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Faculty of Economics and Management

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Diploma Thesis

**Develop a business plan for agricultural company focusing on
vertical agricultural technology**

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DIPLOMA THESIS ASSIGNMENT

Carlos López Guirado Pérez

Economics Policy and Administration
Business Administration

Thesis title

Business Plan for agricultural company focusing on vertical agricultural technology

Objectives of thesis

The aim of the thesis is to develop a business plan for agricultural company focusing vertical agricultural technology.

Methodology

The theoretical part of the thesis provides a critical review of current literature on the selected topic.

Based on theoretical knowledge the business plan to launch the agribusiness focusing on the vertical technology is design. The business plan consists of analytical part with the focus on situational analysis and design part with recommendations regarding the appropriate business model and functional plans for the business.

The proposed extent of the thesis

60 – 80 pages excluding appendices

Keywords

business plan, business model, situational analysis, vertical agriculture technology

Recommended information sources

FORD, Brian R, Jay BORNSTEIN and Patrick T. PRUITT. The Ernst & Young business plan guide. Hoboken, N.J.: John Wiley & Sons, 2007
GALAI, Dan, Lior HILLEL and Daphna WIENER. How to create a successful business plan: for entrepreneurs, scientists, managers, and students. New Jersey: World Scientific, 2016
MALHOTRA, Naresh K. Marketing research: an applied orientation. Boston: Pearson, 2010.
RICKMAN Cheryl The Digital Business Start-Up Workbook: The Ultimate Step-by-step Guide to Succeeding Online from Start-Up to Exit. n/a: John Wiley&Sons, Incorporated, 2012.

Expected date of thesis defence

2020/21 SS – FEM

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Declaration

I declare that I have worked on my diploma thesis titled “Develop a business plan for agricultural company focusing vertical agricultural technology” by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 30.03.2021

Carlos López-Guirado Pérez

Acknowledgement

I would like to express my sincerer gratitude to my supervisor Ing. Ivana Tichá Ph.D. for his support and patience during my work on the diploma thesis.

Secondly, I would also like to thank my gratitude all my family and friends for providing me with support and continuous encouragement throughout years of my study and throughout the process of researching and writing this thesis. This would not have been possible without them.

Develop a business plan for agricultural company focusing vertical agricultural technology

Abstrakt

This diploma thesis is connected with a creating the first Spanish agricultural company focusing vertical agriculture technology based in Madrid. The company will sale a high quality of fresh tomato. The first part of this thesis- theoretical part, is literature review of basic business concepts, an introduction what is this new technology and how is working. The second part- practical part, includes the relevant points why this technology will be change our farming methods, a summary of the organization, the objectives, vision and mission of the company and how the company will work. The second part of the practical includes the market analysis (performed through competitor analysis, supplier analysis, Spanish tomato market in Spain and global vertical farming analysis), SWOT analysis, Segmentation and the operation plan.

Finally, the financial plan is providing a relevant information for the company, including the initial costs, the balance sheet and income statement.

Key words: vertical farming, Hydroponic system, business plan, financial plan, agriculture, rose tomato, urban farm,

Vypracovat obchodní plán pro zemědělskou společnost se zaměřením na vertikální zemědělskou technologii

Abstract

Tato diplomová práce souvisí s vytvořením první španělské zemědělské společnosti se zaměřením na vertikální zemědělskou technologii se sídlem v Madridu. Společnost bude prodávat vysoce kvalitní čerstvé rajče. První část této práce - teoretická část, je literární rešerše základních obchodních konceptů, úvod, co je tato nová technologie a jak funguje. Druhá část - praktická část obsahuje relevantní body, proč tato technologie změní naše zemědělské metody, shrnutí organizace, cíle, vize a poslání společnosti a způsob, jakým bude společnost fungovat. Druhá část praktické části zahrnuje analýzu trhu (provedenou pomocí analýzy konkurence, analýzy dodavatelů, španělského trhu s rajčaty ve Španělsku a globální vertikální analýzy zemědělství), SWOT analýzy, segmentace a operačního plánu.

Nakonec finanční plán poskytuje společnosti relevantní informace, včetně počátečních nákladů, rozvahy a výkazu zisku a ztráty.

Klíčová slova: vertikální zemědělství, hydroponický systém, obchodní plán, finanční plán, zemědělství, rajčata, městská farma,

Table of content

1. Introduction	13
2. Goals and Methodology	14
2.1. Goals	14
2.2 Methodology	14
3. Literature Review	15
3.1 Definition of Business plan	15
3.2 Structure of Business plan	15
3.3 Market research and Industry analysis	17
3.4. SWOT Analysis	17
3.5 Segmentation	18
3.6. Financial Plan	19
3.7. Need for vertical farming	20
3.7.1. Current situation of the Agriculture pollution.	20
3.7.2 Demographic for the future	22
3.7.3. Explaining the solution	23
3.8. Vertical Farming	24
3.8.1 Introduction	24
3.10.2 Types of vertical Farms	25
3.8.3 Type of structure of vertical farming	29
3.9. Characteristic of the rose tomato	31
4. Practical Part	32
4.1. Summary of the organization	32
4.1.1. Description of the organization	32
4.1.2. Legal form and name	32
4.1.3. Product	32
4.1.4. Location	33
4.1.5. Objectives, mission and vision	35
4.2. How the factory will work	36
4.3 Analysis of current market situation	38
4.3.1. Short Global Analysis of the Vertical indoor economy	38
4.3.2. Tomato agriculture in Spain	38
4.3.3. Consumption of Vegetables in Spain 2020	41
4.3.4. Competitor Analysis	42
4.3.5. Analysis of Supplier.	43
4.4. SWOT Analysis	45

4.5. Segmentation	47
4.6. Operations Plan	50
4.6.1. Personal plan	50
4.6.2. Project schedule	51
4.7. Financial Plan	53
4.7.1. Initial costs	53
4.7.2. Sales Forecast	55
4.7.3. Income statement	56
4.7.4. Internal Rate of Return	58
5. Summary and Discussion	59
6. Conclusion	60
7. References	61
8. Appendix:	64
8.1. Appendix A: Truck photos	64
8.2. Appendix B:	65
8.3. Appendix C: Spanish map and division	66

List of Images

Image 1. The main on-farm Agricultural greenhouse gas emission.....	21
Image 2. Population expected in the world	22
Image 3. Aeroponics system.....	25
Image 4 Wick System.....	26
Image 5. Water Culture System.....	26
Image 6. Ebb and Flow System	27
Image 7. Drip System	27
Image 8. Nutrient Film Technology System	28
Image 9. Aquaponics System	29
Image 10. Vertical farming factory	29
Image 11. Container outside view	30
Image 12. Container inside view	30
Image 13. Lycopersicum esculentum (rose tomato).....	32
Image 14. Location of the Company	34
Image 15. Distribution of the farming factory per level.....	36
Image 16. Evolution of the national tomato production in Spain.....	39
Image 17. Map of Spain representing the production of fresh tomato by province in 2019	41
Image 18. Vertical L-G company structure	51
Image 19: Trucks	64
Image 20. Mobile scaffold in mechanical scissors	65
Image 21. Autonomous communities map in Spain.....	66
Image 22. Provinces map of Spain	67
Image 23. Trip by car Murcia to Madrid	67
Image 24. Trip by car Sevilla to Madrid	68

List of tables

Table 1: Ground and production of fresh tomato per Autonomic Community in 2019	40
Table 2: Ground and production of fresh tomato per province in Spain 2019.....	40
Table 3 Analysis of the Potential customer.....	48
Table 4: Salaries expensive.....	54
Table 5 : Initial investment.....	54
Table 6: Expense until setting up	55
Table 7: Amortization value of the company	55
Table 8: Sales Forecast.....	56
Table 9 Income statement of the company for the next 6 years.....	57
Table 10 Calculation of the IRR	58
Table 11 Value Of the IRR	58

List of abbreviations

CEA - Controlled Environment Agriculture

US – United States

S.L. – Sociedad Limitada (Limited Company in Spanish)

CEO – Chief Executive Officer

R&D – Research and Development

SMEs – Small and Medium Enterprise

SWOT - Strengths, Weakness, Opportunities and Threats

B2B – Business to Business

B2C – Business to Customers

LED – Light Emitting Diode

PF - Plan Factory

CPPS - Closed Plant Production System

NASA - National Aeronautical and Space Administration

t- tons

Ha- hectare

t/ha- tons per hectare

CASI - Cooperativa Agrícola San Isidro

NGS - New Growing System

IRR – Internal Rate Of Return

1. Introduction

This paper contains a business plan for the first Spanish agricultural company focusing on vertical indoor agriculture. In point, 2. Of this project, I will explain in more detail about this future company (how it will work, what product will be produced, where it will be produce...).

