UNIVERSITY OF ECONOMICS, PRAGUE

Smart Greenhouse Production

Business Plan

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10.12.2018

D e c l a r a t i o n o f A u t h e n t i c i t y

I hereby declare that the Bachelor´s Thesis presented herein is my own work, or fully and specifically acknowledged wherever adapted from other sources. This work has not been published or submitted elsewhere for the requirement of a degree program.

Date December 12, 2018 Signature _____

Title of the Bachelor Thesis: Business plan of Smart Greenhouses.

Abstract

The aim of my work is to create a business plan of smart greenhouse production. The thesis will include theoretical part, lean canvas and the business plan itself. Theoretical part will include information about entrepreneurship, business plan, agriculture and Information technology, as this topic is very innovational and connects several spheres in it: Information Technology and Agriculture. Also theoretical part will include a brief description of all the analyses used in my work. Business plan has a standard structure. I describe the product, analyze market, make small research and create a 4P strategy: product, price, place, promotion. Agricultural projects are very relevant nowadays in Europe. Optimization of the whole agricultural process can lead to the increased number of products and improved quality. However, there are not so many competitors in the sphere of Smart agriculture. After analyzing financial part we will see that the project can be profitable.

Key Words: Business plan, Entrepreneurship, IT in Agriculture, Marketing Mix, Financial Plan.

Název bakalářské práce: Podnikatelský plán Smart skleníků.

Abstrakt

Cílem mé práce je vytvořit podnikatelský plán inteligentní skleníkové výroby. Práce bude obsahovat teoretickou část, lean canvas a samotný obchodní plán. Teoretická část bude obsahovat informace o podnikání, obchodném plánu, zemědělství a informačních technologiích, neboť toto téma je velmi inovační a spojí v něm některé oblastí: Informační technologie a zemědělství. Také teoretická část bude obsahovat stručný popis všech analýz používaných v mé práci. Obchodní plán má standardní strukturu. Popisuji produkt, analyzuji trh, dělám malý výzkum a vytvořím strategii 4P: product že projekt může být ziskový. (product), cena(price), místo(place), propagace(promotion). Zemědělské projekty jsou dnes v Evropě velmi důležité. Optimalizace celého zemědělského procesu může vést ke zvýšení počtu výrobků a ke zlepšení kvality. V oblasti inteligentního zemědělství však není tolik konkurentů. Po analýze finanční částizji stíme, že projekt může být ziskový.

Klíčová Slova: Podnikatelský plán, Podnikání, IT v zemědělství, Marketingový mix, Finanční plán.

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1 Introduction

Smart greenhouse is a greenhouse with sensors and actuators. The product helps farmers to get more harvest with less time spent for that, as the greenhouse makes everything itself; also the structure is closed so plants will not suffer from wind, hailstorm, ultraviolet radiations and insect attacks.

There are two types of smart greenhouses: hydroponic and non-hydroponic (Globenewswire, 2017). Hydroponic greenhouse deals with the method of growing plants without soil, in the nutrient solution. The general structure and control system of the hydroponic and non-hydroponic greenhouses is almost the same. But the support system is absolutely different, as water and nutrients are supplied not though soil but with the help of special equipment. We will produce hydroponic, as their efficiency is much higher. The costs of such greenhouse are quite high, but its price is also high.

We will speak about the greenhouses and some constructional elements in the chapter “Product”. For me it is very important to briefly analyze the agricultural market of Europe itself and in more details the market of smart greenhouses (both hydroponic and non-hydroponic). Marketing part will consist of several analyses, which will give full understanding of a business and how to implement the project in the real life. The tools are: PESTLE, Porter’s Five Forces, VRIO, SWOT, Canvas Model. Also that part will be based on 4P, we will define target customer, ways to promote our product and price.

The goal of the work is to make a research of the market and understand weather it is profitable to produce smart greenhouses and if the market has a strong potential for development.

2 Problem setting

Entrepreneurship is very important for economy. Every business produces goods or services. Entrepreneurs create new working places, pay salaries, taxes, contribute to GDP (final value of goods and services produced in the county in particular period of time, (The Balance,2018)) and overall development of the sphere and economy as a whole. People usually tend to have their own business to be involved in the activities they are interested in and not to depend on anyone else.

However, every entrepreneur should understand that having a business is very risky. When you have a job you can just loose it in the worst case. When you have a business you can lose all the invested money and time.

Producing smart greenhouses can be a risky business. Agriculture and Information Technology seem incompatible to many people. Embedding IT into the process of growing plants is very expensive. However, sometimes too high investments and overloading of a system with technologies can be risky because of high spendings and high price of the product accordingly. What is more, a client can be not interested in buying very high-technological equipment, firstly, as usually some of the features are not very important and it is better to use cheaper product of a competitor. Secondly, a company needs to employ a highly-paid specialist who can assist in working with the equipment. Thirdly, every breakage causes high costs.

Clayton M. Christensen in his book The Innovator's Dilemma divide technologies into sustained and disruptive. First can make a product very effective and demanded between the clients. The others result in worse product performance at least in the short-term (Christensen, 2016).

Businessmen should understand how to produce a product which is demanded, how to find a client and make him loyal, how to win competition. Financial aspects are also very important. Budgeting and financial controlling are essential for every firm which wants to become profitable.

Entrepreneur should take in account all the aspects mentioned above before deciding to start a business. The next and very important step is preparing a business plan which can be seen as a guidance for starting a business.

3 Aim of work

In my work I will present a business plan which will help to predict some risks and provide a strategy of the company's development. I will analyze external environment, competitors, target customers and provide financial plan for the business.

4 Relevance

This thesis provides a plan for an entrepreneur to create a company producing smart greenhouses. Society is excited with innovations and optimization of processes. Smart greenhouse is a technology related project, which helps to optimize agricultural processes and at the same time it is ecologically friendly. These aspects make it interesting to the audience.

5 Research and Data Collection

There is not so much information about the sphere of smart greenhouses. So, most of the information was collected from the websites of the companies working in production of smart agricultural equipment. Another source was news websites and business journals. Information from lectures and seminars helped me to create a business plan itself. Some ideas were taken from business books, mostly they were about real experience of other entrepreneurs.

6 What Is Entrepreneurship

The goal of entrepreneurship is to attract and keep the customer. (Levitt, 1986)

Schumpeter (1965) defined “entrepreneurs as individuals who exploit market opportunity through technical and/or organizational innovation”

Peter Drucker (1970) “entrepreneurship is about taking risk”.

There a lot of definitions of entrepreneurship, but all of them are about creating something new, innovations, taking risks and response to the needs of society.

Entrepreneurship (business) is the activity, which is aimed to get profit from using real estate, selling goods or services. An entrepreneur could be any person who is engaged in economic relationship and performing commercial activities. Depending on the kind of entrepreneurial activities, there can be several types of businesses:

- Production
- Commercial
- Financial
- Intermediary
- Insurance

Production (manufacturing) entrepreneurship takes place when a businessman produces goods, services, information for future sale to the customers or trade organizations. It includes manufacturing of industrial, agricultural, technical products, communication services, transportation of passengers, personal services, writing books and magazines. It can be any producing of a useful product, which is demanded, can be sold or exchanged for the other one. It can be quite risky, as there is always a chance of goods unrealization, receivables not being paid, high taxes, all these challenges slow down the business and in unstable environment it can lead to business failure (Justas Markus, 2017).

Commercial business is tightly connected to the production industry. In this type of entrepreneurship a company sells already produced goods to the customers. The main activity in this case is exchanging a product for money. The revenue is a difference between goods bought and sold. You can find that activities in any shop, market, exchange, exhibition-sale, auction, trading house. For being successful in this business an entrepreneur needs to understand the needs of people, know which goods are demanded, he should react fast on the changing environment and needs, be communicative and know how to offer products to the customer (Gribov V., Gruzinov V., 2016).

Financial entrepreneurship is a special form of commercial business. Money, securities (shares, bonds and other), which are sold or lent become an object of business. An entrepreneur can exchange money, lend them, sell or buy securities. The difference between buying and selling or percent for lending money is revenue of an entrepreneur. This is one of the most difficult and risky forms of business activities, however, it is one of the most ancient. Such activities are performed by banks, financial and credit companies, currency exchange and other (Egorova E., Loginova E., 2008).

Intermediary business is the activity which allows an entrepreneur to get profit without producing goods, he has a role of mediator in commodity-money relations. Mediator can represent a producer or a customer and perform in their interests. Intermediary entrepreneurs are brokers, dealers, distributors and other. This kind of business can also be quite risky. Revenue is usually discussed with the client, it can be a percent of the deal or fixed rate (Business Dictionary, 2018).

Insurance business consists of preparations of contracts, which obliges an entrepreneur to compensate for damage after unpredictable event, loss of property, values, health, life and other kinds of losses. An entrepreneur gets money, and the chance that he needs to compensate for damage is quite low. Sum of all the insurance fees deducted by the sum of compensations is the profit if the businessman. This kind of activity is the most risky (UTMagazine.ru, 2015).

There are several types of businesses mostly used by entrepreneurs for organizing their work. Every type is different and has its features, so let us describe all of them and later I will choose the most suitable for me:

- Sole proprietor

  Business is owned by an individual. It is mostly used for small companies, the owner is responsible for all the activities and debts.
- Partnership

  Business is owned by two or more people. Each partner contributes capital, skills, information. Owners are responsible for the debts.
- Company

  Business is owned by shareholders. Each shareholder gets a share that is equal to the percentage of the money they put into the company. Business is run by directors.
- Franchise

In that case an entrepreneur buys a kind of a license to perform on the behalf of a well-known brand.

- Limited liability company
- Business is owned by shareholders. Each shareholder cannot lose more than he invested in the company (Alison Job, 2018)

7 What is Business Plan

Business planning helps to set goals, which an entrepreneur or company should follow in short and long period.

The main purpose of business planning is planning of company's activities for short-term and long-term periods with the needs of market and opportunities to get the resource. You need a business plan to get organized, to analyze the market and the demand for your product, to get a clear understanding whom you are going to offer your product to, how to make a business profitable (Alejandro Cremandes, 2018).

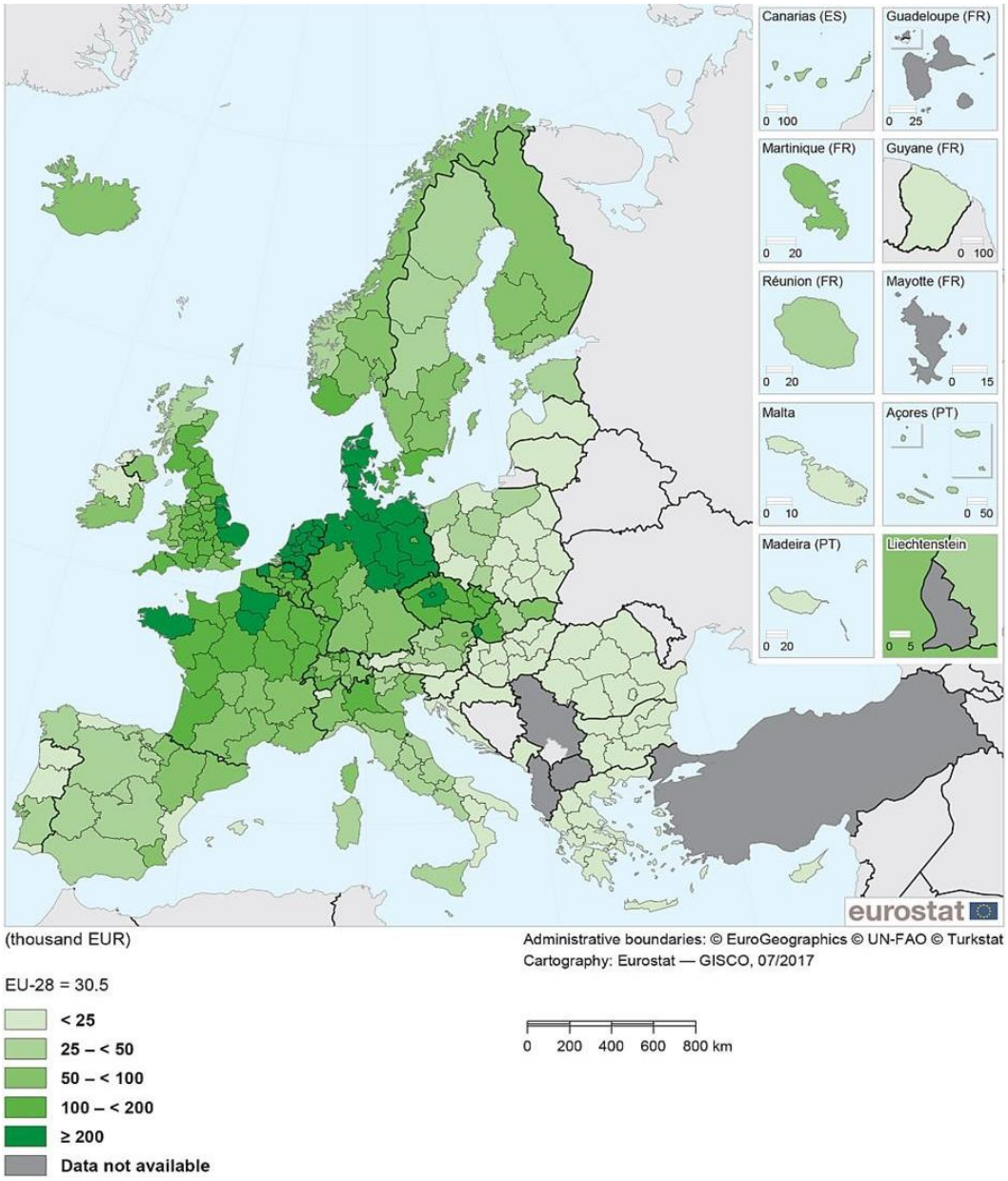
Each business plan should have these components:

