land. Mealworms can even be grown in a closet or under a bed.

- They’re a good source of protein. Mealworms contain about 25% protein, and 12% fat (1).

- They’re tasty! When toasted in the oven, mealworms taste just like roasted nuts or seeds. They’re particularly good covered in chocolate or sprinkled on soup. (7)

End of Life

Our Insectarium has many components, that are durable, so there is no need to renew it every few years because the materials live long for just a bit more money. In case of recycling the product, it is possible to use all technical gadgets for other things further. The components of the livingroom of the insects are also ecological. The bread crumbs, some ecofriendly board and wood, more is not needed. For the building of the insectarium we have long living pmma plastic and steel mesh. Of course, this

are our only components that are recyclable and are no trash that produce chemicals when that become recycled. But it must not come to this, because of the good quality of the plastic, one can also use it again. The same with the steel mesh, if it is needed for other things where you can insert it. But that all only happen, if the customer or the user do not want to have insectarium anymore or do not want to sell it further or use it for other animals. Because from alone it does not become destroyed.

5.4 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

6. Ethical and Deontological Concerns

6.1 Introduction

In this chapter we will develop ethical and professional standards of our company.

In everyday life people should always pay heed to ethical way of behaviour. Being human implies following some moral rules which can be considered in different aspects. For instance, teachers should comply with a particular set of rules regarding acting against their pupils, pupil's parents etc.; companies workers should behave in a moral way towards their co-workers, clients, and superiors; engineers should always care about their products' safety. In our project we could consider ethics and deontology in all its bearings, yet we divided our analysis only into five main aspects which are especially related to our work. These are the following:

- Engineering ethics issue,
- sales and marketing ethics issue,
- academic ethics issue,
- environmental ethics issue,
- liability issue.

During the design of the product, the construction or the selling, there will be a lot of conflicts that can be very complicated to find the right solution. That is why we should put some rules before starting all the process.

6.2 Engineering Ethics

The decisions and actions of the engineers have a great impact on the environment and in society. The engineering profession has, therefore, the obligation to ensure that their decisions are consistent with the public interest and in all matters relating to safety, health and sustainability.

That is why we have use the Nacional Society of Professional Engineers (http://www.nspe.org/resources/ethics/code-ethics). This code of conduct contains the following principles:

• The engineer has a personal obligation to act with integrity in the public interest and applying all

the experience and knowledge necessary for theoretical and practical perform their work.

• In his works, the engineers :

- maintain their core competencies to the necessary level and only assume those jobs for which they are adequately trained

- Will not lead to misunderstandings in their academic qualifications or in their Professional titles.

- they issued impartial analysis and findings with their employers or their clients, avoiding conflicts of interest, and observe properly the duties of confidentiality

- conduct their work properly thus preventing avoidable dangers safety and health as adverse impacts on the environment

Engineers can rely on the Engineering code of ethics to make the right decisions. Engineering ethics, internationally, comprise of three basic core aspects: Competence, Integrity and Sustainability.

(7) (8)

6.2.1 Competence

Engineers shall perform services only in the areas of their competence.

• Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved

• Engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control

• Engineers may accept assignments and assume responsibility for coordination of an entire project and sign and seal the engineering documents for the entire project, provided that each technical segment is signed and sealed only by the qualified engineers who prepared the segment

(8) (9)

6.2.2 Integry

Engineers shall be guided in all their relations by the highest standards of honesty and integrity.

• Engineers shall acknowledge their errors and shall not distort or alter the facts

• Engineers shall advise their clients or employers when they believe a project will not be successful

• Engineers shall not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment, they will notify their employers

• Engineers shall not attempt to attract an engineer from another employer by false or misleading pretenses

• Engineers shall not promote their own interest at the expense of the dignity and integrity of the profession

• Engineers shall give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others

• Engineers shall accept personal responsibility for their professional activities, provided, however, that engineers may seek indemnification for services arising out of their practice for other than gross negligence, where the engineer's interests cannot otherwise be protected

• Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall present such information to the proper authority for action

• Engineers shall not attempt to obtain employment or advancement or professional engagements by untruthfully criticizing other engineers, or by other improper or questionable methods

(10)

6.2.3 Sustainability

Sustainability ethics is concerned with the moral aspects of the threefold relationship of humans with other contemporaries, future generations, and nature. It simultaneously analyses the moral aspects of this threefold relationship. + Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment for future generations.