Let us start with some brief background information on vertical agriculture and what it is. The term vertical farming was coined by Gilbert Ellis Bailey an American Geologist in 1915. In 1999, at New York's Columbia University, professor Dickson Despommier, along with his students, popularized the modern idea of vertical Farming. (Lawson, 2018)

This concept began to be used when one day in class professor Dickson Despommier asked his students what they would like the world to look like in 2040 when there will be over 90 billion mouths to feed. Then the students were sharing ideas about farming on the rooftops within Manhattan and see, how many people they could feed. Suddenly they discovered that this good idea wasn't enough for feeding this city. Then Dickson said to them "I took your good idea and made it a better idea by moving a rooftop garden in the building itself" and voilà. (dok, 2017).

Vertical farming doesn't just consist of producing food along a light frame of bars of wood or metal crossed over each other, attached to a wall for plants to grow up. It is the practice of agricultural framework that can be orchestrated vertically to create substantially more food per hectare of land than traditional farms. These types of farms use Controlled Environment Agriculture (CEA) that usually have closed atmospheric systems with hydroponic nutrient and artificial lighting systems. (Lawson, 2018)

The idea of farming in huge buildings instead of farming in fields could be considered unnatural by the society. To this, I answer that we have to start by saying that farming is not natural, we are the only conscious species that destroy ecosystems in favour of food production. Is the farming of 283.000 hectares of almond trees in California natural? Considering that, this type of tree originates in Central Asia not the US. (Almonds, 2020). We consider natural what is farm in the field with the Sun's rays, but let me say that plants don't need the sun, they need spectrum and they don't need soil they need nutrients and micronutrients. This point I will discuss more deeply in this paper.

2. Goals and Methodology

2.1. Goals

The main goal of this thesis is to create a business plan for the first Spanish agricultural company focusing on vertical indoor farming, operating in the Community of Madrid, founded by a private person form of Limited Company, Spanish abbreviation S.A. In addition, the thesis explains how this new type of agriculture works and its applications and benefits, as well as exposing that niche business.

This business plan should explain the nature of the business, the strategy plan, the functional plan, advantages and disadvantages and estimating future expenses and benefits. Based on the information provided, we should see whether this business idea is viable or not.

2.2 Methodology

Data for theoretical part section were gathered from a variety of sources, including literature and internet web pages, using inductive, deductive and extraction methods.

With regard to practical part, the methodology was to conduct a thorough analysis of the tomatoes market in Spain, analysis of potential customer, competition analysis and SWOT analysis.

Data from the National Statistical Institute of Spain and Ministry of Agriculture, Fishing and Feeding of Spain were processed into spreadsheets.

Based on the results of these analyses the financial plan were compiled. The financial plan was elaborated from calculation the initial costs, salaries, sales forecast, income statement and Internal Rate of Return.

3. Literature Review

3.1 Definition of Business plan

A business plan is a document that describes in detail the financial, marketing and operational missions of the business; also, it includes the objectives and how these goals are going to be achieved. (Hayes, 2020)

Business plans are important documents used to attract investment before a company has established a proven record of accomplishment. It is very important that this document be clear, simple and include the proper data. (Hayes, 2020)

It is essential for start-up companies as well as for developing current businesses having a strong business plan. It helps to understand their current challenges, situation and establish the goals and mission. For start-up companies it is crucial to have a correctly identified business plan that will cover the current vision of the company, goals and expectations, marketing management plan, strong financial analysis that will be convenient for the external investor to invest. (Ries, 2011)

3.2 Structure of Business plan

Executive Summary

An executive summary is the overview of your entire business plan and should succinctly highlight the most important parts of the plan. It consists of a general view of the business model, financial, operational, marketing and management plans.

According to Ross Kimbarovsky, CEO and founder of CrowdSpring, "The executive summary of a business plan is designed to capture the reader's attention and briefly explain your business, the problem you are solving, the target audience and key financial information". Although this document must be quick and easy to read for it to be engaging and comprehensive. (Schooley, 2020)

Company description

It is a brief description of the business background and business idea. Anyone who reads this point should get a clear idea of what the business does. Then this point should include a brief history, overview of customers, summary of goals and summary of the process.

Products or services

This section should include what do you offer and how it will benefit your client and its use. At this point in the Business Plan should include a description of the product or services, details about life cycle, intellectual property, advantage or disadvantage, a comparison in relation of the competitor's product and the R&D activities that are in process or have an idea to work.

Location

The location of the business and the characteristic of the space in which it is installed, be it a commercial premises office or warehouse , can play a determining role in the competitive position and the chances of success of many freelancers or SMEs. In the case of the vertical indoor agriculture, it will be one of the more important advantage characteristic.

Other factors must be analyse for consider which it is the best location for the business:

Proximity, attractiveness and ease for customers: it must be analyse in which area of population it is convenient for the company be locate. For example if you are a large supermarket and your client are families who make great purchases with the car and the area where you want to realize the business idea doesn't have space for a parking then you need change your location.

Presence of the competition: It is important that there is no competitor in the area of influence but on occasions, the sum of competitor benefits everyone since this is how a pole of attraction is former for customer all over the city.

Proximity to suppliers & Communications: It can help reduce several transport cots and be essential for the operation of the business, access to large infrastructures (ports, airports, rail lines and roads) and use raw materials in better conditions.

3.3 Market research and Industry analysis

It is the most useful tool for business strategies, used for identify competitors and analyse generally industry. This analysis involves identifying the overall economic, political and legal and market factors that may influence the way the industry develops. (N. Greco, Milliot, & Wharton, 2014).

“Market research is a systematic, objective collection and analysis of data about a particular target market, competition, and/or environment. It always incorporates some form of data collection whether it is secondary research or primary research which is collected directly from the respondent” (Arora & Mahankale, 2013).

Any market research project’s goal is to identify and assess how changing elements of the marketing mix will affect customer behaviour. Market research can be defined as the process of providing basic information to a business (or any organization that deals with the public). Market research data is required to make a wide range of marketing and operational decisions (Morden, 1991).

3.4. SWOT Analysis

SWOT analysis is a tooling used to produce an internal and external analysis of the company, with this analysis the companies can know theirs’s strengths, weaknesses, opportunities and threats. Conducting SWOT analysis helps the companies to be ensured about their strength and opportunities and to solve the problems related to weaknesses and threats (Snelling , 2012).

Conducting a SWOT analysis for a business forces the entrepreneur to think about the business in a completely different way. The main goal of the SWOT analysis is to develop a strong business strategy based on the company’s strengths and weaknesses as well as the market threats and opportunities.

The SWOT analysis consists of two parts:

Internal Analysis: Tries to identify the current strategy and the position of the company against the competition. The resources and abilities of the company must be evaluated, with special attention to the detection and elimination of weak points and enhancement of strong points, as well as the resistance capacity of the company itself, that is, its strength in the event that the strategic formulation fails.

External Analysis: Involves determining the strategic factors of the environment in order to detect potential threats and opportunities for the company. Thus, current competitors, their market share, possible future competitors, technological development, information and communication systems, substitute products, etc will be significant of study.

The internal analysis divided in two parts:

The strengths are factors internal to the organization or partnership that can be especially important for the campaign, such as human and material resources, access to government officials or decision makers a good reputation.

The weaknesses are factors internal that may limit the ability of the company, such as inexperience, limited funds, lack of relevant contacts and capacity deficiency.

The external analysis consists of two parts:

The opportunities are factors external as aspects of society or community that have the potential to support the organization or that can be used for take advantage against their competitors.

The threats are factors external, factors that are not under their direct control, which can negatively affect the business operation and hinder the achievement of its objectives and goals, such as security issues, a change of government, climate, a social environment hostile or national crisis.

3.5 Segmentation

Segmentation is defined as defining targeted customers and dividing the entire market into clearly identifiable segments, which are groups of people who have similar needs, wants, requirements and demands. Making proper segmentation is critical for the company's success in operating for a specific group of people (Hart, 2008).

A target market is a specific group of potential customers who are willing, need and want to purchase a company's product or service. Understanding the size of a specific customer segment will assist the company in identifying and forecasting its sales. It is critical to determine the size of the segment in order to forecast the business's profitability (Torkko, 2000).