- Executive Summary (elevator pitch of your business, brief description of the project, summarizing all the components of the plan)
- Product Description (overview of the product, its advantages and value for the customer)
- Market Analysis (analyzing external environment, competitors, finding your place in the market)
- Organization Management (providing a strategy for the business, this part includes information about organization of the company)
- Sales Strategies (in that part pricing and promotional strategies are provided)
- Financial Projections (an entrepreneur needs to understand if it is profitable to do the business, that is why several financial projections are created: optimistic, realistic and pessimistic)(Quick Books, 2018)

8 Agriculture in Europe

To begin with let us start with the basic information about agriculture in Europe. Despite its small area Europe always had a leadership position in the agricultural sector; due to the high level of technologies the efficiency of the processes was very high. Moreover, European population is very dense, so it is needed to grow a lot of food in limited area.

Average economic size of the farm holdings



Source: Eurostat, 2018

In the map above you can see the average development of agriculture in Europe. The deeper the color the higher monetary economic size of farm, which is calculated as monetary value of agricultural output in EUR per hectare (Eurostat,2018). There are a lot of agricultural companies in Europe, potentially they can use smart greenhouses.

In my work I would like to focus on plant growing, as greenhouses are used this branch of agriculture. Europe is very efficient in this sphere. It is explained not only with favorable climate conditions, but with high level of equipment, rational selection of crops, efficient use of fertilizers. Wheat and corn production develops very fast. Their main developer is France, which is one of top 10 among world's corn exporters. In the northern regions rye crops are very demanded. In Germany, Belgium, United Kingdom, Ireland there are lots of fields for barley, as it is used in brewing and whiskey production. In France you can find a small area, climate of which allows to produce rice.

In most of the countries the main food crop is potatoes, and Netherlands is a main producer of seeds. Sugar beet is one of the main technical crops. France is the main producer and exporter of sugar in the region. The second one is Belgium. Sugar beet is grown in Germany and some other countries. Austria, Belgium, France and Germany are famous with hop, which is used in brewing as well as barley. Tobacco and flax are also grown there.

Oil-bearing crops have a significant role, main of which are sunflower and olives, which are grown in the warm regions. Corn and rape are also used in oil production. Sage, rose, rosemary, lavender and other are used for essential oil crops production, they are produced in Provence and Languedoc, as these region is famous for perfume and cosmetics production.

In the food allowance of Western Europe population vegetables and fruits have a significant role. A lot of agricultural companies grow various kinds of cabbage, onion, carrot, cucumbers, spinach, spicy herbs. In southern regions, especially in France, tomatoes are very popular (Eurostat, 2017).

As you see, Europe is divided in several areas by the kinds of plants, as different fruits and vegetables need different climate. However, greenhouses can help to create needed climatic conditions. And one country becomes able to produce whatever it needs. Greenhouses are very popular in northern countries, especially in Netherlands, as the weather there is quite cold and windy. These countries are famous with flowers, which need very special climate and windless area, not to damage the plant.

Smart agriculture is developing in:

- Netherlands
- UK
- Belgium
- Germany

- Austria

These countries are quite rich and able to spent money on innovative technologies, and the climate there is not so mild, that can create high demand for smart greenhouses.

9 Internet of things in agriculture

Nowadays agriculture is in the digital era. Investment bank "Goldman Sachs" states that using innovative technologies could increase efficiency by 70% till 2050 year. Agriculture is on the threshold of the "Second Green Revolution" (Goldman Sachs, 2016). Experts assume that internet of things in agriculture can cause such a splash of land productivity, which was not seen even after inventing of tractors, herbicides and genetically changed seeds.

Technologies are evolving: now they are cheaper, easier to produce. People can have information about every single agricultural object, moreover, it is possible to calculate mathematically the algorithm of activities and predict the result. The agricultural industry basically was the most distant from IT. Now these to spheres can connect and give great results. Automation of agricultural processes is a deliberate necessity in the development strategy of agro-industrial companies.

The main resource for future development of agricultural efficiency, provision of stable result, increasing competitiveness in the local and global scope is data science and data management.

In 2010 there were less than 20 hi-tech companies in agricultural sphere (Rob Leclerc, 2016). In 2013 – 2016 more than 1300 technological start-ups were invested in, overall deposits are more than 11 billion dollars (Agfunder, 2017). There is a new investment segment AgTech, which is now bigger than FinTech and CleanTech.

- Financial technology is the new way to deliver financial services with implementing technologies, this method can compete with traditional financial methods due to its higher efficiency of processes (Investopedia, 2018).
    - Clean technology is about minimizing negative environmental impact of the company. That describes energy efficiency improvement activities, reduction of resources used and their re-use, decrease of environmentally unfriendly ejections and other environmental protecting activities (Margaret Rouse, 2010).

AgTech is developing not only in USA, but also in Canada, India, China, Israel. To my mind, in several years it would be developing in Europe (especially Netherlands, Belgium, Denmark).
Agricultural business is very vulnerable, as it is influenced a lot by climate. We cannot predict all the business processes as in production. Standard timetable of processing (watering, fertilization, chemicalization) does not consider all the local features and climate variability and cause inefficient result - overrun of materials or hidden problems. Drought or excess of moisture, lack or surplus of fertilizers, weeds and insects require immediate intervention. A flash of disease can

appear unexpectedly and sometimes it is quite difficult to understand the reason, different diseases can destroy a big part of the harvest. A farmer should have more than 40 decisions during a season:

- Which seeds to plant
- When to plant
- How to process them
- How to cure sick plants
- How to cope with dangerous situations

A lack of information can lead to the situation that during the planting, cultivation, care of a crop a farmer can lose up to 40% of the harvest. During collection, storage and transportation also 40% can be damaged. Scientists stated that besides weather 60% of factors can be controlled with the help of Hi-tech management (automated controlled system) (Christopher J. Smith, 2017).

To work as efficiently as with the help of control systems a farmer should:

- Collect all the detailed information about previous seasons, harvest, weather, effects about all the used fertilizers.
- Organize continuous access to information about weather, temperature, content of substances in soil.
- Integrate all the information in the system of data management.
- Embed a system of business analytics for processing the information and developing strategy to provide instructions.

These are the activities, which could be done with the help of internet of things. It automates all the cycle of agricultural activities. The main goal of implementing informational technologies into different spheres is automation of the cycle, minimization of costs, improving the efficiency of the company, optimization of resource usage.

Implementing only smart greenhouses will not increase profit significantly, as after growing the plants, you also need to collect harvest, store it somewhere and transport it to the client. And these activities are more difficult to automate. It requires the higher level of informational integration, which can influence not only profitability but also competitiveness. But the number and quality of harvest increases a lot after implementing smart greenhouses.

Data aggregation, its proceeding in the real time is a revolution for farmers. The system helps to make decisions and develop a strategy. The more partners use the systems, the smarter it is, as it gathers information about different activities and conditions.

For example, the system can predict that 2-degree temperature increase can cause hatching of insects or increase of humidity. It will lead to diseases. The smart greenhouse in that case can prevent temperature increase.

Now farmers are able to control weather conditions and to predict the result with mathematical accuracy.

10 Types of Analyses Used in the Work

To analyze whether our business has the chance to become successful we need to conduct several researches. Such analyses are essential for any business. They consider economic environment, possible stakeholders and ways how the company interacts with them. Strengths of the business should be analyzed to know how to win the competition; weaknesses are also important to know what can go wrong and be prepared for any risky situations. Now let us discuss the analyses used in the work.

10.1 Lean Canvas

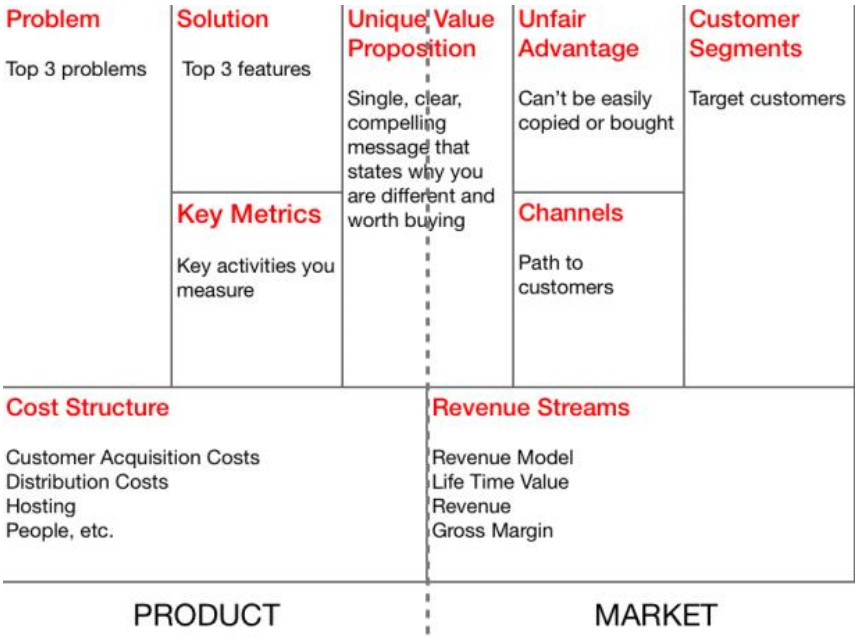
For an entrepreneur it is important to have information about his business in an organized way. This business model helps to formulate main ideas of the business plan in an easy-to-read format.It is very convenient if an entrepreneur wants to share his idea with investors and other stakeholders (Steve Mullen,2016).

Lean methodology is basically about elimination of waste. Lean company focuses on fulfilling clients‘ needs by performing processes which give zero waste; such company is well-organized and the processes are optimized (Lean, 2018). Lean Canvas is based on the Business Model Canvas created by Alexander Osterwalder. The first version is an instrument for strategic management, which helps to describe the business and highlight its key metrics. This Model was mostly aplicable to existing businesses. Ash Maurya created Lean Canvas, which was aplicable to lean startups, which are aimed at eliminating waste: time, inventories, capital, labour (Canvanizer, 2018). Lean process is based on feedback. You make one step, get a feedback from the client, analyze his reaction and move further .

The model consists of nine blocks, which are:

- Problems: describes problems of a customer, which our product can solve
- Customer segments: describes the potential customer
- Unique value prepositions: describes value that can be delivered to the client
- Solution: describes ways how to solve problems
- Channels: describe the ways to reach the potential customer
- Revenue streams: describes the source of revenue
- Cost Structure: lists all the costs we should take into account
- Key metrics: describes indicators measuring the performance of the company
- Unfair Advantage: some feature of a business, which is very difficult to copy or imitate (Steve Mullen, 2016).