That is why during preparation and reasarching we were supposed to take care of all these aspects and we surely can say that that any other contemporaries, future generations, and nature will not be hurt. We are not going to use any nonrenewable resources that are going to run out in future and moreover it is worth to notice that most of them are recyclable. Materials are not toxic, mealworms and user-friendly so they will grown in good an healty conditions which not influence on worms taste. It assures good quality of them. Our product can face with opponents of meat eating but as long as it is used to grown insects and as long as our company is focus mainly on provide insects for animals it should not be a big problems because we did a reasearch and a lot of vegans and vegetarians agreed that eating insects is fine. We also take care of health and safety aspects of workers.

6.3 Sales and Marketing Ethics

Our sales and marketing activities have to follow ethical standards if we hope to avoid sanctions from regulatory agencies and loss of reputation with customers. Ethical companies know how to respect the rights of all stakeholders in the business while making decisions that are in the interests of the company.

- Marketing communication should not contain statements or visuals that offend standards of decency.
- Relevant factors likely to affect a customer’s decisions should be communicated in a way and time so they can be taken into account.
- Marketing communication should not play on fear or exploit misfortune.
- Marketing communication should not appear to condone unlawful behavior.

- Marketing communication should be truthful and not by implication, omission, ambiguity or exaggeration mislead the customer
- Marketing should not misuse research results or quotations of individuals.
- Marketing claims made about a location should be capable of substantiation and that evidence should be available so it can be provided to any organization responsible for regulation of ethics of the profession.
- When an advertisement appears in a medium containing news or editorial matter, it should be recognizable as an advertisement and the identity of the advertiser should be identifiable. Where appropriate, it should contain contact information to enable the customer to contact the advertiser.
- Marketing communication that contains comparisons should comply with the principles of fair competition and be based on facts that can be substantiated and not unfairly selected.
- Marketing communication should not denigrate any person, group of persons, organization or community.
- Marketing should not contain any testimonial or endorsement unless it is genuine, verifiable and relevant.
- Marketing communication should not imitate those of another marketer in any way likely to mislead or confuse the customer.
- Those who collect data in connection with marketing communication activity should have a written privacy policy that is readily available to customers.
- In any communication channel (including social media), if an opinion is put forward that could lead to an action that financially benefits the author (or employer), it should include a full disclosure statement.

6.3.1 Professional conduct

Ethical conduct in sales and marketing means using a professional approach to customers, competitors, members of regulatory bodies and company colleagues. Characteristics of such conduct include respectful interactions, consideration for cultural diversity and nondiscriminatory behavior toward people who are different than us. We have to behave honestly, portray situations and products accurately and make constructive contributions to discussions about problems and solutions, and you must observe the applicable laws and regulations at all times and adhere to company ethics policies.

We can say that professional conduct is:

- Place the integrity of the profession and the interests of clients above your own interests
- Act with integrity, competence, and respect
- Mantain and develop our professional competence
- Professionalism and integrity.
- Duties to clients and employers(11)

6.3.2 Competition

Healthy competition delivers value to customers while allowing companies that compete to earn an appropriate return on their investment. Ethical behavior in a competitive environment includes supporting fair competition, competing on the basis of accurately representing your products and services in the marketplace and fulfilling your obligations in good faith.

In order to healthy competition it is obvious that we can not copy products of other companies and we can not use other patents to earn money. Thus,we made a big reasearch to find and define our

competitors, their products and their companies. We analyze them, and compare it to our project to be sure that we are not going to break any rules and not going to make the same product as already exists on a market. The same situation was connected to the name and logo of our company. We had to find a cathy name but it couldnt be used before, it had to be unique. That is how Insecto appeard. We will skip part about saying that practicing industrial espionage and other similar technics is not a healthy competiotion because we hope that it is obvious that we are not going to play such kind of a game. To check list of patents we used a google website and http://www.uspto.gov/patent site.

6.3.3 Pricing

Evryone of us want to earn as much money as possible but we can not forget to be fair. That is why our company is going to follow few simply ethics rules in pricing. We believe that all our simple, honest and clear rules will make our customers come back to our company. In pricing we following ethical guidelines it means prices have to be clear without hidden charges like taxes. The consumer has to know how much he is going to pay when he makes the purchase. Our prices have to reflect both the cost you incur in delivering the product or service and the value the customer expects to receive. Our company believe in connection between customer and us so we always deliver good quality product in hope that customer will come back for another one. Because of that we always propose fair price, apprioprate to quality.