In this case, utility Analysis has been used as a tool to know what the potential customers can be for the company. This analysis consists of subjecting certain criteria, chosen

specifically by sector, product or service, to customers. Each criteria will have a percentage of weight to make the final decision. When finalizing the analysis each customer will have a final note, the note number depends on so many criteria have been chosen for the analysis, that is, If five criteria have been selected the note will vary from 1 to 5. Finally, the customers with the most note will be the potential customer. This tool is easier and reliable for used.

Four basic factors that affect market segmentation are;

- Demographic segmentation focuses who are the customers. For example in B2B the company try to know the age, gender, income, location, family situation, annual income, education... or in B2C the company size, the industry is operated and Job function.
- Psychographic segmentation focuses their personalities and characteristics. For example; personality traits, values, attitudes, interest, lifestyles, psychological influences, priorities and motivations.
- Behavioural segmentation focuses on how the customers acts. For example, understand the Purchasing habits, spending habits, user status or brand interactions.
- Geographic segmentation focuses where the customer live. For example; ZIP code, city, country, radius around a certain location, climate, urban or rural.

3.6. Financial Plan

Financial planning is a vital part of a business plan or company. This section shows how the business plan is going to finance so that the idea can be carried out. Companies perform financial calculations, forecasts and assumptions in order to attract investor or obtain bank loans. In order to be simply successful, they must conduct a financial analysis of their business plan (Torkko, 2000).

In addition, the financial part should cover the next 3 years. Meantime the first year is the crucial year, and then it should include initial costs, financing calculation, costs and revenues.

The Financial planning should have an Income statement and sales forecast.

- **Sales Forecasting:** It is the process of future sale, taking into account the environmental conditions. It is performed based on the analysis of trends, trying to deduce to what extent the historical billing data will influence the future, and the analysis of other influencing factors: environmental factors, sector evolution, sales potential of the company, quality and price of the product or service, competitor analysis. Etc.
- **Income statement:** is a financial statement that shows the company's income and expenditures. It also shows if a company is making profit or loss for a given period. The income statement helps companies understand the financial health of their business.

Profit and loss statement assist business owners in determining whether they can generate by increasing revenues, by decreasing costs or both. It also demonstrates the effectiveness of the strategies established by the company at the start of a fiscal period. This document can be used to determine if the strategies have paid off. Based on this analysis, the owners of the business can come up with best solutions for make more profitable.

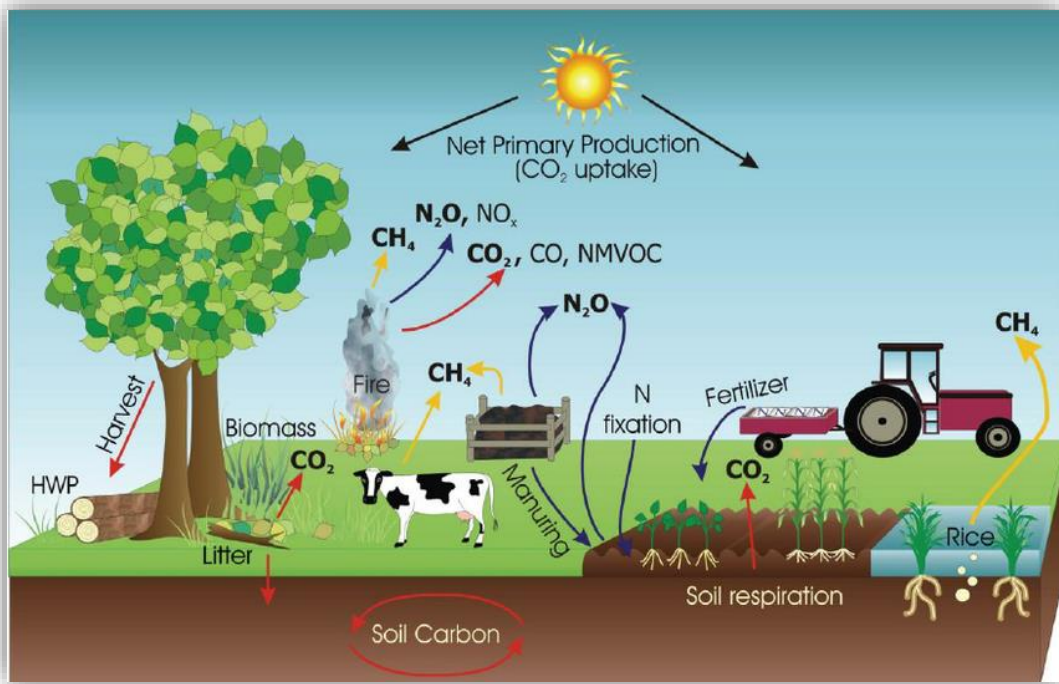
3.7. Need for vertical farming

3.7.1. Current situation of the Agriculture pollution.

The current model of agricultural production and distribution has a serious impact on people's lives and on our environment. Abuse of pesticides and chemical fertilizers are killing the organic nutrients in the field, monocultures, deforestation, land grabbing or depopulation of rural are just some of the decisive problems that affect us greatly.

Before reaching to our table, the food we consume has been produced stored, processed, packaged, transported, prepared and served. In each of these phases greenhouse gases are released into the atmosphere. Agriculture in particular, emits significant amounts of methane and nitrous oxide, two powerful greenhouse gases. Nitrous oxide emissions are an indirect product of organic and mineral nitrogen fertilizers. The climate change is becoming a real problem and it is being accelerated with these emitted greenhouses gases.

Image 1. The main on-farm Agricultural greenhouse gas emission



Source: https://www.researchgate.net/figure/The-main-on-farm-agricultural-greenhouse-gas-emission-sources-removals-and-processes-in_fig1_281439963

Climate change is hampering traditional agriculture with more torrential rains, long droughts, flooding's causing crop destruction and ruin for the farmers. Consequently, the three main factors on which the crop depend upon are affected by the increase of temperature on earth in these ways.

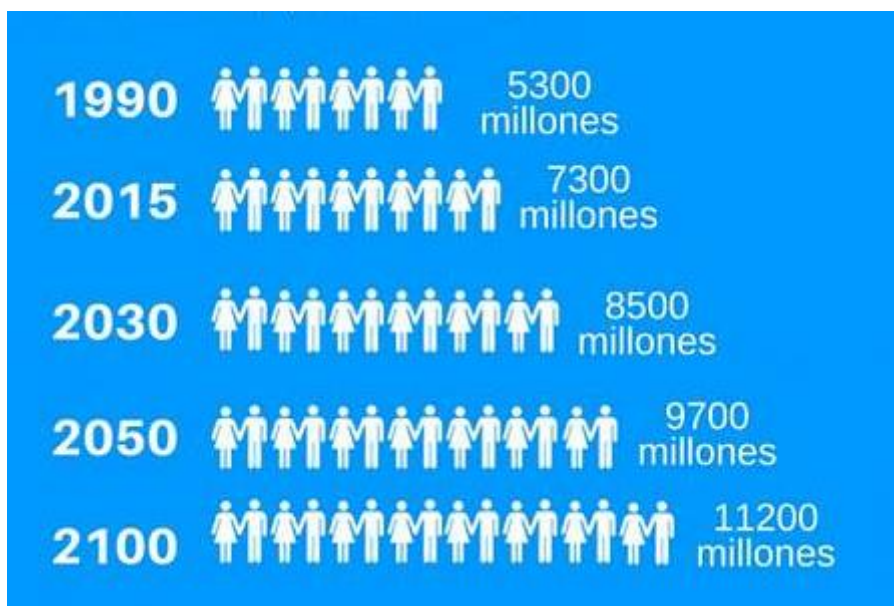
- The loss of fresh water sources
- Desertification
- Soil degradation

Technology in the agricultural sector is advancing but not enough to be able to face the future problems, such as feeding 9.700 million people which is expected in 2050. To do this we will have to increase our yields per hectare, be efficient with water expenditure, replace pesticides, faces pets without chemical products and increase the production without deforesting the forest.

3.7.2 Demographic for the future

As mentioned in the previous section, the expected population for 2050 will be 9,700 million. The challenge the world faces is not easy, If there are already millions of people dying of hunger today, how are we going to feed 32% more of today's population?. It should be added that there are the different solutions that are applied should to help the environmental recovery of this planet but it still complicates more than the current situation.