Lean Canvas Model



Source: Ash Maurya, 2010

10.2 PESTEL

PESTEL analysis is an easy way to discover environment of the business. This tool shows the aspects that can influence the business. It includes several spheres:

- Political aspects: government policy, foreign trade policy, trade restrictions, tax policy, corruption, labor law, corruption
- Economic aspects: Economic growth, crises, inflation, interest rates, currency exchange rates, unemployment rate, average income
- Social aspects: Population growth rate, lifestyle, age and racial distribution, career preferences
- Technological aspects: level of technological innovations, automation, technological awareness
- Environmental aspects: climate, environmental policies, weather
- Legal aspects: employment laws, patent laws, consumer protection laws, antitrust laws (Pestle Analysis, 2018)

The result of PESTEL analysis helps to identify threats and opportunities for SWOT analysis, another tool used in the work.

10.3 Porter's Five Forces

This analysis defines the level of competition in the concrete industry. If the competition is high, there is no point for an entrepreneur to enter the industry. The tool should evaluate such factors:

- Competitive rivalry. Knowing your competitors is very important, their number and power affect the business significantly
- Power of suppliers. Suppliers can also affect a business, if their number is low, they can increase prices, so that your costs will be very high
- Power of consumers. Consumers can be powerful enough to dictate their prices, an entrepreneur should try to find a market with a lower buyer power.
- Threat of substitutes appearance. Your product can be forced out by substitutes, so if it can be replaced by many products, the situation is risky.
- Threat of new competitors appearance. New markets usually attract entrepreneurs, you should consider all the barriers for entry. If it is easy to enter your market and it is profitable, be aware of high competition in future (MindTools, 2018).

All this aspects are essential and paramount for any business plan. This analysis checks whether the company has the opportunity to attract clients, produce a product for them and get profit from it.

10.4 VRIO

VRIO analysis helps to investigate the resources of the company and how the business can use them to win the competition. To understand if the resource is able to become a competitive advantage an entrepreneur should answer these questions:

- Is the resource valuable
- Is the resource rare
- Is it costly to imitate the resource
- Is the firm able to organize value with the help of the resource.

Based on the answers the researcher gets the following results:

- The resource is a competitive disadvantage
- The resource is a competitive parity
- The resource is a temporary competitive advantage
- The resource is an unused competitive advantage
- The resource is a sustained competitive advantage

This analysis can help to optimize the resources, make them more efficient for the company (Ovidijus Jurevicius, 2013)

10.5 SWOT

SWOT analysis helps to identify strong and weak aspects of the company and create the list of opportunities and weaknesses.

- Strength is the characteristics of a product, which makes it advantageous.
- Weakness is the characteristics of a product, which weakens its chances for success.
- Opportunity is the external factor, which can help to reach the goal.
- Threat is the external factor, which can prevent goal achievement (Noah Parsons, 2018).

This method can be used for various products for evaluation of perspectives and strategic planning, this tool does not require special knowledge and education, every entrepreneur can carry it out.

10.6 Marketing Mix

Marketing Mix is an essential tool for every business plan. It has four categories to describe Product, Price, Place, and Promotion (the tool is also called 4P's). You should consider the components to make the business successful.

Product should fulfill needs of the customers, it should bring value to clients.

Price is an important component to be considered, an entrepreneur should analyze the average price in the market and the price a customer is willing to pay. There are three pricing strategies: penetration, neutral and skimming. Penetration strategy describes setting the prices as low as possible to attract new customers. Neutral strategy is analyzing average market price and setting it at the same level. Skimming pricing is a strategy of setting a price higher than average to create a feeling of higher quality and value.

An entrepreneur needs to choose a right place for the most efficient distributional policy. There are three types: intensive, exclusive and selective. During intensive distribution an entrepreneur uses as many channels as possible. Exclusive stands for few channels. Selective is about selling a product in a limited number of distributors and intermediaries.

Promotion describes such activities as: providing information, creating interest, bringing awareness. Choosing the right promotional strategy can bring an entrepreneur a lot of customers. However, a businessman should match promotional expenses with his budget (Marketingmix, n.d.).

11 Lean Canvas

Lean Canvas model will help a reader to get aggregated information about the business. You will find key elements in the 9 blocks of the model. And more detailed information will be in the business plan itself.

11.1 Problems

Each customer has a problem, which an entrepreneur is able to solve. Here is the three main problems, which smart greenhouses are able to solve.

- High percentage of harvest is damaged by weather conditions. Wind can break plants, rainy or dry weather can also harm them a lot. Also insects spoil the plants.
- Farmers need to have huge territories to grow crops.
- To work on planting, take care of the harvest and crop it a farmer needs to hire a lot of workers.

11.2 Customer Segments

Each business should have a target customer to have a clear understanding about his needs. The segment is very narrow, as smart greenhouses are mostly used in middle and large agricultural companies, which are able to invest into technological deveopment, interested in innovations and production optimization. Located in European Union (mostly Czech Republic, Germany, Austria, Belgium, United Kingdom).

11.3 Unique Value preposition

In this part we will discuss benefits that the client gets from using the product. The main value is that the customer is able to get more harvest of higher quality with less energy and labor expenses, so the customer is able to generate higher profit. Our clients will enjoy an innovative product, which is able to control all the agricultural processes, collect information and analyze it.

11.4 Solution

In this part we will describe how smart greenhouses help to solve customers' problems.

- Closed structure of the greenhouse helps to prevent mechanical damage. Sensors help to maintain the needed temperature and humidity level. Conditions are ideal for the plants, so the output is much higher when using smart greenhouses.
- Using a system of growing plants in the containers with solution amount of place needed for growing decreases. Considering the fact that harvest from one plant in the smart greenhouse is much higher than in the open space and crop ripens several times during the year, the need for space is much lower.

- Process of planting and harvesting is much easier after implementing smart greenhouses. Taking care of the plants is conducted by the smart equipment, so the farmer needs much less workers.

11.5 Channels

Clients will be able to order our products via several channels:

One of the selling channels is our main office. A consultant there will describe all the features of the greenhouse, place the order and the client will get the greenhouse in 2 weeks.

The second selling channel. Via website a customer is able to order a greenhouse to every place where the company operates. This channel is very convenient, so we predict it to be the main channel. A client does not need to spend time and can get consultancy in the website.

Main agricultural exhibitions and fairs are perfect for promoting a product, bringing awareness to it. This is is a marketing channel.

11.6 Revenue Streams

The only revenue is selling smart greenhouse. Prices for smart greenhouses are quite high and it is possible to cover all the expenses occuring during the process of doing business. We will calculate price of the smart greenhouse and revenue in the following chapters.

11.7 Cost structure

There are several types of cost considered in the work:

Initial: expenses for establishing Limited Liability Company, furnishing of the office, buying equipment for the factory.

Fixed : costs for website, managers and financial controller and rent (320 000 CZK)

Variable (depend on the number of greenhouses): materials for greenhouse, engineers, who will have a piece-rate payment, transportation costs (1 410 440 CZK/greenhouse).

The cost structure will be discussed precisely in the financial part.

11.8 Key Metrics

In this block we discuss factors by which we can measure progress. We will use ARRR metrics created by Dave McClure. It can measure progress of the startup. To my mind, it contains very efficient ways to analyze the performance of the startup:

Acquisition: customers attracted with the help of various channels;

Activation: client tries the product and likes it, feedback from the client is very important for us;

Retention: customer wants to buy more products from our company;

Referral: clients find the product good enough to refer others;

Revenue: a business can generate some income from the customers.

Lean model gives the summary which shows steps where to develop the business.

11.9 Unfair Advantage

Our main advantage is level of technological awareness of employees. It is difficult to imitate it, so it is hard for new competitors to enter the market. Technological research is needed before starting the business, so inside information is also our unfair advantage. Innovations, information and professional employees can be an advantage, which puts us ahead of my competitors and cannot be easily copied by them.

<table>
<tr>
<td rowspan="2">Problems
Some percentage of the harvest is damaged by weather conditions;
Farmers need to have huge territory to grow crops;
A lot of workforce needed;</td>
<td>Solution
Closed structure of the greenhouse helps to protect the plants from damages;
Growing plants in special liquids needs not so much place;
Automated system does not require people to work with plants on the everyday basis.</td>
<td rowspan="2">Unique Value Preposition
Great agricultural equipment which helps to increase quality and quantity of the harvest.</td>
<td>Unfair Advantage
Level of technological awareness of the employees is difficult to imitate or copy.</td>
<td rowspan="2">Customer segment
Medium or large agricultural company;
Interested in innovations;
Located in the European Union.</td>
</tr>
<tr>
<td>Key metrics
ARRR metrics is a good tool for</td>
<td>Channels
Main Office
Website
Agricultural exhibitions and fairs.</td>
</tr>
<tr>
<td colspan="3">Cost Structure
Rental
Website
Labor
Materials
Transportation</td>
<td colspan="2">Revenue Stream
Revenue from selling greenhouses;</td>
</tr>
</table>

So, in this part we decided that from the analysis of market, its potential for growth, competitors and potential customer, our business can be very successful and profitable. The only remaining part is calculating finances.

12 Executive Summary

In my bachelor thesis you can find a business plan for Smart greenhouse production. Our product will help clients to grow more plants of higher quality. Sensors, which control temperature, lightening and humidity level, will make it possible to collect harvest several times a year. Customers will be able to generate higher profits and to decrease labor and energy costs significantly.

Our office will be in Opletalova street, which is located in Prague 1) and all the production processes will be conducted in Mirosovice, a small town not far from Prague. I consider that our main sales channel will be website, that is why a consultant will be ready to answer all the clients‘ questions online.

Our main competitors are: Heliospectra, LumiGlow, Rough Brothers, Nexus Corporation, Argus Control Systems, Certhon, Logiqs, Greentech Agro, Netafilm and International Greenhouse Company. To overcome competition we are going to set lower prices than average market prices and choose penetration pricing strategy. Average salaries in Czech Republic are lower than in the USA and northern Europe. The price of one greenhouse will be 1 700 000 CZK.

Analyses of the industry show that such business can have success. There are a lot of agricultural companies in Europe, they are interested in innovations and willing to pay for equipment, which can help to optimize key possesses.

Financial estimation shows that the business can be profitable, we need to produce less than 2 greenhouses a month in average to generate positive profit.

I will invest 1 000 000 CZK from personal savings, that will be enough to cover all the initial and fixed costs. All the variable costs are in the price of a greenhouse, and the client will pay before getting the smart greenhouse, so I do not consider these costs in the investment.

I have developed three sales scenarios: pessimistic, realistic and optimistic. Realistic income statement shows that it is possible to have approximately 2 300 000 CZK net profit in half a year. In first month the profit is negative, as we will not be able to have many customers and will not get many orders, but from the second month the profit is positive. I will be the main proprietor of the business and managers and financial controllers will help me with daily activities.

13 Business Overview

In this part we will discuss such important features of the business as:

- Mission
- Vision
- Objectives

13.1 Mission

My mission is to implement IT technologies in agricultural sphere, to help companies make their product better and to increase their efficiency. I would like agricultural companies to offer their customers fruits and vegetables, which are free of any additives, natural, safe and healthy. To my mind, this project can help people and environment, it will save water and space.

13.2 Vision

I would like the company to develop and to become well-known in the agricultural sector, to gain that popularity we will produce product of the best quality. In 5 years I would like to become a strong competitor for such players of the market:

- Heliospectra (Sweden)
- LumiGrow (US)
- Rough Brothers (US)
- Nexus Corporation (US)
- Argus Control Systems (Canada)
- Certhon (Netherlands)
- Logiqs (Netherlands)
- Greentech Agro (US)
- Netafim (US)
- International Greenhouse Company (US) (Market Research Firm, n.d.)

These companies are operating not only in hydroponic sphere, but from year to year hydroponics become more popular, so I expect to have some success in the business.

13.3 Objectives

Every business needs to set some long-term and short-term goals, to know, where to move. My goals are:

- In 3 years extend the company: more staff, more greenhouses produced/period of time.
- In 5 years have customers at least in 15 countries;
- In 15 years become one of 10 main players of the smart greenhouses industry;

14 Product

Nowadays agriculture is a great sphere for investments. Frequent financial crises made investments in industrial goods production quite risky. The demand for such products can decrease, as when people do not have jobs and money, they do not buy cars and real estate, but they should eat.

One of the best sectors for entrepreneurs is production greenhouses for vegetables, just because of the same reason as a high demand for them. Up-to-date smart greenhouses give an opportunity for the most efficient production in the agricultural sector, as the main idea of the product is automation of the intense growing process. However, entering this market is very expensive.

In this part of my work I will give you some understanding of the product. Smart greenhouses can improve efficiency of the company with the help of:

I will focus on production of hydroponic smart greenhouses. This system allows to grow plants without soil. Why I decided to use hydroponic?