For us ethical pricing means:

- Clear price
- No hidden costs
- Delivery price determined
- Price apprioprate to quality and to reality.(12)

6.3.4 products

Ethical sales and marketing offer only safe products that are suitable for their intended use. Supply of the product includes supplying instructions that the customer can follow to make the product work as intended, providing customer service to resolve problems and dealing with problems objectively by applying appropriate solutions. Following these ethical guidelines is good business practice because it increases customer satisfaction.

6.3.5 research

Businesses obtain personal information about their customers during sales activity and marketing research. Ethical practice means you respect the privacy of customers and safeguard their data. You have to follow privacy legislation and inform customers that you are collecting their data, let them know its intended use, use the data only for that purpose and destroy it securely when you no longer need it.

1. Discuss intellectual property frankly Academe's competitive “publish-or-perish” mindset can be a recipe for trouble when it comes to who gets credit for authorship. The best way to avoid disagreements about who should get credit and in what order is to talk about these issues at the beginning of a working relationship, even though many people often feel uncomfortable about such topics.

2. Be conscious of multiple roles APA's Ethics Code says psychologists should avoid relationships that could reasonably impair their professional performance or could exploit or harm others. But it also notes that many kinds of multiple relationships aren't unethical–as long as they're not reasonably expected to have adverse effects.

3.Follow informed-consent rules When done properly, the consent process ensures that individuals are voluntarily participating in the research with full knowledge of relevant risks and benefits.

4. Respect confidentiality and privacy Upholding individuals' rights to confidentiality and privacy is a central tenet of every psychologist's work.

5.Tap into ethics resources One of the best ways researchers can avoid and resolve ethical dilemmas is to know both what their ethical obligations are and what resources are available to them.

6.3.6 promotion

Sales and marketing include promoting your products and services to potential customers. Ethical promotion portrays your offers honestly and accurately, without links to attractive lifestyles that are not relevant. You have to promote your products and services on their own merits and highlight those features that members of a target market might find valuable when promoting to that market segment.

- Marketing communication should not contain statements or visuals that offend standards of decency.
- Relevant factors likely to affect a customer’s decisions should be communicated in a way and time so they can be taken into account.
- Marketing communication should not play on fear or exploit misfortune.
- Marketing communication should not appear to condone unlawful behavior.
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- In any communication channel (including social media), if an opinion is put forward that could lead to an action that financially benefits the author (or employer), it should include a full disclosure statement.

6.4 Academic Ethics

The academic ethics is similar to the previously explained ethics as its main asset is the integrity of the person. We have chosen as the script conducted by the University of Northern Iowa (http://www.uni.edu/) and have found this scheme:

6.4.1 plagiarism

Plagiarism is intentionally or unintentionally using someone else's words or thoughts, without giving proper credit.

- Substantial copying without credit
- The copying is done fraudulently
- The intention is clearly to fool the reader
- It has a potential negative repercussion for the reader and/or original author

so we educate all the team-members how to avoid plagiarism like the examples mentioned here above.

6.4.2 misrepresentation

Misrepresentation is a false statement of fact

6.4.3 fabrication

Fabrication means falsifying or misusing data in any academic exercise.

6.4.4 cheating

Cheating is attempting to present as one's own, work that one has not performed, or using improper means to pass an examination

6.4.5 facilitation

Facilitation occurs when you knowingly or intentionally assist another in committing a violation of any of the previous sections of this academic ethics policy.

We, as a company, must work on avoid this situations to make our customers feel 100% confidence in our product.

6.5 Environmental Ethics

Environmental ethics is the philosophical discipline that considers the moral and ethical relationship of

human beings to the environment. In other words: what, if any, moral obligation does men have to the preservation and care of the non-human world? While ethical issues concerning the environment have been debated for centuries, environmental ethics did not emerge as a philosophical discipline until the 1970s. Its emergence was the result of increased awareness of how the rapidly growing world population was impacting the environment as well as the environmental consequences that came with the growing use of pesticides, technology, and industry. That is why our company is committed to:

• Use low levels of pollutants to the environment, to insects and customers

• Use readily recyclable materials

• Create a product in which the different materials used are easily separated by category (glass, plastic , cardboard) for proper recycling

• Make a recyclable packaging for transporting using the right amount of material

6.6 Liability

Businesses are usually liable for defective products, negligence and breaches of warranty. These are all examples of tort liabilities. A business is liable if their product injures someone physically or emotionally. Businesses are also liable for injuries that happen on their property and any damages that occur as a result of actions taken on behalf of the business. There is a specific type of product liability know as strict liability, which describes who (among manufactures, contractors, suppliers and retailers) is specifically responsible in the cases of defective products.