Image 2. Population expected in the world



Source: <https://www.rtve.es/noticias/20190617/poblacion-mundial-llegara-9700-millones-personas-2050-pese-crecimiento-mas-lento/1958520.shtml>

Another problem to add to this lot is that urbanization will continue to grow at an accelerated rate of 70% of the population (currently this figure is around 49%). The possible problems will be affront can be:

- Intensive growth in cities can lead to more poverty and prevent local governments from providing services to all people equally.
- High level of pollution with a noticeable impact on human health.
- Urban development can magnify the risk of environmental disasters

- Poor air and water quality, water scarcity, water waste problems and high energy consumption
- Wildlife will be harmed by large quantities of toxic substances, habitat loss and food sources.
- Loss of biodiversity.

To feed this larger, urban and richer population, food production (excluding foods used in biofuel production) should increase by 70%. For example; Annual cereal production will have to increase from 2.1 billion tonnes today to 3 billion tonnes; annual meat production should increase by more than 200 million tonnes to 470 million tonnes.

Clearly this can be achieved if governments and companies make the necessary investments and policies are implemented that favour agricultural production and respecting the environment.

3.7.3. Explaining the solution

One of the solutions that are proposed to solve the great problem that concerns us all is urban vertical agricultures. The urban farms means growing plants and vegetables with hydroponics system in vacant areas inside the cities for example in underground boxes, on rooftops, in closed greenhouses or industries buildings. The main goal is to bring near the product from the farms to the consumption point, saving transport costs, producing fewer polluting vegetables, healthier and no longer breaking mountain terrain for farming. The key to success in this technology is that the human controls all aspects of the plant's growth, facing fewer problems that the traditional agriculture is enduring. For example;

- Atmospheric conditions
- Soil problems
- Insect infestation
- Crop diseases

This hydroponic indoor system is being able to grow fresh vegetables totally free of pesticides and with the best quality. It is a wonderfully amazing technology with the following characteristics;

- This technology is able to save up to 95% of the water used to grow a vegetable.
- it also managers to carry out 3 or 4 life cycles of a product at the same time as compared to a one cycle which is currently achieved thanks to the LED light.

- Increased production yields by three per m².

Although this technology has many benefits, there are some has limitations and disadvantages. For example;

- The biggest limitation is that this system is not suitable for all types of plants and it cannot be used to grow fruit trees or large trees for now.
- The initial costs of the business plan are high.
- Lack of knowledge in the sector

Clearly this does not mean that we can render this type of farming useless and resort to traditional agriculture methods. A simpler solution can be using these two types of agriculture as complementary. An idealistic plan would be to cultivate the vegetables and plants that can be achieved with this technology in the cities and leave that land to grow another crop or let it repopulate with the forest.

3.8. Vertical Farming

3.8.1 Introduction

Vertical Farming originally defined as a practise of cultivating crops vertically and it can be applied outdoors and indoors. However, the modern idea of vertical farming utilizes Controlled Environment Agriculture (CEA), which can be achieved in closed indoor systems. In the scientific literature this type of systems are called Plan Factory (PF) and Closed Plant Production System (CPPS) to divided closed production system from other category of systems. (Tuomisto, 2018)

This type of farming is an innovate direction in the technological development of protected ground because with worldwide population growth, the demand for more food and more land to grow food is ever increasing. It is relevance is due the need to save energy, nutrient substrate and water in conditions of the growing sustainable conditions. The Characteristic of this technology from farming methods is significantly reduced the consumption of energy and water, and less space is used. (I Balashova, S Sirota, & Ye Pinchuk, 2019)

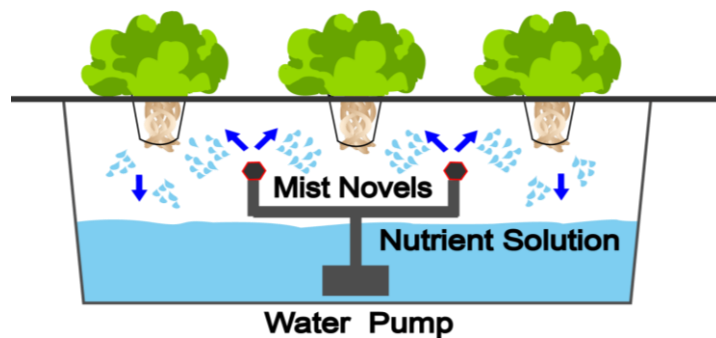
3.10.2 Types of vertical Farms

Vertical Farms come in various shapes and sizes, from simple two-level or divided mounted frameworks to large stockrooms a few stories tall. However, all vertical farms use one of three soil-free systems for providing all the nutrients that plants need. The following data describes the three growing systems.

- 1- **Aeroponics**. This innovative indoor growing technique was developing and invented from The National Aeronautical and Space Administration (NASA) on 1998. NASA was interested in finding efficient ways to grow plants in space, because transporting food to spacecraft comes at very high cost. It is defined as growing plants in an air/mist environment with no soil and very little water. This system is the most efficient plant-growing system for vertical farms, using up to 90% less water than rest of the systems. The plants have also been grown with more mineral and vitamins, making the plants healthier and potentially more nutritious (Birkby, 2016).

In the figure 1 we can appreciate how this systems is working in a simple way.

Image 3. Aeroponics system



Source: <https://www.nosoilsolutions.com/aeroponics/>

- 2- **Hydroponics**: The most common growing system in vertical agriculture, this system consists farming plants in nutrient solutions that are free of soil. The plant roots are immerse in the nutrient, which is habitually monitored and circulated to ensure the right chemical composition is maintained. (Birkby, 2016)
They are five main type of hydroponic system; bellow I will briefly describe each of them.

- **Wick System:** It is easily the simplest type system; it is notable for not using pumps, electricity or aerators. This system consist in put the nylon wicks around the plants before being sent straight down into the nutrient solution then the plants are placed directly within absorbent substance like perlite or vermiculite. (Sensorex, 2020).

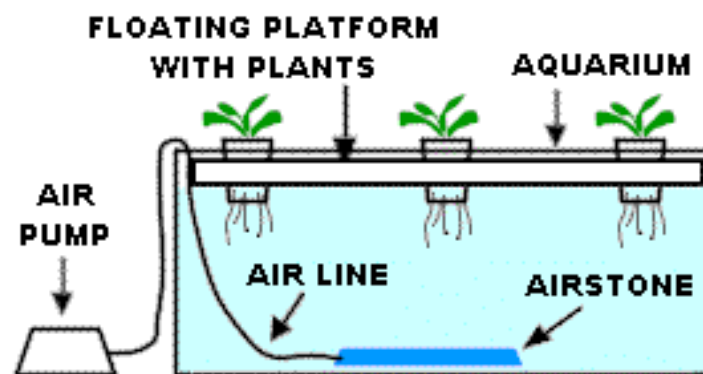
Image 4. Wick System



Source: <https://smartgardenguide.com/what-is-wick-system-hydroponics/>

- **Water Culture system:** The roots of the plant is submerged directly into nutrient solution, that is mean the oxygen and nutrients that the plant need for survive is sent into the water by diffuser or air stone. With this systems the nutrients can be easily absorbed by the plants. (Sensorex, 2020)

Image 5. Water Culture System



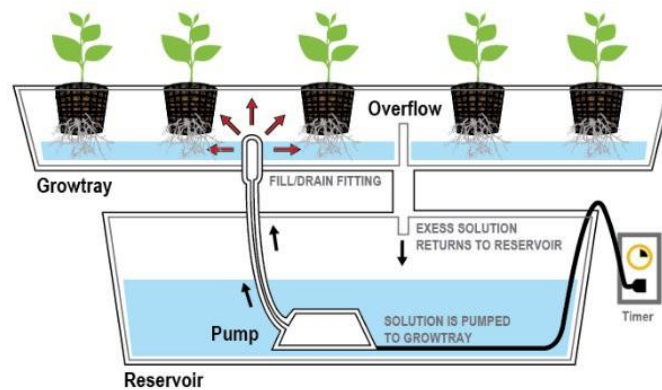
Source: <https://www.simplyhydro.com/free2/>

- **Ebb and Flow (Flood and Drain):** This system involves the periodic flooding and draining of the nutrient solutions. There are two phases; the

Flood is when the water with the nutrients flow to the growing plant's bed where the roots will absorb the nutrients. The drain is when the water drains back to reservoir.