- It can be placed in any region, no matter if the soil there is infertile;
- It can be placed even in the regions where are no soil;

Such type of smart greenhouses is more expensive for production, but I decided to choose it as, To my mind, this is where future is. And here are some more advantages of hydroponic greenhouses:

- Disadvantages of dirt. When plants are grown in soil, they have as much space as they need, roots can spread whenever it is possible, and a farmer cannot control the amount of water and fertilizers reaching the specific plant. Moreover, soil cannot keep all that substances for a long period of time, it leaks through it.

- Water overrun. If you want to use less water in the process of growing plants, hydroponic greenhouse is a great idea for you. This technology significantly decreases costs for companies, this is very important for some countries in Europe, where the prices for water and energy are enormously

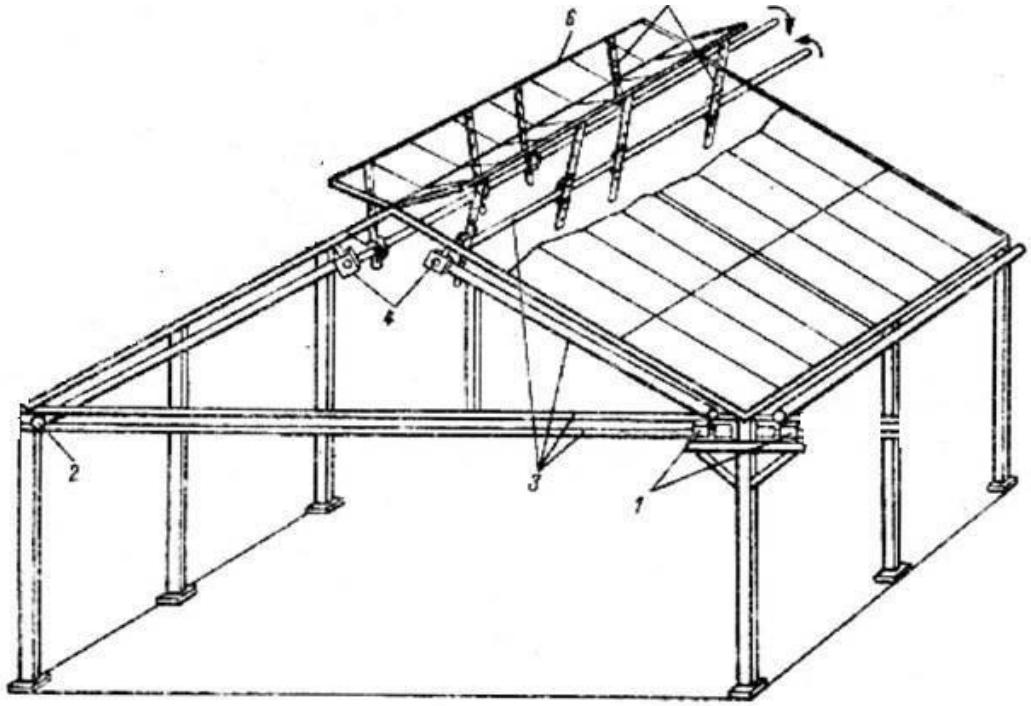
  high. Researchers at the University of Arizona state that non-hydroponic technique require nearly 10 times more water than hydroponic.
- Less Diseases and higher pest control. Some insects can reach plants through soil, also some diseases can move from one plant to others through dirt. Grubs, root rot or powdery mildew and other troubles can destroy the whole year crop and transfer to the next one though soil. Hydroponic system can help to prevent such situations, diseases cannot move to other plants in such environment.
- No weeds. Weeds can become a huge problem for a farmer. They consume water, fertilizers, nutrients and light allotted for plants. They are very unpretentious and tenacious. Also they occupy a lot of space, and do not give a chance for roots of the necessary plants to spread enough to consume the needed substances. It is very difficult to pull out weeds, as their roots are very strong usually. But in a farmer does not remove them, they can multiply and grow very fast.
- Better harvest in less time. The life cycle of the plants can be significantly prolonged in the greenhouses controlling temperature, humidity and light, moreover oxygen, water and nutrients can reach the plants faster, as they are delivered directly. The harvest can be collected more frequently and a farmer can create the environment in which he is able to get crops through the whole year. The quality increases as it is easy to control and prevent diseases and insect attacks.

Now let us talk about the product itself. Automated Hydroponic Greenhouse consists of the following subsystems and equipment:

- Greenhouse with transoms;
- Hydroponic system
- Heating system
- Ventilation system
- Lighting system
- Automation system Smart Greenhouse

Let us provide the equipment for the greenhouse 20*10 meters, 5 meters height. The greenhouse has gable roof and transoms in the rope. To have a precise financial calculations I decided to prepare a detailed technical plan.

Scheme of a Smart Greenhouse



Source: Own creation

14.1 Type of environment for roots

An environment in the hydroponic system should be chemically inert materials, water conductive and aerating. Here are some kinds of environment which can be used for roots development in the hydroponic system:

- Peat, expanded clay, perlite. These substances are put into special containers of plastics, fiberglass, metal, polyethylene film. Irrigation is processed through surface deposition (droppers, sprinklers) or through solution supply from below
  (underflooding, flow channels). These is how tomatoes, cucumbers, strawberries, chrysanthemums and other plants are grown.
- Mineral wool. This material ensures optimal balance of air and moisture for root development. It can be prepacked into cubes or be in the form of fiber. The most popular way of irrigation is individual drop counter for every cube. The most popular substance is “GRADAN”, its quality is very high, farmer can avoid diseases and pests. The growth processes are easily controlled. This material is good for tomatoes, cucumbers, eggplants, pepper, strawberry, gerberas, roses and other.

- Nutritious solution. Roots are dipped into narrow plastic channels with holes.
  Solution circulates through the channels, then it is poured into the catchment pipeline, then it goes to the catchment basin, after that it can reach the plants again.

  To my mind, the most efficient method is nutritious solution. So, we will use it for our greenhouses.

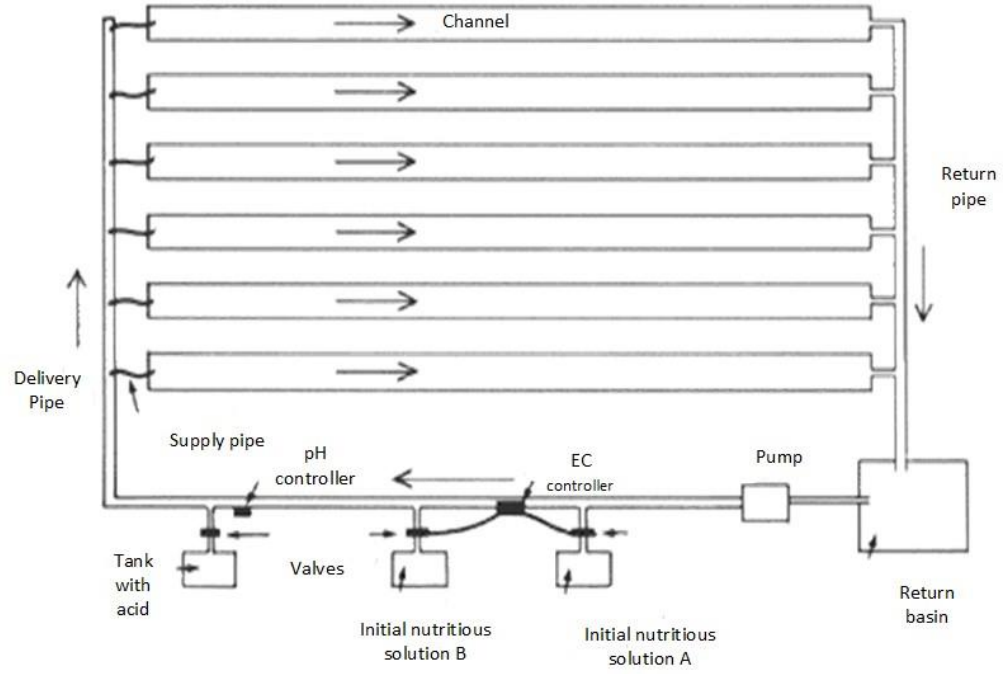
14.2 Irrigation system

In case of flowing hydroponic system roots are dipped into the nutritious solution, which continuously circulates through channels and connecting pipeline.
For producing a standard flowing hydroponic system, these components are needed:

- Channels, through which the solution circulates;
- Catchment pipe, where the solution is poured after passing through channels;
- Catchment basin, where the solution is poured after the pipe;
- Pump for water supply from catchment tank and water return to the beginning of the system;
- Basins for concentrated nutritious and acid solutions;
- Controller with sensors for pH (acidity) and EC(electrical conductivity) measurement. They should be equipped with valves, to add acid or nutrients and control the balance of components in the solution;
- Racks for support and providing the necessary skew.

You can see the scheme for irrigation system of my greenhouse below.

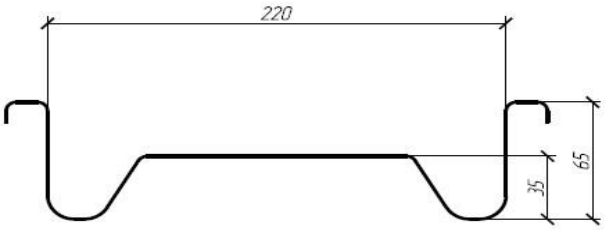
Scheme of an Irrigation System



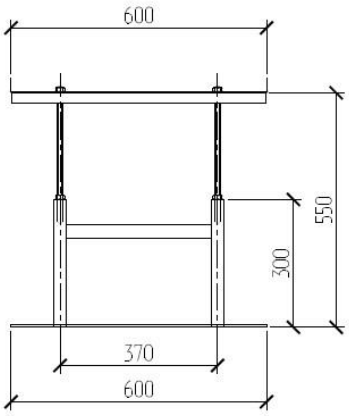
Source: Own creation

For controlling doses and distribution of the solution we will use “PRIVA” system, which consists of:

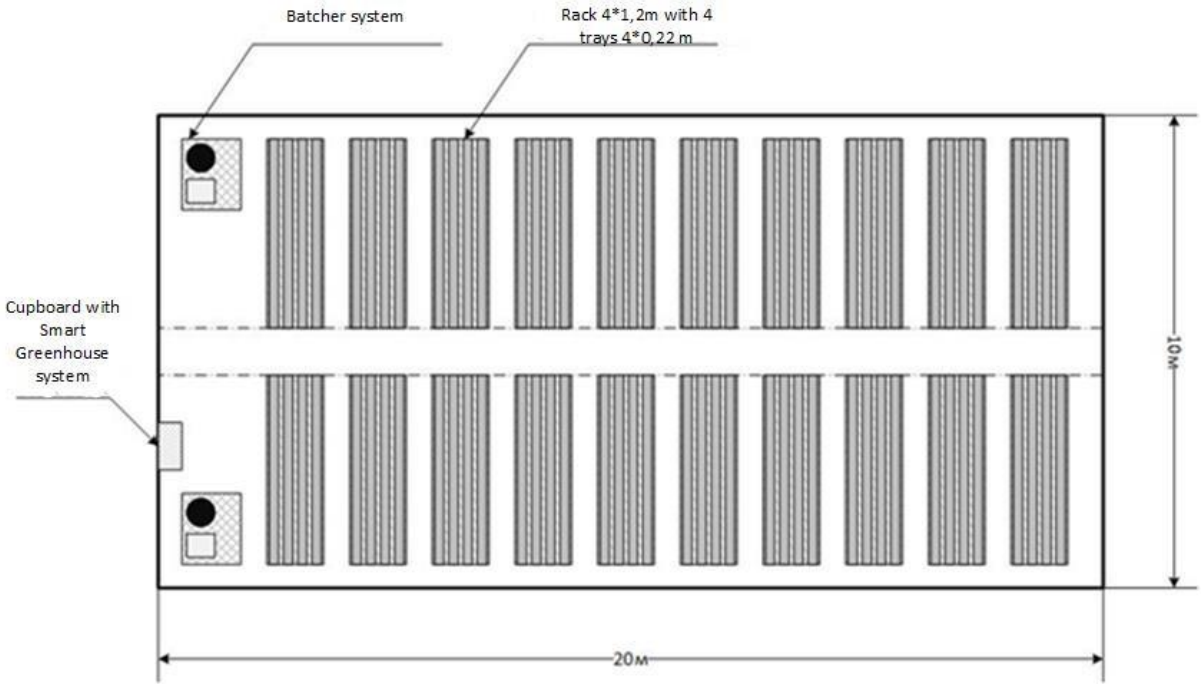
- Computer
- Components of the previous scheme
- Metal-plastic trays



Tray for growing flower and vegetable plants 220*65*35



Adjustable support for the tray for growing flower and vegetables products. We will place the tables on the height of 800 millimeters (height of the highest plant's crown).