In insecto we have three party in the liability section we have to think about such as:

- Legal liability

we are committed to create such a product which will obey some legal rules, e.g. EU directives such as:

1. Machine Directive (2006/42/CE 2006-05-17);

more info –>
http://ec.europa.eu/enterprise/sectors/mechanical/documents/legislation/machinery/index_en.htm

2. Electrical Safety: Low Level Voltage Directive (2006/95/CE 2006-12-12);

more info –> http://ec.europa.eu/enterprise/sectors/electrical/lvd/index_en.htm

3. Restriction of Hazardous Substances (ROHS) in Electrical and Electronic Equipment Directive (2002/95/EC 2003-01-27);

more info –> http://ec.europa.eu/environment/waste/rohs_eee/legis_en.htm

- Criminal liability

The liability that arises out of breaking a law or committing a criminal act. Liability insurance does not cover criminal liability.

So we make sure that we make and sell the insectarium according to the laws , so that nothing is done illegal

Read more: http://www.businessdictionary.com/definition/criminal-liability.html#ixzz3XOMdyv46

- Professional liability

in this case, following the engineering code of ethics is highly preferable.

6.7 Conclusion

We have to understand ethics as a part of the integrity of the person. All aspects of our life, both work and personal, are governed by a code of ethics. Therefore, our insectarium project must have ethical standards : the design will try to be as sustainable as possible and use materials less contaminating; in the phase of marketing a real product will be sold without handling any kind of product characteristics ; and finally , it must be the author's own work , not plagiarized.

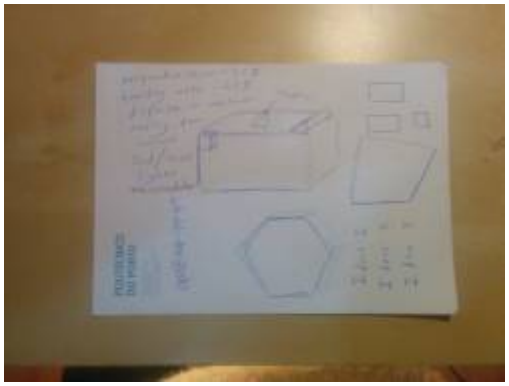
7 Project Development

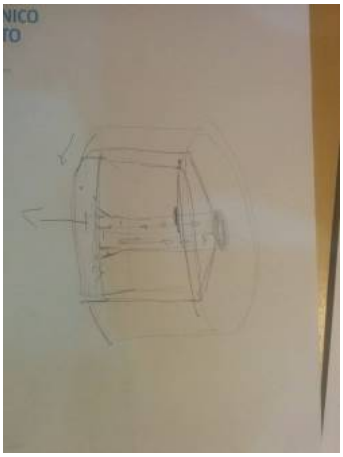
7.1 Introduction

The objective of the project insectarium is to start developing an aquarium for insects to grow for animal feed.