The system is fully motorized by a pump and timer and can be programmed to fit the needs of the plant in question. (Max, 2021)

Image 6. Ebb and Flow System

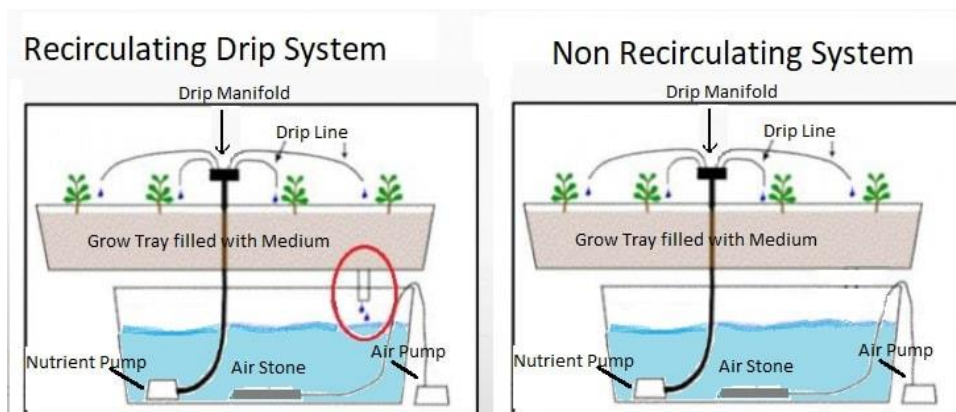


Source: <https://medium.com/@HydroponicsName/flood-and-drain-bfe5fd1dc4c5>

➤ **Drip systems:** It is very similar that the previous system but the different is the nutrient solutions is pumped into a tube, by a drip system that sends the solution directly to the plant base. This system can be from small or large production.

In addition, the system can be circulating or non-circulating. The circulating system will send back the extra nutrients into the solution tank; on the contrary, non-circulating system will not do this function. Both system can be adjust to meet the needs of each individual plants.

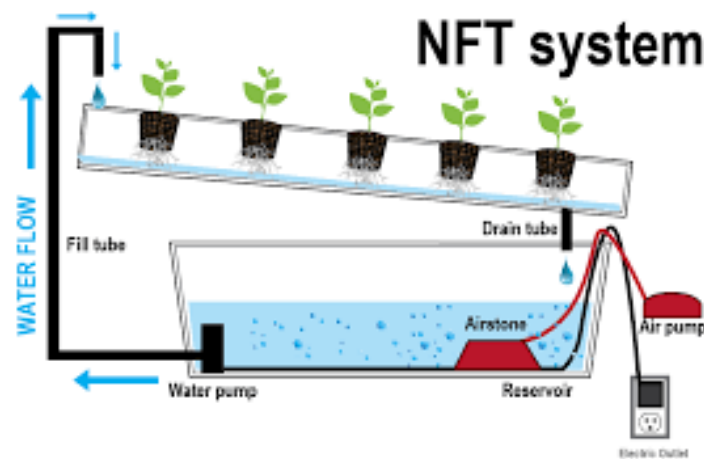
Image 7. Drip System



Source: <https://luv2garden.com/hydroponic-drip-systems.html>

- **N.F.T. (Nutrient Film Technology):** This system is almost similar that the Edd and Flow but the different is the nutrient solution is continuously flowing over the roots. The system uses a pump to send fertilized water to the grow tray as like in the other system but in this one the grow bed is placed at an angle to allow the solution to flow down and back again to the tank, and a new solution is pumping again. (D'Anna, 2019)

Image 8. Nutrient Film Technology System

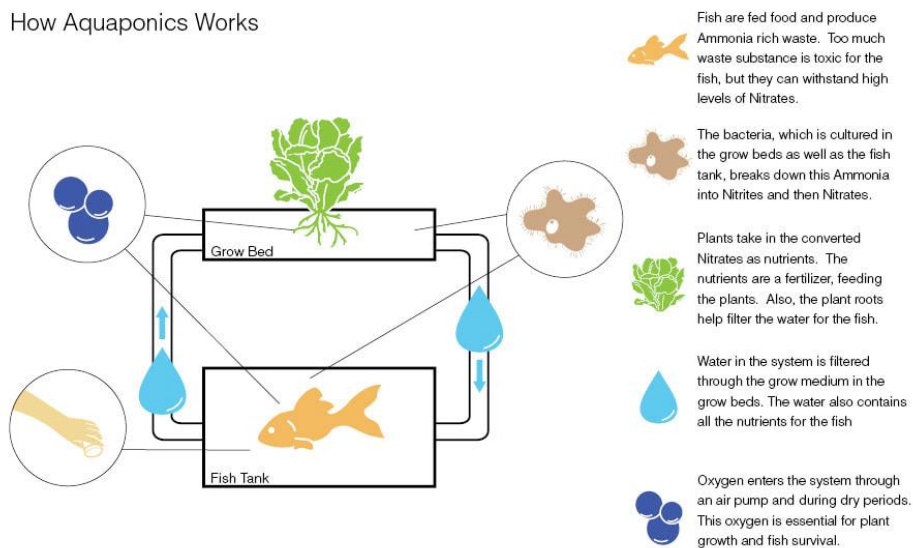


Source: <https://medium.com/@HydroponicsName/nutrient-film-technique-ebd1f7e5676c>

- 3- **Aquaponics;** This system take the Hydroponic systems one-step further, is a combination of plants and fish in the same ecosystem. Fish are growing in an aquarium, producing nutrient-rich waste that is used as feed for the plants. In return, the plants filter and purify this water, which is recycled to the fishponds. The aquarium is working in the same way like the nutrient-solution tanks in the previous systems. (Birkby, 2016)

Image 9. Aquaponics System

How Aquaponics Works



Source: <https://www.fiverr.com/malekalmsri/create-a-special-3d-aquaponic-system>

3.8.3 Type of structure of vertical farming

The vertical systems can be farming in different structure; it can be classified in two main types:

- **Building-based vertical farms:** the activity takes place in buildings or industrial buildings normally near to the points of sales; they also tend to take advantage of central and abandoned buildings.

Image 10. Vertical farming factory



Source: <https://medium.com/@jzipdamonsta/food-for-thought-is-vertical-farming-an-ethical-way-to-feed-the-world-f729530fb671>

- **Shipping-container vertical farms:** these types of structure the activity is taking in containers. Normally is using in service carrying goods around cities. There are equipment with LED lights, drip-irrigation systems, and stacked shelves, all the system is managed with computer-controlled which can be use from smart phone or laptop.

Image 11. Container outside view



Source: <https://growcer.com/why-we-dont-use-containers-on-our-farm/>

Image 12. Container inside view



Source: <https://puregreensaz.com/vertical-farming-costs/>

3.9. Characteristic of the rose tomato

The rose tomato is considered a high quality tomato. It is a variety of tomato that is grown in different areas of Spain, although the most famous one is from Barbastro, a town in the Sierra de Aragón. It is a peculiar tomato for various reasons. The most recognizable is in its size, each unit weighs, on average, 500 grams, although it can weigh more than 1 kilo for example; rose tomato from Lietor (a village in the Sierra del Segura, Albacete) the weigh per unit is around 800-1.200 grams. Another characteristic is its colour, soft red, pink or rose, much paler than the intense red of other tomato varieties. In addition, it has an irregular shape and very delicate and very fine skin. Often this variety of tomato have scars on the surface due precisely to that delicacy of their skin.

The size and shapes is, without a doubt, the first thing that the eyes catches from the consumers. There are those who think that this variety is a "ugly fruit" because it is an irregular and scarred tomato. The consumers get used to see a perfect-orbed red tomato in the supermarkets and seeing how a natural tomato really is becomes rare for society in our days. The value of the rose tomato is in its texture and flavour; that it is mean; the value is in its organoleptic qualities. It is easy to cut, it is soft on the palate, it has lowly level of acidity, and it has an intense taste and an enveloping aroma that emerges as soon as we cut it and reminds us of traditional tomatoes.

In addition, this tomato has nutritional properties that beneficial for health, for example;

- It is rich in Beta-carotene, vitamin A precursor.
- It gives us potassium.
- It contains vitamin C.
- It is very low in carbohydrates and calories. An average rose tomato, 500 grams, has only 77 calories.

4. Practical Part

4.1. Summary of the organization

4.1.1. Description of the organization

This organization will be the first Spanish agriculture company focus on vertical farming technology. This Company will sell a fresh and ripe tomato of high quality, freshly harvested, pesticide and chemical-free and grown intelligently and efficiently. To obtain this level of product quality a hydroponic system and LED lights will be used for the growth and maintenance of plants. The company will be located in an industrial ship in the community of Madrid, being able to easily and freshly delivery the product.