Source: Own creation

In the scheme above you can see that the racks with metal-plastic trays are set in 2 rows – on the right side and on the left side from the central pass. The rack is of 1,2 meter width, consists of two adjustable supports (width 6 meters). There are 4 metal-plastic trays (4*0,22 meters). The

racks are located at a distance of 1 meter from each other. Central pass is 1 meter. There are 20 racks in the greenhouse (10 in every row).

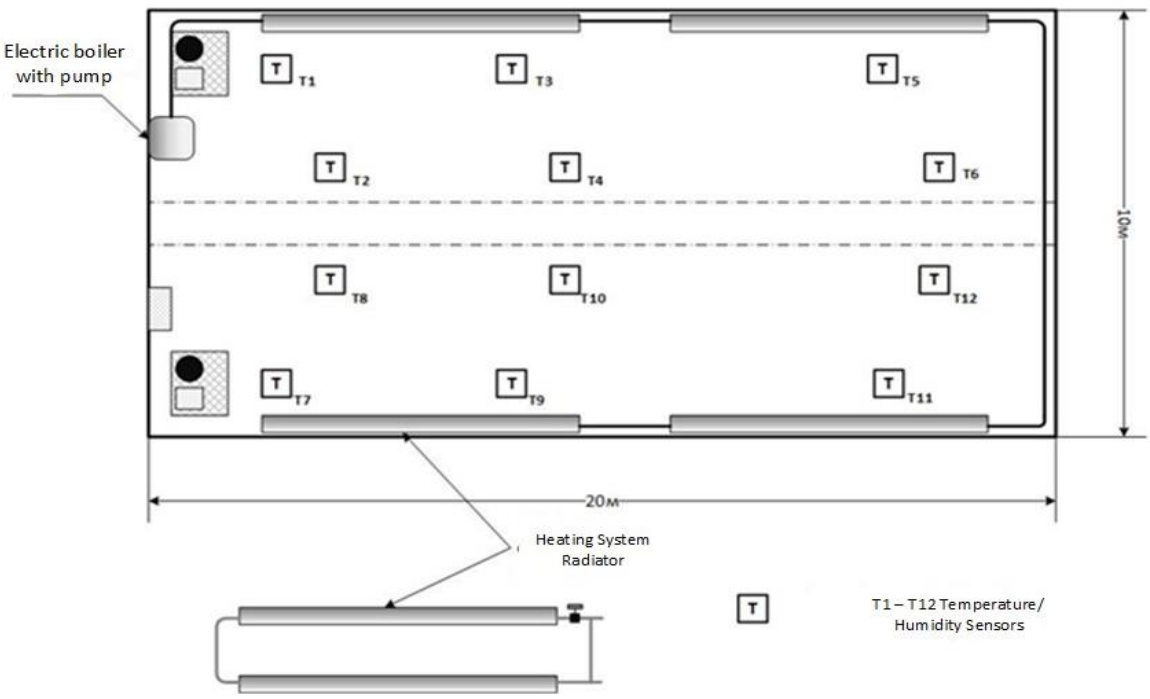
Near the entrance you can see two batcher systems and one cupboard with Smart Greenhouse system. Every tray can have 2 rows of plants, with the distance of 15 centimeters between their roots, in average 50 plants in one tray, 200 in one rack, 4000 in the greenhouse.

14.3 Heating System

For maintaining the needed temperature for plants in the cold time, we will install the heating system in our greenhouses. I am going to use water heating system with electric boiler for water heating. As a radiator we will have pipes (diameter 100 millimeters), placed on the side walls of the greenhouse. Water temperature control is conducted by temperature sensors in different places of the greenhouse. Management of the electric boiler is held by the controller of Smart Greenhouse system. We will use Pro Term Ray 12K boiler. And circulation pump Grundfos UPS 32-80.

There will be 12 temperature and humidity sensors in the greenhouse (model AM2302 DHT22).

Scheme of a Heating System



Source: Own creation

Sensors T1, T3, T5, T8, T10, T12 are placed on 1 meter height from the floor, sensors T2, T4, T6, T7, T9, T11 are 1,5 meter higher (2,5 meter from the floor).

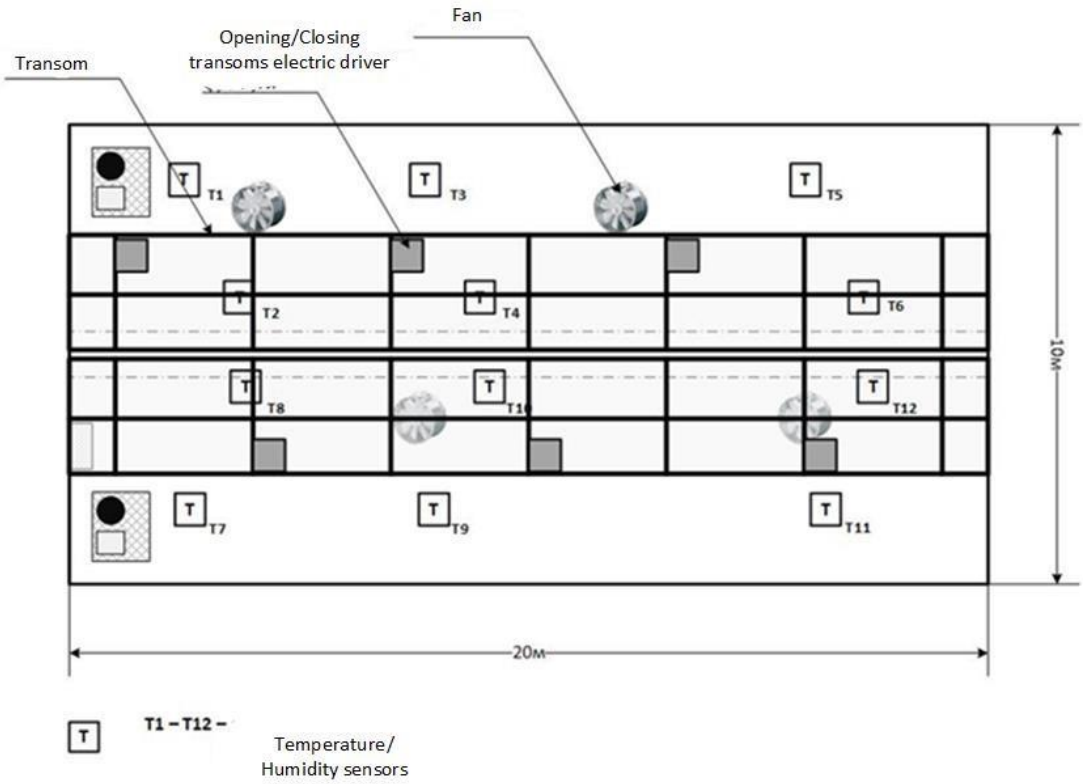
14.4 Ventilation System

Ventilation system is intended to supply the greenhouse with the oxygen, its even distribution among the greenhouse, even distribution of temperature among the structure. Ventilation system consists of electric fans and electric drives of transoms opening. Temperature control in different places of the greenhouse and its even distribution is carried out by the temperature sensors. Fans and drives of transoms opening management is done by the Smart Greenhouse system controller.

It is very important to spread the heat evenly over the whole covered area of the greenhouse, this will help plants to ripen simultaneously. Fan mixes air layers to homogenize air masses and works as an economical device with optimal results. We will use Maico EZG 30/4B single-phase.

Opening and closing of the transoms will be held by rod electric drives ST-450 N180.

Scheme of the Ventilation System



Source: Own creation

In the scheme above you can see ventilation system. There will be 4 fans in the greenhouse, place on the height of 2,5 meters, for transoms control we will use 6 electric drivers located in the place of transoms opening.

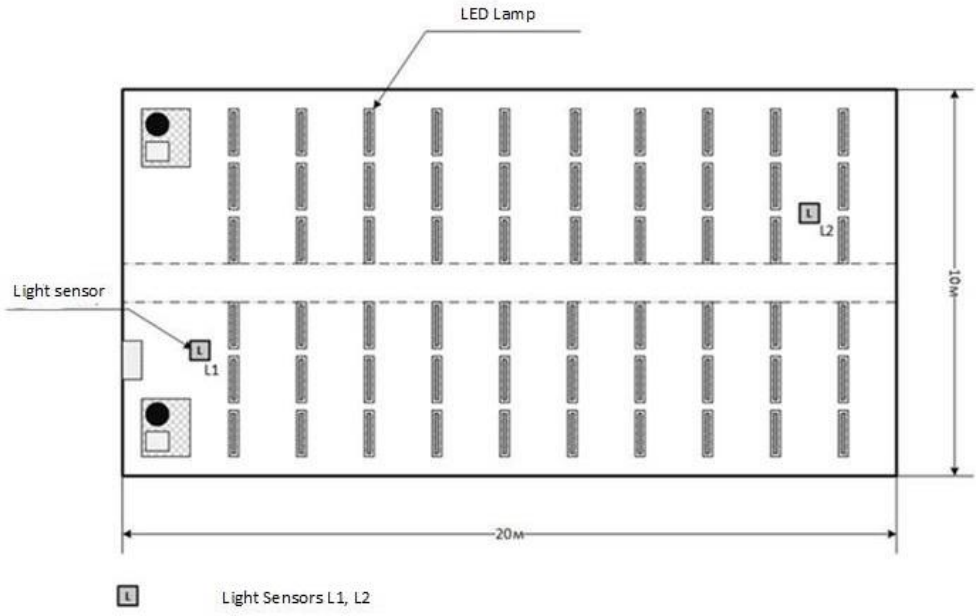
14.5 Lighting System

Light is an important component for plant development. It is needed for building complex organic chains from simple molecules. Energy is necessary for every process, plants take it from light. Photon of light on the surface of leaf starts biochemical reactions, which result in developing roots, stems and leaves. This process is called photosynthesis.

In our greenhouse main lighting is natural (from the sum), which gets through the side walls and roof of the greenhouse. Additional lighting is LED lamps. Illumination control is held by light sensors, and the overall management is done again by the Smart Greenhouse controller. As LED lamps we will use industrial LED lamps DS-PROM 83 (760*85*78 millimeters). Lamps are placed on the height of 1 meter of the upper point of the plant (2 meters from the floor). One rack has 3 lamps.

For illumination level measurement we will use Troika-module. These sensors are 0,5 meter higher from the LED lamps. Smart Greenhouse controller gets information from the module and analyzes the intensity of natural lighting. If the lighting level is low, it turns on the lamps. During night they are turned off. There are two illumination sensors in the greenhouse.

Scheme of Lighting System



Source: Own creation

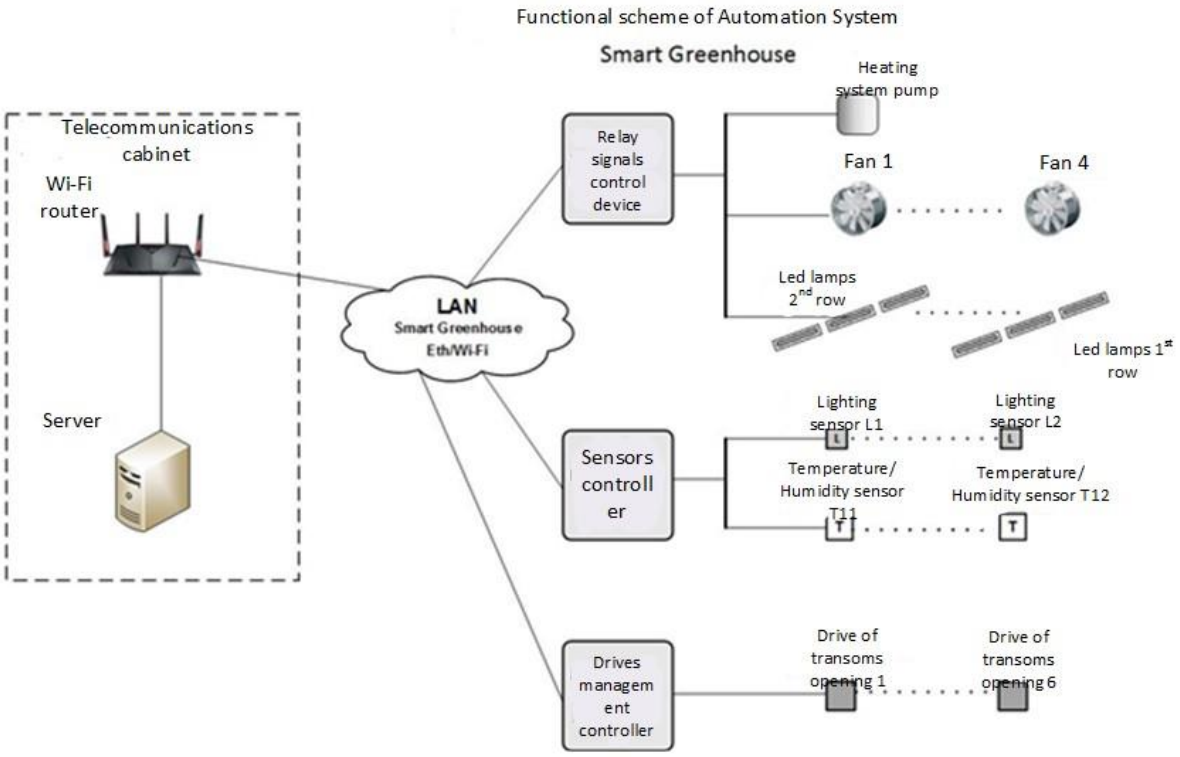
In the scheme above you can see the lighting system of the greenhouse.