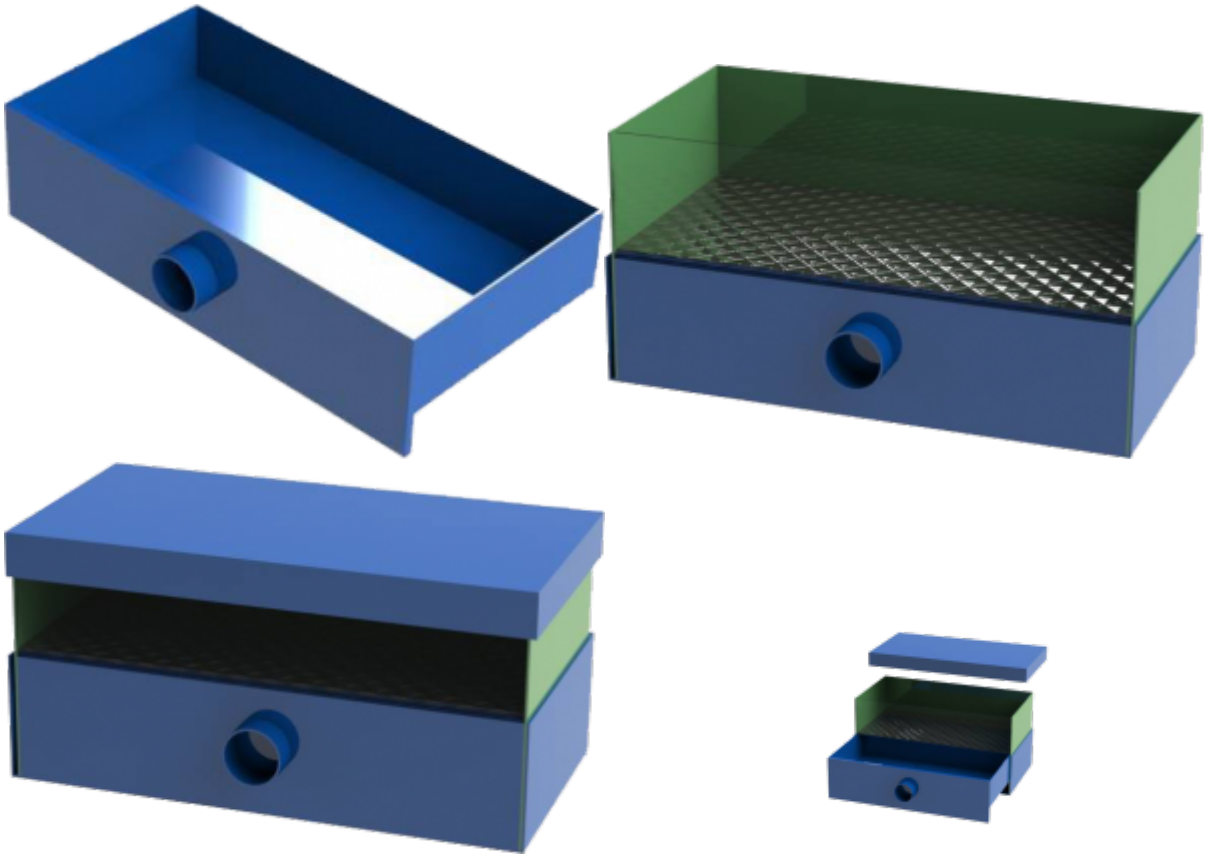
Based on the knowledge obtained through state-of-the-art studies, the development of a suitable architecture for the insectarium will be presented in the following. Afterwards, the prototype´s required components, electronic functionalities and implementation processes will be explained and experimentally evaluated.

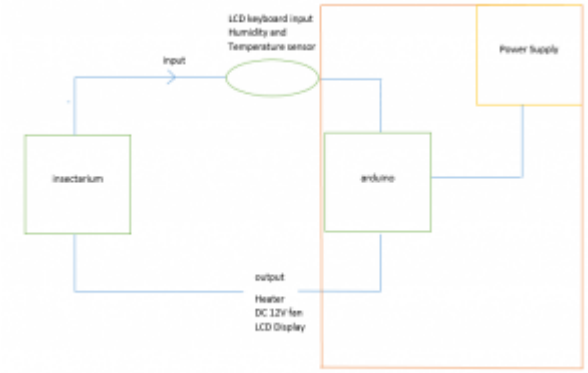
First we made some sketches with different ideas of how the insectarium should look like.

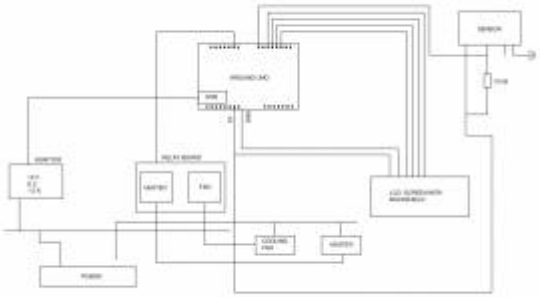




afterwards we dicided wich was the best solution for the insectarium and made a 3D design of it.







7.2 Architecture

We have decided to do a simple insectarium, with no strange forms and no strange materials.

First of all we have to decide what type of plastic we are going to use, and that is why we made a comparison between the most used plastics in construction.