4.1.2. Legal form and name

The legal form of the business will be Limited Company and a private person will found it. The name of the business is *Vertical L-G S.L.*

4.1.3. Product

The area of cultivation will be 4500 m² so it will take the tomato that produces the most kilos per m² and is good of quality. The select products is *Lycopersicum esculentum* (rose tomato) from Solanaceae family. The product will sale fresh without any type of chemical products to the supermarket by Hydroponics technology. The added value is the product will be fully matured and fresh, and by the time it is collected, packaged and delivered in the supermarket it would have been 3 hour maximum. In addition, the final consumer will taste the product will all the plant properties.

Image 13. *Lycopersicum esculentum* (rose tomato)



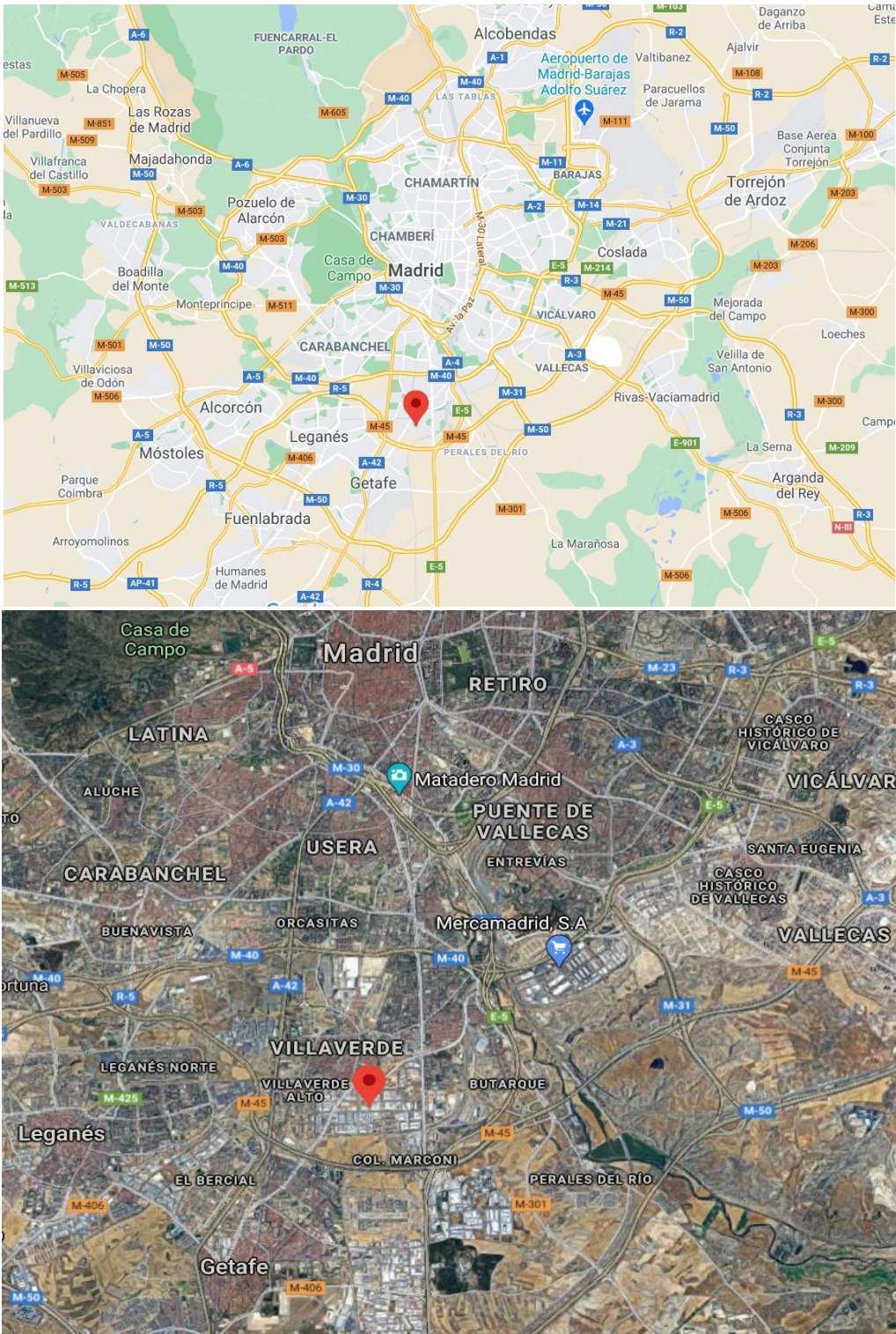
Source: <https://frutasferrer.es/producto/verduras/tomates/tomate-rosa-de-barbastro/>

4.1.4. Location

The company will be located in the Community of Madrid, for be more exactly in Villaverde between Madrid and Getafe, Street: Calle de la Resina N° 31, Madrid. The main reasons of this choice are:

- The high demand for agriculture products and the approach of the product to the final consumer and save costs.
- The low supply of farming companies in the Community of Madrid, because the community, territorially speaking, is small and has no space for agriculture. It is a building land community.
- In this area of Madrid, the Industrial estate is cheaper than other parts of the city and it located only an 8 km from the centre.
- The area has good road connexion, near to M-30, M-40, A-42, A-3. It is a very good location for delivery the product and easy to access for our future customer.
- The infrastructure has 4.500 m² & 8 metres high for the farming factory and another 300 m² for offices.

Image 14. Location of the Company



Source: Google Maps, my own research

4.1.5. Objectives, mission and vision

Objectives:

- The principle objective is to raise Spanish society`s awareness that we need to gradually change the way we farming to have a more sustainable planet for the next generation.
- The company must be a national reference from using this type of technology and be the leader of the market.
- Getting the final consumer to relate our brand as a good action for the ecosystem. When they buy our products, they should feel like they are helping this planet to me more efficient and green.
- After 3-4 years depending the situation, the objective it will opening 2 more factories one in Valencia and the other one in Malaga.
- The more ambitious objective will be open ours own stores. Then the company will transform from B2B to B2C, where it will have to remodel the Business model. This objective, at the moment, it will be only an idea.

Mission:

Be a national reference from using vertical indoor technology and continue being the leading firm to do so.

Vision:

The mission of the company is feeding the Spanish society in a smart and healthy way and raise the society awareness that we need to gradually change the way we grow to have more sustainable planet for the next generation,

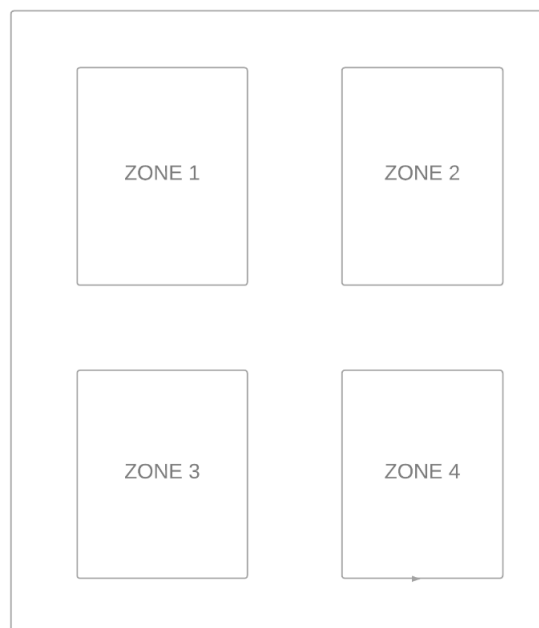
4.2. How the factory will work

The infrastructure consists of 4.500 m² surface are of land and 8 metres height for the farming factory and another 300 m² surface area for offices. The office will be divided in 3 parts; one little laboratory with surface are of 120 m² for the investigation manager and his assistant; one meeting room with 80 m² to attend the customer and have the company meetings in there; the rest 100 m² will be designated for a coworking office for the Accounting manager, Financial manager, Maintenance manager and Chief Executive Officers.

The farming Factory will be divided into 2 levels owing, thanks to the creation of a shelving infrastructure to take advantage of the 8 meters height; each level will be distributed in 4 areas of 700 m² each with corridors in the middle to ensure the tomato harvest. The difference in height between two levels will be 3.5 m so that the plants will have enough space and the harvesting task will be easier and comfortable. The company will have 5600 m² surface area available for farming between the two levels.

With the hydroponic system, the Company can make three complete cycles of tomatoes per year. Each cycle takes around 3 months and 1-2 weeks. The reason for the division in 4 parts per level is to be able to be producing tomatoes throughout the year.