14.6 Smart Greenhouse Automation Equipment

For producing Smart Greenhouse automation system we need:

- Server, which provides peripheral device management and their interaction with each other. Server is a software, which is installed on one industrial minicomputer.
- Wi-Fi router, which provides local network construction for interacting of server with peripheral devices. Server can be connected to Wi-Fi router either through Wi-Fi or through Ethernet.
- CUWDb is an extensible configurable device of relay signals management. It provides management of pumps, fans, lighting and other electric devices suitable for control channels of the device. There can be from one to several devices CUWDb in one smart greenhouse, this depends on the customer's requirements.
- SC-01 is sensor controller providing information collecting from temperature, humidity and illumination sensors.
- DCC-01 is drive management controller. It provides rod electric drives of transoms opening/closing.

Scheme of the Smart Greenhouse Automation System



Source: Own creation

In the scheme above you may see automation system of our smart greenhouses.

As a server we will use MITXPC Intel Xeon D-1518.

There will be Smart Greenhouse software on the server. It is intended to control automation system and organization of interaction among peripheral devices and automation system server.
For system monitoring we will connect to the software via Wi-Fi with the help of laptops, smartphones or tablets, also we can use Internet for remote connection.

As Wi-Fi router we will use ASUS RT-AC1200. It has high quality and its price is quite pleasant. Also it corresponds to all modern standards. CUWDb is a relay signals control device. So, in this part we discussed the benefits, which the company will have after implementing our technologies, advantages of hydroponic greenhouses and full construction process of the product.

15 Industry Overview

Nowadays technologies become more and more popular. IT tends to enter all the industries, even the industry which was considered as the farthest from innovations. Smart Greenhouse market is developing very fast now, the technology we discussed above is more and more popular. You may think that the competition is very high, as we observe such interest from the audience. However, it is quite difficult to produce a good greenhouse, which will be applicable for companies' use. It requires serious technical preparations and research.

The market is rising; there are many new players in the sector. But many of them focus only on small greenhouses, which can be a part of smart house concept. In the work we will discuss latest trends, reason of success and geographical segmentation of the market.

We can say, that one of the main reasons for smart greenhouses popularity is population increase. It is logical, that if the population is bigger, supermarkets and small shops need to sell more food, the demand for fruits, vegetables and cereals is higher. Large agricultural companies can increase the quantity and quality of the harvest using smart greenhouses; moreover by controlling temperature and lighting they can collect crops several times a year.

High costs of the production and deep research requirements do not give an opportunity to many companies to enter this market. Most of companies, are interested only in producing small systems for placing at home or in the garden, but not in the production scale. Also many of the organizations operate only in the non-hydroponic sphere. That is why I assume, that I would be successful among other producers, as I have just a few direct competitors.

Here are some of the main competitors:

- Rough Brothers, Inc. (USA),
- Ceres Greenhouse Solutions (USA),
- GreenTech Agro LLC (USA),
- Logiqs B.V. (Netherlands),
- Argus Control Systems Ltd. (Canada),
- Heliospectra AB (Sweden),
- JFE Engineering Corporation (Japan),
- Nexus Corporation (USA),
- Terrasphere Systems,
- LLC (USA), Certhon (Netherlands), • LumiGrow Inc. (USA),
- Hort Americas (USA).

As you see, most of them are located in the USA . From strong European competitors we have only Netherlands and Sweden. This can be easily explained United States try leave behind all the countries in the technological development and economical level. And they manage to be among leaders in most of the industries due to their professionals and high level of science development and technologies. America needs to produce a lot of food to meet the needs of the huge population of almost 330 million people, which continuously increases. The fact that Netherlands has top producers of agricultural equipment is quite obvious too. Agricultural sector of Netherlands is very developed, the country is one of the main producers of corn, vegetables and flowers it is the second largest exporter after the USA, however, only 2 percent of the population are involved in this industry, it means that almost all the processes are automated.

In other European countries we do not have strong competitors. This gives us the opportunity to develop our company in such directions as Belgium, Germany, UK, Austria. Maybe in some time we will be able to leave behind Dutch competitors, as the price of their greenhouses is quite high. Optimization of supply chain can minimize the costs.

To my mind, industry of Smart Greenhouse producing has a high potential for growth and agriculture and Information Technology association in general has many directions to develop. It is expected that the market size of the industry will increase more than in two times in less than 10 years.

Russia is also expected to become one of the main players in the industry. Former head of medical company “Invitro” Sergey Abramov decided to join the sector. He will sell franchises of iFarm projects. The company produces small smart greenhouses that can be placed in the house of on the roof, the business should become profitable in two years after starting a franchise. Nowadays Russia is tries to produce a good smart greenhouse for mass production, it should have bigger sizes and more difficult in manufacturing, but it can be used by large agricultural companies.

Asia also makes an attempt to develop in the industry and is very successful in that. China and Japan and India have a quite high economic potential. These countries produce rice and tea for the whole world, moreover, they try to participate in creating all the latest technologies.

Brazil nowadays also takes part in producing Internet of things based agricultural equipment. Brazil exports coffee, bananas, oranges, sugar, and cacao. 65 percent of export revenue comes

from agricultural sector. Almost 40 percent of population is involved in the industry, that means that the processes are not automated. To maintain one of the leading exporters of fruits and vegetables Brazil needs to embed Information Technology into agricultural sector. This can decrease the costs in long-term perspective and increase the number and quantity of the harvest.

So, the market of smart greenhouses seems very attractive to me. It has not so many competitors, as producers need to invest a lot in the business and research and technology processes. However, these issues can be quite time and money consuming. The demand for such product is high, which is also a huge benefit for the company manufacturing smart greenhouses.

16 Marketing Strategy

Marketing part is essential for every business plan. It contains analyses about environment in which the business exists, its main stakeholders:

- Competitors;
- Suppliers;
- Customers;
- Investors;
- Government;

After collecting all the needed information we will discuss can the business be profitable, demanded and do we have a chance to reach our goals. Then we need to determine place to sell our product, its price and ways to promote. Now let us start with the analyses.

16.1 PESTEL

Now we are going to discuss aspects from different areas, which can influence the business.

Political factors:

- I would like to have customers in several countries in Europe and the business itself should be located in Czech Republic. Due to European Union policies the export costs can be minimized. Trade between members of the union is more like an internal trade, so there are no customs duties. VAT is also not paid if both companies are registered in the European Union. This factor significantly reduces the costs.
- Our product can be specified as an agricultural equipment, so it complies with harmonized rules and the product can be transported among the territory of the European Union.

- Salaries in Czech Republic are quite low in comparison with other European countries. Minimum salary is 11 000 CZK, which is approximately 430 EUR, and the average salary is 25 000 CZK, which is less than 1000 EUR.
- Corruption, to my mind, is the only negative factor. It is not very high in comparison with such countries as Russia, Ukraine, Sudan or Afghanistan. But it is relatively high in comparison with other European countries, such as: Denmark, Sweden, and Netherlands.
  Corruption decreases the efficiency of business and increases costs.

Economic factors:

- European Union has always been a strong economical player, it has high Gross Domestic Product, however, Czech Republic was not one of the main actors. But now the country develops very fast, we can see it from many factors the currency exchange rate (Czech koruna is much more valuable than it was several years and even months ago), property price is increasing, professionals all over the world choose Prague, Brno and other cities in Czech Republic for work and life, these factors demonstrate the potential for economic growth.
- Inflation in Czech Republic is not very high, moreover, it is decreasing now. In October 2017 it was 2,9% now it decreased to 1,9%. Interest rates are also quite low. You can borrow money with 1,5 – 3% rate. That can be very advantageous, especially for a new business, which needs financing.
- Nowadays Europe is in the crisis situation, this can affect any business, however, company connected with agriculture and food production will not have such a negative impact from crisis situations as, for example, automotive industry. The demand for food will be always high, especially in the era of population growth.

Social factors:

- Population of the European Union increases quite fast, this situation can be explained by a high level of immigration. Moreover, some of the immigrants are illegal, but they also need to buy food, that increases the demand for fruits and vegetables, which are produced with the help of agricultural equipment.
- There is a new trend of controlling the quality of food. Many companies grow fruits and vegetables with the help of additives, that gives more harvest, however, its quality is lower, concentration of nutrients and vitamins is lower. Nowadays people try to track how the food was

produced. Smart greenhouse gives an opportunity to grow plants faster in in higher quantities without any additives.

- Another trend is automation and interest to the IoT based products. Internet of Things makes our greenhouses more interesting to the audience. That can attract suppliers and customers.
- There are more and more professionals in IT sphere. Our business will surely need employees, who are experienced in Information Technologies. Higher supply of labor will make it easier to find the applicants we need.

Technological factors:

- Level of technological development in Europe is high, so it would be easy to find employees and equipment required by the business; Environmental factors:
- In the countries we plan to work with the climate is not so mild, so smart greenhouses will be much demanded.
- Our project is environmentally friendly, it saves energy and produces plants of a high quality, that factor will attract audience, as nowadays people are concerned with environmental issues.

Legal factors:

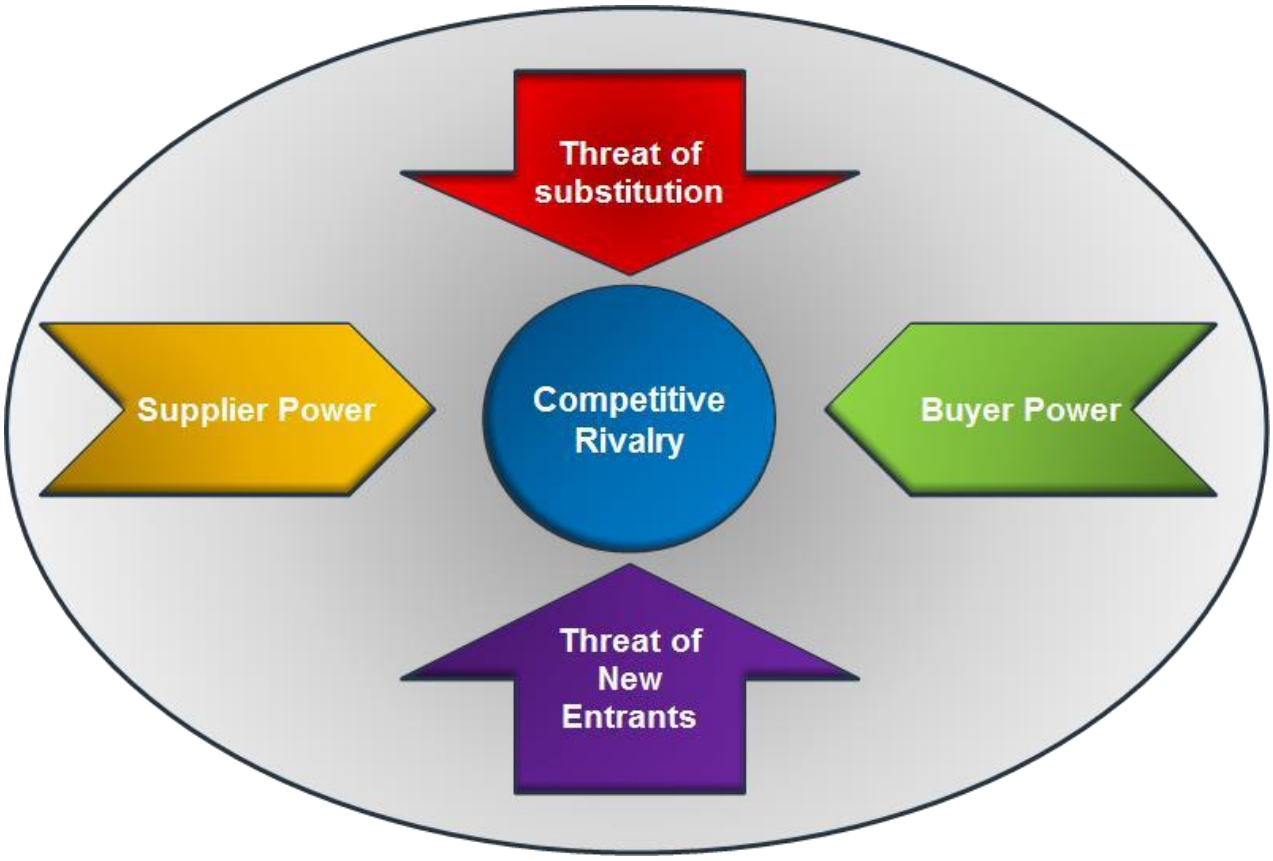
- There are no licenses needed for smart greenhouse production, this factor is also quite beneficial for the business.
- The product cannot be dangerous to the consumer of smart greenhouses and even to the consumer of vegetables and fruits grown in the greenhouses, , also we will use the best equipment to produce a product that cannot disserve the customer, so we are not expecting any issues with consumer protection legislation.