PLASTIC	NAME	DENSITY (g/cm3)	TEMPERATURE (ºC)	TRANSPARENCY (%)	STRENGTH
HDPE	HIGH-DENSITY POLYETHYLENE	0.93-0.97	120	Opaque	Strong intermolecular force
UHMW-PE	ULTRA HIGH MOLECULAR-WEIGHT POLYETHYLENE	0.945	136	39-75	Really strong intermolecular force
PP	POLYPROPYLENE	0.90-0.91	100	70-85	Normally tough
PVC	POLYVINYL CHLORIDE	1.40	80	80-85	Normally tough
POM	POLYOXYMETHYLENE	1.41-1.42	115	75-85	High
PMMA	**POLYMETHYL METHACRYLATE**	**1.19**	**160**	**93**	**High (20 times stronger than glass)**

After having all that information, we choose the PMMA because of its good properties.

Then, we started looking for companies that sell PMMA in different ways and different properties and we choose MATERIALS WORLD

PRODUCT	COMPANY	CLARITY	MAINTENANCE	MAXIM SERVICE TEMPERATURE	CHEMICAL RESISTANCE	IMPACT STRENGHT	WEIGHT	RECYCLABLE	PRICE	LINK
Cast acrylic sheets	Acrylic sustainable solutions	Excellent (92%)	Easy	High (85°C)	Excellent	Good	Light (half the weight of glass)	Fully	(waiting for an answer)	http://www.pmma-online.eu/about-pmma/types/cast-sheets
Cast acrylic sheets	Dagol	Excellent (93%)	Easy	High (80-90°C)	Good	Excellent (60 times more than glass)	Light	Yes	(waiting for an answer)	http://www.dagol.pt/uk/html/prod_acrilico_cast.html
Plexiglas	Professional plastics	High light transmittance	Easy	High (82°C)	Good	Good (17 times more than glass)	Light	Yes	(waiting for an answer)	http://www.professionalplastics.com/plexiglass-acrylicsheet-cast?xlt_to=en
PMMA	**Materials world**	**Excellent (93%)**	**Easy**	**High (80°C)**	**Good**	**Good (20 times more than glass)**	**Light (half the weight of glass)**	**Yes**	**108 €**	**http://www.mwmaterialsworld.com/es/plastico/metacrilato-164348/planchas-de-metacrilato/metacrilato-transparente-colores.html**

7.3 Components

(7)

Microcontroller

Microcontroller	Voltage input	Voltage output	Easy of use	Power consumption	Price to needs	Size	Cpu Speed	Additionals req.	Price
Arduino Micro	7-12V	5V	Easy	Small	Good	Small	16MHz	Usb Converter	23,37
PLC	12-24V	-	Hard	Big	Bad	Average	-	Expensive Software	280
Raspberry PI	5V	5V	Average	Very Small	Average	Average	700MHz	SD Card	43
Arduino Uno	7-12V	3.3V or 5V	Easy	Small	Good	Average	16MHz	-	22,18
Arduino Nano	7-9V	5V	Easy	Small	Good	Small	16MHz	-	23,99

We decided that the best microcontroller to use in our project will be Arduino UNO. It is the cheapest one and fullfil all requirements that we need. It is important that voltage input range is between 7V and 12V because we would like to use 12V adapter to connect fan and heater so we can also connect arduino using this adapter.

Arduino Uno:
http://pt.mouser.com/ProductDetail/Arduino/A000066/?qs=sGAEpiMZZMtE4ePzUE8d2JuFIVM5Ac0l

Sensors

Temperature sensor	Voltage input	Accuracy	Temp range	Additional converters	Price
TMP36	2.7 - 5V	1-2	-40 to 125	Resistor	1,66
LM35DZ	4-30V	0.4	0 to 100	Resistor	2,55
MCP9700A	2.3 - 5.5V	4	-40 to 100	Resistor	0,37

Humidity sensor	Voltage input	Accuracy	Price
HH10D (with EEPROM)	2.7 - 3.3V	3%	11,07
HCZ-J3-B	1V AC	5%	3,64
HIH6030-021-001	2.3 - 5.5V	4.5%	6,03
HCZ-D5-A	1V RMS	5%	0,84

Temp + Humid sensor	Voltage input	Temp accuracy	Humid accuracy	Additional converters	Price
DHT11	3.3 - 5V	1	4%	10k ohm resistor	4
RHT03	3.3 - 6V	0.5	2%	10k ohm resistor	11,01
DHT22	3.3 - 6V	0.5	2%	10k ohm resistor	9,9