Image 15. Distribution of the farming factory per level



Source: Lucidchart, my own research

The first cycle of zone 1 will be commenced in January and extend until April, the first cycle of zone 2 in February until May, the first cycle of zone 3 in March until June and the first cycle of zone 4 in April until July. When the cycle is finished for each zone, a new cycle will begin, then the production of tomatoes will be ensuring.

The process of harvesting will be done at dawn so the product will be available to be in the supermarkets in the morning and the final customer can enjoy a fresh tomato just picked from the plant. Between the process of harvesting and delivery of the product, no more than 3 hours can pass.

To access the second level, the Company will have two mobile scaffold in mechanical scissors (appendix 2) so that employees can use for harvesting the second level of tomatoes. The five employees will be in charge of harvesting, delivery de product and maintain of the hydroponic system.

4.3 Analysis of current market situation

4.3.1. Short Global Analysis of the Vertical indoor economy.

The humanity is due to need to save energy, nutrients and water in conditions of the growing world population and the growing urban space. This is the reason this market is increasing every year and it has very good perspective for the future. Some countries have been using this technology since 6-7 years ago and other ones do not start yet (like Spain).

In 2018, the volume of this market was 1.15 billion \$. By the end of 2019, the vertical vegetable market growth around 25% that is mean the value was 1.44 billion dollars. The expectation of the value of the market in 2025 will be 6 billion dollars, for these expectations to come true, investors are needed and to raise society's awareness that this technology is the future.

The countries of Asia-Pacific Region (China, Indian, Japan, Taiwan, Singapore and South Korea) are the global leaders in this market; they are occupied 42% of the global market. The European countries as Germany, United Kingdom, Belgium and Netherlands are in the second place in this market, they represent approximately 30%. The third position correspond to North America as Canada, Mexico and USA, representing 21% of the global market. Finally, the rest 7% is occupied by other countries (I Balashova, S Sirota, & Ye Pinchuk, 2019).

The main volume of this market are green crops and strawberries. The main vegetables crops of protected ground (tomato, cucumber and pepper) are represented to a small extent.

4.3.2. Tomato agriculture in Spain

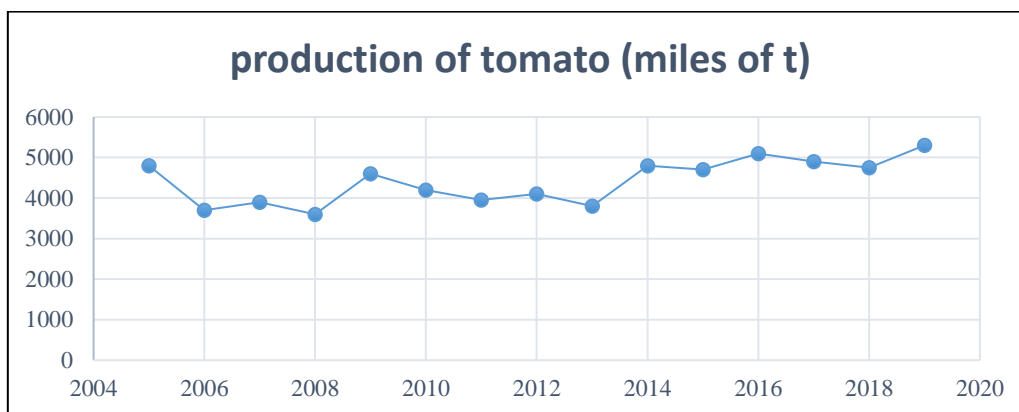
Spain is one of the most important fruit and vegetable countries in the world and the tomato is ones of its standards of quality. It is grown, above all, in the Communities (appendix 2) Region of Murcia, Extremadura and Andalucía. It is a very professional and technical sector that exports around 80% of its production. The fresh tomato sector In Spain is stable situation now after having managed the competition from Morocco, the drop in prices and the lack of water.

The national tomato production in 2019 just over 5 million of tons. The tomato farming in Spain is growing up every year since 2013, after a few year of decline that coincided

with the global economic crisis (image 16). This increase in production is caused by an increase in the area cultivated, 62.700 hectare and an improvement in crop yields reaching 83.5 t/ha national average.

Andalusia is the principle Community of production tomato in Spain, with an average production of 2.4 million of tons per year. In the second position of production is Extremadura, with 1.77 million of tons per year. Region of Murcia is in the third in the ranking with 288.400 tons per year. Also, Andalusia is the community with the most hectares grown tomato with 26.000 hectare, followed by Extremadura with 24.000 hectare and Region of Murcia with 2.400 hectare. However, Murcia has the best crop yields ratio, with 120 tons of tomato per hectare, about passing the Spanish average (83.5 t/ha).

Image 16. Spanish tomato production



Source: author, research with Ministry of Agriculture, Fishing and Feeding
(<https://www.mapa.gob.es/es/>)

Table 1: Ground and production of fresh tomato per Autonomic Community in 2019

Community	Production		Ground		Crop yields
	x 1000t	%	ha	%	t/ha
Andalusia	2480	47,54	26000	41,48	95,38
Extremadura	1770	33,93	24300	38,77	72,84
C. Murcia	288	5,52	2400	3,83	120
Navarra	180	3,45	2200	3,51	81,82
Castilla-La Mancha	91	1,74	1300	2,07	70
C. Valenciana	78	1,50	1250	1,99	62,40
Rest of Spain	330	6,33	5230	8,34	63,10
Total	5217	100	62680	100	83,23

Source: author, research with Ministry of Agriculture, Fishing and Feeding

(<https://www.mapa.gob.es/es/>)

At the Spanish province level (appendix 2), Badajoz is the leader in tomato production. In 2019, Badajoz produced 1.57 million of tons, which accounts for 88.5% of Extremadura production. In the second position is Almería with a production of 1.1 million of tons (44.50% of Andalusia production); Third position is Sevilla, producing 0.88 million of tons (33.50% of Andalusia production); fourth position is Granada with a production of 0.36 million of tons (14.06% of Andalusia production). The other position correspond to Murcia and Alicante with a production of 288.474 and 51.920 miles of tons. However, the province of Murcia is more efficient, since its performance is 119.04 t/ha, the highest in Spain. (Table 2)

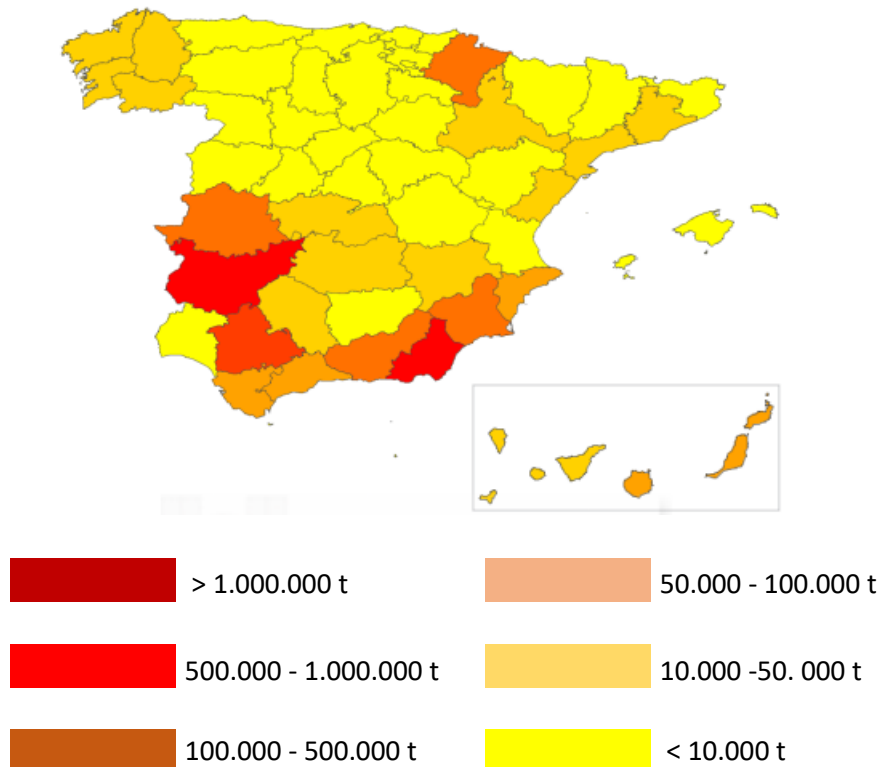
Table 2: Ground and production of fresh tomato per province in Spain 2019.