As you see, there are plenty of aspects affecting smart greenhouse production business. Most of them have a positive impact.

16.2 Porter's Five Forces

This analysis examines the power of those stakeholders, who can significantly affect the business.

Porter's Five Forces Analysis



Source: Professional Academy, n.d.

- Threat of substitutes appearance;

  The possibility of substitutes appearance is quite low. All the processes, which can replace growing plants in hydroponic greenhouses, are much less efficient: plants in the fields are exposed to environmental instability; non-hydroponic greenhouses are less efficient due to the fact that nutrients need to go through soil to reach the roots, some of them do not reach the plants. New substitutes are very difficult to create, as it requires serious research, high level of technological development and huge investments.

- Threat of new competitors appearance;

  The industry can be very attractive to the entrepreneurs, however, entering the market of smart greenhouses is quite difficult, it requires high investments and high level of technological awareness,

- Power of suppliers;

Suppliers' power is average. It is not so difficult to find the same equipment made by other producers and number of their customers in not very high, however, there are not so many producers, so their power is not low.

- Power of consumers;

  Power of consumers is quite high, there are not many of them, as the product is narrowly specialized and expensive. However, the number of producers of smart greenhouses is also not very large, so the power of consumers in not extremely high.

- Level of competition;

  Competition is average; there are not many producers, as the business requires high costs and level of technological development. However, it is increasing now, as investors are interested in the sphere.

To sum up, I would like to say that for our business it is very important to produce product of a high quality and try to have average price, or even less than average, reaching these goals will result in:

- Winning competition;
- Attracting and retaining customers.

16.3 VRIO

Let us discuss main resources of our business:

- Innovations;

  Innovations are very important for smart greenhouse production, so, we consider them valuable. Such innovative technologies are quite rare and it is very costly to imitate the resource, as it requires serious research. Innovations are exploited; the company is able to organize value with the help of the resource. This can be a sustained competitive advantage.

- Human resources;

  Experienced and professional employees are very important for producing smart greenhouses of a high quality, so, the resource is valuable. It is quite difficult to find experienced staff and rather costly to train employees. Business is able to organize value from highly professional employees. This resource can be a sustained competitive advantage.

- Physical resources;

Physical resources are all the offices, buildings in which smart greenhouses are produced and equipment. They are valuable. Many companies have a lot of factories and equipment, so the resource is not rare; however, it is very expensive to imitate it. Physical resources are exploited. This resource is a competitive parity.

- Financial resources;

  Financial resources are necessary for production of smart greenhouses, we consider them valuable. Many companies have this resource, so it is not rare; it is costly to imitate it. Business can create value with the help of financial resources. This can be a competitive parity.

VRIO Analysis

Resource	Valuable	Rare	Costly to imitate	Exploited	Conclusion
Innovations	Yes	Yes	Yes	Yes	Competitive advantage
Human resources	Yes	Yes	Yes	Yes	Competitive advantage
Physical resources	Yes	No	Yes	Yes	Competitive parity
Financial resources	Yes	No	Yes	Yes	Competitive parity

Source: Own Creation

To conclude, I would like to say that our main resources are innovations, employees, physical and financial resources. We should focus on innovations and human resources, it can allow the business to win competition, high level of technological development, experienced staff, who will improve qualifications constantly will give us a chance to become one of the strongest players in the market.

16.4 SWOT

Now let us talk about strong and weak aspects of our business. Based on these features we will identify opportunities of our company and threats, which endanger it.

Strengths:

- Ability to grow plants without soil or in the infertile regions; Plants are grown in closed structure without soil, that gives an opportunity to the farmer to use any place for production.

- Efficient nutrition, temperature and humidity supply; Nutrients go directly to the roots; they do not have to pass though soil, which holds water and fertilizers. Automation controls temperature and humidity level, which allows to create the ideal environment for any plant;
- Higher yields; Ideal environment prevents the plants from diseases and gives the opportunity to the farmer to collect harvest several times a year.

Weaknesses:

- High production costs; Hydroponic smart greenhouse production requires high investments, it can be very difficult for entrepreneur to find investments for a product of a high quality.
- High level of technological development does not let entrepreneurship lo let the market without serious research and high level of technological awareness.
- Unprofessional employees. The industry is not developed enough, so there is a risk of unprofessional employees, who are not very experienced in the industry.

Opportunities:

- Geographical expansion; We can sell our smart greenhouses all over the Europe, it will be very demanded in infertile areas, moreover, European trade policies allow us to expand the business with the minimum costs due to open economic area.
- Developing a brand of growing clean and healthy plants; Ability to produce clean and healthy plants for farmers can become one of the main advantages to create a brand with strong loyalty of the customers.
- One of the best producers of smart greenhouses; We can make smart greenhouses of a high quality, especially if our professionals are experienced, we can reach that by conducting trainings.

Threats:

- Nonprofessional employees; Level of technological awareness of the team should be very high, if the employees are not experienced, the company can suffer a lot by increased costs of production or lower quality greenhouses.
- Inability to cover expenses; The investments to such a business and costs for its doing are very high, so, there is a risk that a company will not be able to cope with the costs and get broke.

- Appearance of new competitors; One of is the threats is appearance of new competitors, as the industry is very attractive for entrepreneurs, interested in Information Technologies and agriculture, having enough money and appropriate level of technological awareness.

To sum up, I would like to say that the risks can be minimized, if our business is well organized and has an elaborate investment strategy. We will be able to win competition by making smart greenhouses of high quality. Trainings can significantly increase level of employees and make them our important resource.

SWOT Analysis

Strength: **Growing plants without soil or in infertile regions;** **Efficient nutrition and water supply, temperature and humidity control; High yields.**	**Weaknesses:** **High investments and production costs;** **High level of technological development required;** **Unprofessional employees.**
Opportunities: **Geographical expansion;** **Becoming one of the best producers of smart greenhouses;** **Developing a brand of growing clean and healthy plants.**	**Threats:** **Inability to cover expenses;** **Nonprofessional employees;** **Appearance of new competitors;**

Source: Own Creation

16.5 Marketing Mix

Now, based on the analyses, let us create a marketing mix, which consists of following constituents:

16.5.1 Product

We have already discussed our product very thoroughly in the "Product" part of the work. It is a hydroponic smart greenhouse for agricultural companies growing plants. They are quite large. We are able to produce smart greenhouse individually for every customer's needs, or standardized greenhouses with 20 square meters size. The quality should be very high to become a strong player in the market. The product will be attractive to the clients not only

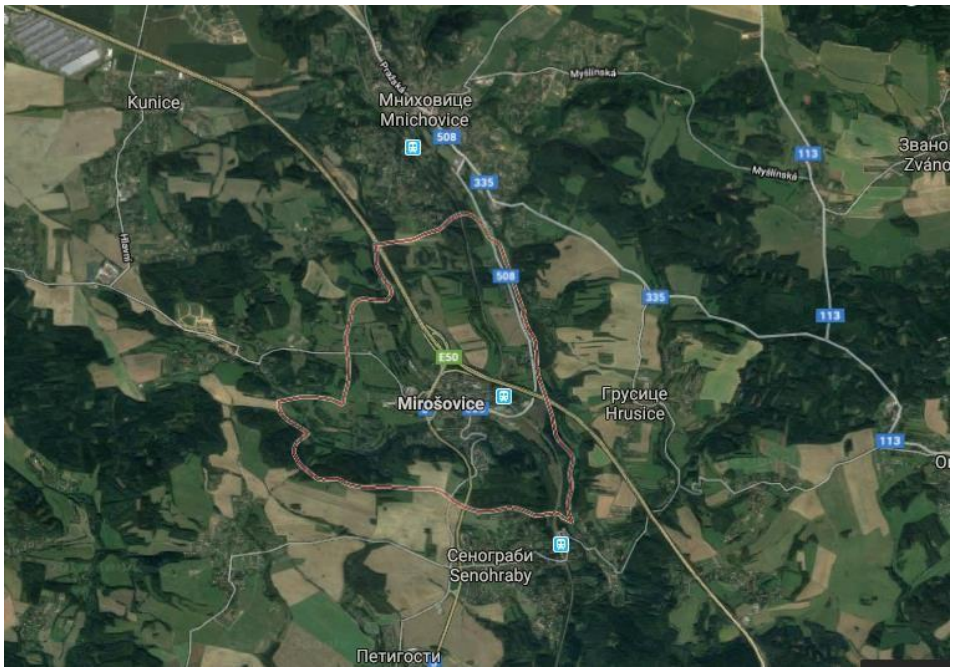
because of the quality, but also because of the energy saving technologies, that will allow agricultural companies to minimize their costs.

16.5.2 Price

The price will be lower than the average market price. 66 300 EUR (XE Currency Converter, 2018, 10 December) in comparison with 80 000 – 100 000 EUR (the prices are taken from websites of main competitors). We have chosen penetration pricing strategy for entering the new market and attracting customers. We are able to have lower prices than competitors as average salaries in Czech Republic are lower than in USA, Netherlands and Sweden.

16.5.3 Place

Smart greenhouses will be produced in Czech Republic in Mirosovice. This is a small town near Prague.



Source: Google Maps

The main office will be located in Prague 1, it will be easier to communicate with the potential clients and will make a pleasant impression. We are going to have customers in Czech Republic, Germany and Austria. Later our goal is to expand to Belgium, UK, Netherlands and Denmark. The choice of Mirosovice as a place for construction department is conditioned with lower land prices.

We have chosen exclusive distribution strategy. Customers will be able to buy the product only via website and in our main office in Prague 1.

16.5.4 Promotion

Promotion is very important for any business. For choosing methods of promotion, we are going to define our potential customer first.

- Agricultural company;
- Size: Middle – large (Small agricultural companies are unable to invest so much money in innovations);
- Interested in innovations and production optimization and willing to invest in the technologies;
- Located in European Union (mostly Czech Republic, Germany, Austria, Belgium, United Kingdom).

It will not be very efficient such a popular method as using social networks for promotion, as our product is quite narrowly specialized, so we will have high costs resulting in low efficiency.

First of all, we should create our own website, so that our customers could find information about the products, prices and contact details.

The other method is to have different presentations and contacting the client directly, as the deals are quite big, we are going to be in touch with the customer (even potential).

One of the most efficient methods to my mind is visiting agricultural exhibitions and fairs with presentations and a small model of the greenhouse. This can help to show our product visually to the potential clients. For us German or French events are very suitable, they are large-scale and famous.

- IFFA-Delicat (Germany)
- Garden Trade Fair (Germany)
- International Agricultural Show (France)

There are a lot of farmers and big agricultural companies at these events. Some of them can be interested in innovations and optimizing their production.