Our research shows that it is the best to buy one device with temperature and humidity sensor included. If we are buying sensors separately the price is higher and the quality is worse. Because to

buy two sensors that are comparable to DHT11 we have to should buy TMP36 (temperature sensor) and HIH6030-021-001 (humidity sensor) and the price is then 7,69euro which is almost two times bigger than DHT11 and accuracy is still slightly worse. That is why we rejected other options and focused on DHT11 or DHT22 which is more expensive but also two times more accurate. Finally we decided that DHT11 has enough accuracy and it is our device to buy.

DHT11:
http://www.ptrobotics.com/atmosfericos/2628-electronic-brick-dht11-humidity-temperature-sensor.html?search_query=dht11&results=3

Displayer and keyboard

We need displayer with keyboard to display Temperature and humidity and set the temperature range inside the insectarium . We considered displayer included keyboard and two separate components to provide the best quality and the best price. We found simple buttons for 0,49euro each. We need at least 5 buttons so the price is equal to 2,45euro.

Displayer + keyboard	**Voltage**	**Quality**	**Power Consumption**	**Size**	**Price**
7segments (+5x Push Button INM-0711)	-	Bad	Average	-	1,28+2,45 = 3,73
LCD MC21605A6W-FPTLW (+ 5x Push Button INM-0711)	5V	Good	Small	16×2	8,81 + 2,45 = 11,26
LCD MC21605B6WD-BNMLW (+ 5x Push Button INM-0711)	5V	Good	Small	16×2	8,24 + 2,45 = 10,69
LCD Button Shield INM-0700 (*with keyboard*)	5V	Good	Small	16×2	15.93
LCD Shield For Arduino INM-0780 (*with keyboard*)	5V	Good	Small	16×2	14.50
Itead 1602 LCD Shield (*with keyboard*)	5V	Good	Small	16×2	6.7

In accordane to our research it is the best option to use Itead 1602 LCD Shield with integrated keyboard, because to size and quality is enough and the price is the best.

Itead 1602 LCD Shield:
http://www.ptrobotics.com/lcd-alfanumerico/2629-itead-1602-lcd-shield.html?search_query=LCD+Shield+For+Arduino&results=11

Electric Heater

We need an Electric heater in order to heat the room so that if the insect enclosure temperature decreases and goes out of the temperature range that the insects are comfortable with the Electric heater will be activated to increase the temperature. When looking at the electric heaters we considered heat lamps, car heaters and thermal heaters to analyse which heater is the best quality and price for the application.

Electric heater	**Voltage**	**Quality**	**Power consumption**	**compatibility**	**size**	**price**
(PTC faceplate heater)	(12-30)	(good)	20	good	small	17 euros

Electric heater	Voltage	Quality	Power consumption	compatibility	size	price
Car mirror heater	12	good	24	good	small	2,29 euros
Heat lamp	120	okay	60	poor	small	5 euros
Light bulp	220	good	12	Small	Average	10euro
Infrared light bulp	220	average	12	small	average	12euros

We had to reject some of the proposals because were not suitable for our project. Light bulb emits light and mealwors don't like light. Infrared light don't heat air, it heats organism which is not the best solution. PTC faceplate heater is quite expensive. After some thorough research We believe the best device is car mirror heater - http://pt.made-in-china.com/co_jukayheater/product_Pet-Film-Heater-for-Car-Wing-Mirror_eysesnusg.html.

Additional devices:

- Adapter 230V AC to 12V AC: https://www.minfo.pt/catalogo/detalhes_produto.php?id=291736

* 2x 10k Ohm Resistor: http://pt.mouser.com/ProductDetail/Vishay-BC-Components/PR02000201002JR500/?qs=sGAEpiMZZMsEIsGLxVc9kJnhKNrGydX3

- 2x Relay 5V: http://www.g7electronica.net/en/reles/1349-5vdc-10a.html

7.4 Functionalities

7.5 Tests and Results

7.6 Conclusion

Provide here the conclusions of this chapter and introduce the next chapter.

8. Conclusions

8.1 Discussion

Provide here what was achieved (related with the initial objectives) and what is missing (related with the initial objectives) of the project.

8.2 Future Development

Provide here your recommendations for future work.

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Appendices