So, in this part we decided that from the analysis of market, its potential for growth, competitors and potential customer, our business can be very successful and profitable. The only remaining part is calculating finances.

Rich Karlgaards says that non-material aspects of the business are of the same importance than material, however, usually they are underestimated so, strong brand, loyal clients can be as

advantageous as strategy and finances. Non-material aspects create value in the long-term perspective, for example, loyal clients will support your business and buy your products for a long time, however cost savings work only in short-term perspective.

Non-material competitive advantage helps to create a brand. A team should be diverse, so that it can be full of different ideas (Karlgaard, 2014).

17 Financial Plan

This part is essential for every business plan. It gives information about:

- Initial business investments;
- Cost of product and its price;
- Budgeted income;

17.1 Initial Business investments

Before starting producing smart greenhouses we need to invest in:

Initial investments

Expence	**Amount Invested**
Price for establishing LLC	9 000
Office furnishing	50 000
Factory equipment	150 000
Total	**209 000**

Source: Own Creation

So, initial business investments are 209 000 Czech korunas.

17.2 Cost of Product

Let us start with calculations of costs for one smart greenhouse, as you know the product is very expensive, costs include:

- Equipment installed in the smart greenhouse;
- Materials;
- Labor costs;

The costs for producing one greenhouse are shown in Appendix A. Materials and labor costs for one product is 1 390 440 CZK. The price for such greenhouse will be 1 700 000 CZK.

18 Fixed and Variable Costs

We are going to create a website, as the main source to communicate with the clients through. Also we need to pay salaries to the managers, who will communicate with the customers and

suppliers (4 managers) and to the financial executive (1 will be enough at the beginning), a small office in the center of Prague is 50 000 CZK per month, a large place for smart greenhouse assembling is 60 000 per month, salaries of engineers are calculated in the price of the greenhouse (318 000 CZK), they will have piece-rate payments.

Now let us calculate fixed and variable costs.

Variable and Fixed Costs

Fixed Costs	**Amount in CZK**
Rent	110 000
Managers	140 000
Financial executive	35 000
Website	35 000
Marketing and PR	50 000
Total Fixed	**370 000**
Variable costs/ 1 greenhouse	**Amount in CZK**
Materials	1 072 440
Engineers	318 000
Transportation	20 000
Total Variable	**1 410 440**

Source: Own creation

As you see, the main costs are materials, equipment for greenhouse production and labor costs.

The investments should be quite high for the business. So, let us calculate the initial investments that are needed. We will invest 1 000 000 CZK of personal savings into the business. The greenhouses will be prepaid by the customers, so we do not need to consider cost of materials and engineers when calculating the initial investments, but we need to consider all the initial expenses, rental costs and labor costs of managers and finance controller.

19 Sales Forecast

Let us calculate 3 possible scenarios: pessimistic, realistic and optimistic. There is a risk of low sales, so we should consider all the possible outcomes. In the table below you can see a sales forecast for the first half a year.

Three Scenarios of Sales Forecast

Sales in CZK	Pessimistic	Realistic	Optimistic
January	1 700 000	1 700 000	3 400 000
February	1 700 000	3 400 000	3 400 000
March	3 400 000	5 100 000	5 100 000
April	3 400 000	5 100 000	6 800 000
May	5 100 000	8 500 000	8 500 000
June	1 700 000	6 800 000	8 500 000
Total	**17 000 000**	**30 600 000**	**35 700 000**

Source: Own Creation

19.1 Budgeted income

Now let us try to calculate the income for first 6 months, we are going to start our business in January, we can assume that we will produce only 2 greenhouses. We will use the realistic sales scenario and the costs will be calculated accordingly

Income Statement

Item/Month	January	February	March	April	May	June
Sales Revenue	1 700 000	3 400 000	5 100 000	5 100 000	8 500 000	6 800 000
Costs of Goods Sold	1 072 440	2 144 880	3 217 320	3 217 320	5 362 200	4 289 760
Gross Profit	627 560	1 255 120	1 882 680	1 882 680	3 137 800	2 510 240
Rental	110 000	110 000	110 000	110 000	110 000	110 000
Website	35 000	35 000	35 000	35 000	35 000	35 000
Wages and Salaries	493 000	811 000	1 129 000	1 129 000	1 765 000	1 447 000
Advertising expenses	50 000	50 000	50 000	50 000	50 000	50 000

Transportation	20 000	40 000	60 000	60 000	100 000	80 000
Net Profit Before Taxes	-80 440	109 120	498 680	498 680	1 077 800	788 240
Taxes	0	20 733	94 750	94 750	204 782	149 766
Net Profit	-80 440	88 387	403 930	403 930	873 018	638 474

Source: Own creation

As you see, the estimated profit for the first month is negative, we consider the fact, that the company needs some time to find customers and during January only one greenhouse will be sold. Then we assume that sales will significantly increase in half a year and we will generate high profit. Main part of expenses are production expenses: materials, labor costs of engineers; these expenses are covered by the price of greenhouse, so we do not need to sell a lot of items, even producing 2 greenhouses a month will give us some profit. In one year we are planning to increase sales and hire at least 4 more employees: 3 more managers and 1 more financial controller.

Bo Burlingham in his book describes ideas, which are extremely useful for my business. It is not needed to scale and expand to have a profitable and successful company. Usually extension of a business can lead to decreased quality of a product. Small and middle companies are mostly focused on customers and their needs (Burlingham, 2016). So, we are not going to focus on significantly increase the number of greenhouses produced. We are going to focus on customer needs and every expansion will not affect the quality of the product and attitude towards the client.

19.2 Break-Even Point Analysis

Break-Even point analysis shows how many smart greenhouses do we need to sell to cover all the expenses and generate zero profit.

BEP = Fixed Costs (Revenue per one greenhouse – Variable costs per one greenhouse)

= 370 000(1 700 000 – 1 410 440) = 370 000/289 560= 1,3 (See the table „Variable and Fixed Costs")

This analysis shows that selling one greenhouse is not enough to cover all the costs. We should produce in average 1,3 greenhouses a month to have 0 profit. 2 greenhouses a month will give us positive profit.

20 Cash Flow Statement

Cash Flow statement shows all the inflows and outflows from the business. At the beginning we invest 1 000 000 CZK to cover initial expenses and fixed expenses, all the variable expenses will be covered by the price of the greenhouse.

Cash Flow Statement is based on the realistic scenario. As you see, the closing balance in half a year is more than 3 million Czech korunas.

Cash Flow Statement

	January	February	March	April	May	June
Opening Balance	**0**	**690 560**	**868 947**	**1 275 877**	**1 678 807**	**2 546 825**
Cash Inflows	2700000	3400000	5 100 000	5 100 000	8 500 000	6 800 000
Capital investment	1000000					
Sales	1700000	3 400 000	5 100 000	5 100 000	8 500 000	6 800 000
Cash Outflows	2 009 440	3 200 880	4 598 320	4 602 320	7 427 200	6 011 760
Price for establishing LLC	9 000					
Office furnishing	50 000					
Factory equipment	150 000					
Total initial investments	209 000					
Costs of Goods Sold	1 072 440	2144880	3217320	3217320	5362200	4289760
Operating Expenses	728 000	1 056 000	1 381 000	1 385 000	2 065 000	1 722 000
Rental	110 000	110 000	110 000	110 000	110 000	110 000
Website	35 000	35 000	35 000	35 000	35 000	35 000
Wages and Salaries	493 000	811 000	1129000	1129000	1765000	1447000
Advertising expenses	63 000	51 000	44 000	47 000	49 000	48 000
Transportation	20 000	40 000	60 000	60 000	100 000	80 000
Other costs	7 000	9 000	3 000	4 000	6 000	2 000
Taxes	0	20 733	94 750	94 750	204 782	149 766
Net Cashflow/Closing balance	690 560	178 387	406 930	402 930	868 018	638 474
Closing balance	**690 560**	**868 947**	**1 275 877**	**1 678 807**	**2 546 825**	**3 185 299**

Source: Own creation

21 Conclusion

The aim of my bachelor thesis was to develop a business plan for smart greenhouse production. I described the product, showed the value which clients get, analyzed external and internal factors influencing the business, provided marketing mix and financial plan.

Theoretical part includes basic information about entrepreneurship, tools and analyses used in my work, brief overview of agricultural sector nowadays and implementation of Information Technology into agriculture.

All the key elements of the business plan are summarized in the Lean Canvas Model. I have described problems, which smart greenhouses help to solve, they are: high losses of harvest, need for space and workforce. Customer segment, which we will focus on, are middle-size and large agricultural companies. I picked out the value the customer gets based on the solutions of the problems. Physical/online sales channels and marketing ones are also described in the model. Revenue streams and costs are listed as well. Then advantage of my company was explained. Finally, I figured out that ARRR model will be used for checking progress.

The market is quite expensive to enter, to produce one greenhouse we need approximately 1,4 million Czech korunas. However, it means that there will be less potential competitors, which is beneficial for us. The main issue is to find customers, but considering the trend of implementing IT into all spheres we product to be interesting to the customers and the business to be successful.

Initial investments will be 1 000 000 CZK. I assume that in half a year our net profit will be approximately 2 330 000 CZK. So the closing balance will be three times higher than the initial investments

To sum up, I would like to say that Smart greenhouse production business can succeed on the European market and can generate profit.

22 Appendices

Appendix A – Smart Greenhouse Specifications

Item	Price	Quantity	Total amount
Equipment			
Greenhouse 20x10x5м	340 000,00 Kč	1	340 000,00 Kč
Batcher system "PRIVA"	45 000,00 Kč	2	90 000,00 Kč
metal-plastic tray 220x65x35мм. Length 4м.	950,00 Kč	80	76 000,00 Kč
Adjustable suspport TOP-002/600	2 500,00 Kč	40	100 000,00 Kč
Electric boiler Pro Term Ray 12K	19 000,00 Kč	1	19 000,00 Kč
Circulatio pump Grundfos UPS 32-80	6 000,00 Kč	1	6 000,00 Kč
Radiator	4 000,00 Kč	4	16 000,00 Kč
Temperature/humidity Sensor AM2302	185,00 Kč	12	2 220,00 Kč
Fan Maico EZG 30/4 B	23 500,00 Kč	4	94 000,00 Kč
Rod electric drive ST-450 N 180	3 200,00 Kč	6	19 200,00 Kč
LED-lamp DS-PROM 83	3 350,00 Kč	60	201 000,00 Kč
Illumination Sensor	110,00 Kč	2	220,00 Kč
Mini-server MITXPC Intel Xeon D-1518	15 000,00 Kč	1	15 000,00 Kč
Management software Smart Greenhouse	5 000,00 Kč	1	5 000,00 Kč
Wi-Fi router ASUS RT-AC1200	1 000,00 Kč	1	1 000,00 Kč
Relai Control Device CUWDb	11 000,00 Kč	1	11 000,00 Kč
Sensor Controller SC-01	4 500,00 Kč	1	4 500,00 Kč
Drive controller DCC-01	9 000,00 Kč	1	9 000,00 Kč
Materials			

Pipes, fittings for batcher systems	25 000,00 Kč	1	25 000,00 Kč
Pipes, fittings, heating systems cranes	10 000,00 Kč	1	10 000,00 Kč
Mounting kits for fans Maico	250,00 Kč	4	1 000,00 Kč
Mounting kit of a lamp DS-PROM 83	180,00 Kč	60	10 800,00 Kč
Power caple for illuminationand power supply	7 000,00 Kč	1	7 000,00 Kč
Low-current cable	4 000,00 Kč	1	4 000,00 Kč
telecommunication cabinet for Smart Greenhouseautomation system	2 000,00 Kč	1	2 000,00 Kč
Electrical cabinet, automatic devices for power supply, sockets	3 500,00 Kč	1	3 500,00 Kč
		Total	1 072 440,00 Kč

Labor costs			
Greenhouse installation	150 000,00 Kč	1	150 000,00 Kč
Hydroponic system installation	75 000,00 Kč	1	75 000,00 Kč
Heating system installation	18 000,00 Kč	1	18 000,00 Kč
Ventilation system installation	15 000,00 Kč	1	15 000,00 Kč
Works on electrical installation and installation of lighting	35 000,00 Kč	1	35 000,00 Kč
Installation and adjustment of the Smart Greenhouse automation system	25 000,00 Kč	1	25 000,00 Kč
	Total works		318 000,00 Kč
	Total costs for production		**1 390 440,00 Kč**

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