Province	Production	Ground	Crop yields
	tons	ha	t/ha
Badajoz	1569311,00	21.521	72,92
Almeria	1.107.706	10.940	101,25
Sevilla	879.780	7.716	114,02
Granada	363.535	4.016	90,52
Murcia	288.474	2.408	119,80
Alicante	51.920	532	97,59

Source: author, research with Ministry of Agriculture, Fishing and Feeding

(<https://www.mapa.gob.es/es/>)

Image 17. Map of Spain representing the production of fresh tomato by province in 2019



Source: author, research with Ministry of agriculture, fishing and Feeding
(<https://www.mapa.gob.es/es/>)

The conclusion that can be extracted with this information is that tomato productions is located in south of Spain and exporting it from there to the rest of the country. The Community of Madrid has a low production of tomato but it is one the biggest market in Spain. The tomato need to do a trip of 4 hours from Murcia or 5.30 hours from Sevilla at least every day for arrive to Madrid market (appendix 2), the price of the tomato will increase for the delivery of the product. Also normally the tomato is harvested before it is fully ripe to be stored a couple of days before it is sold to the consumer. Because of this, tomato is losing the potential of the flavour and taste, the quality of the product is less.

4.3.3. Consumption of Vegetables in Spain 2020

The demand for fresh vegetables in households in 2020 and according to data from the Food Consumption of the Ministry of Agriculture, Fisheries and Food, has stood at 2,732 million kilos, 12% more than the previous year. The households spending in fresh

vegetables 5.312 million € in 2020, 15% more than in 2019. COVID has marked the growth of household consumption throughout 2020.

The most consumed vegetables during 2020 have been tomato, with 633 million kilos and a growth of 10% compared to the same period in 2019; lettuce (arugula include) with 338 million kilos (+12%); pepper with 245 million (+18%) and onion with 188 million kilos (+12%) . (FEPEX, 2021)

4.3.4. Competitor Analysis

In the case of this Company and this particular sector, the competition will not be as important as it may be in other sectors. As previously highlighted, this company will be a pioneer in Spain in using technology applied in cities, so the greatest threat is the creation of new companies that are attracted by this technology and profit margins.

The current competition for Vertical L-G are companies that use traditional farming methods. Precisely few companies produce this type of rose tomato because it is a delicate tomato and the possibility of losing the harvest or part of it is high if it is grown in the method already mention. This variety of tomato is usually gown more on villages for own consumption or to local markets, but there are two large exporting companies of this type of tomato

- **Cooperativa Agrícola San Isidro (CASI)** is the only supplier in Almeria and one of the few in Spain to produce this type of tomato for selling a large scale. The company cultivate a total of hectares in the current campaign, the producing is located in the Levante are of Almeria, due to the characteristic of the water, the soil, the climate and the wind that his product needs; it is the second year that the company bet for this rose tomato.

The principal customer for this company is Mercadona. This retail company is the only one, which have this variety of tomato on their stores. Mercadona bought 1.2 million of kilos from CASI last year. (Diario de Almería , 2020)

- **CORREAS GROUP** is a family company born in Sabiñánigo 60 years ago. Currently, this company encompasses nine companies located in different points of Spain and Morocco. Most of these companies are mainly dedicated to the production packaging, distribution, import and export of horticultural products nationally and internationally.

One of them is dedicated of production of the rose tomato in the province of Huesca. The company has 15 hectares and an approximate a production of 1 million kilos per year. Almost all the production is exporting to other countries as England or Germany. (GRUPO CORREAS, s.f.)

4.3.5. Analysis of Supplier.

To create this company, several supplier will be needed for different needs of the company. At this point, it will not be possible to write about all of them since parts such as the reconstruction or the creation of the structure for the second level of the farm would need to contact, speak and see the construction in person with the suppliers, which has been impossible due to the current situation. Therefore the following supplier that the company will have it are:

- **New Growing System (NGS)** is a Spanish company that was founded in 1991 for the propose to continuous development of new farming techniques. NGS sells its own hydroponic system and the installation. Currently the company did more than 200 projects in more than 25 countries and in 4 different continents; it has also created a new automated version of its Hydroponic recirculating system without soil (NGS, 2021).

NGS will be the most important supplier for this business plan. This company is the only supplier of Hydroponic system in Spain. Apart from selling their type of hydroponic system, they also take care of the installation and preparation for the system. The company will providing all the materials necessary for the correct functional of the system (Led lights, tomato seed, program the system...).

- **Fotocasa** is a webpage specialized in the sale and rental of second-hand and new-build homes in Spain. The company also has a department from rent or buy industry building or business offices with competitive prices.
- **Media Markt** is a chain of establishment superstores German, sells appliances, computer and consumer electronics, which it is, establish in Spain since 1999. Media markt will provide all the electronic system technology the company need as Computers, laptops, TV, mobile phones....
- **Ikea** is s Swedish-based Multinational Corporation that manufactures and retails furniture, appliances and household items. Ikea will provide the necessary office material for the properly function of the company.

- For the two trucks and the two mobile scaffold in mechanical scissors will be purchased through second-hand pages specializing in vehicles such as <https://www.milanuncios.com/> or <https://www.coches.net/segunda-mano/>

4.4. SWOT Analysis

Strengths

The strengths of the company are:

- Efficient
- High quality of the technology
- Save 95% of water during the process
- Soil is not need in the process
- Farming vegetables without adding any chemical product
- Double production per m2 comparing to the competitor
- Better use of the land per m2
- Location
- Saving transportation and delivery costs
- Markets Leaders
- Good connexion network
- Concern for the environment
- Reducing the cycle life of the vegetables.
- High quality of the product
- Saving cost in manures and fertilizers
- Hydroponics indoor systems allows cultivation in places that cannot be
- The most fresh tomatoes in the market
- Production is not affected by the weather

Weakness

The weakness of the company can be:

- High initial cost
- Limitation of farming other species of plants
- The plan are susceptible to changes
- Hydroponics is an agricultural technology that requires a lot of detail and attention
- Electricity costs
- Vulnerable to a power outage
- Lack of knowledge on the subject

- New product to final customer

Threats

Instances that can be:

- Failure of the new technology
- Not achieving the expected goals
- The market will reject our product
- New competitors enter in the market
- New a better technology can be invented
- Government regulations; the government can add more taxes and destroy the sector
- Power outage

Opportunities

The opportunities for the company can be:

- New product with good sensations in the market
- Be a revolution in the market
- Expand over the country easily
- Be leaders on the market
- Change the mentality of the final consumers and be a reference to them

4.5. Segmentation

The potential customers will be retail companies at least at the beginning of the company until the future idea of having our own store is more realistic.

The retail sector is an important economic growth engine in Spain, that's because there are a lot of companies covering the sector and making it more competitive and fairer to the end consumer each year. There are local, provincial, national and international brand companies but in this case it will focus on companies located in the Community of Madrid.

The selected 9 brand companies operating in the Community of Madrid are:

- Lidl (<https://www.lidl.es/>),
- Carrefour (<https://www.carrefour.es/>),
- Mercadona (<https://www.mercadona.es/>),
- Hipercor (<https://www.hipercor.es/>),
- Dia (<https://www.dia.es/compra-online/>),
- Aldi (<https://www.aldi.es/>),
- Alcampo (<https://www.alcampo.es/compra-online/>),
- Eroski (<https://www.eroski.es/>),
- Ahorramas (<https://www.ahorramas.com/>).

The next analysis will decide who potential customer can be for Vertical L-G. These 9 companies will be subjected to five criteria with different weight for making the decision, each criterion will have a note variation between 1-5. The two companies with the highest grade approaching 5 will be the potential customers for Vertical L-G. (table 3)

- The company care about their supplier:** 1 will mean they don't care about their suppliers and 5 will mean they really care about their suppliers.
- Bargaining power:** if the supplier have bargaining power to the retail company. 1 will mean little bargaining power and 5 will mean high bargaining power.
- Reputation of the brand company to consumers:** 1 will mean bad reputation to consumers and 5 will mean very good reputation to consumers.

d) **Quality of the Products:** 1 will mean bad quality of the products and 5 will mean high quality.

e) **Need for a quality tomato:** 1 will mean the company don't need a quality tomato and 5 will mean they need for a quality tomato.

Table 3 Analysis of the Potential customer

Criteria	Weight	Brand Company							
		Lidl	%	Carrefour	%	Mercadona	%	Dia	%
A	10%	3	0,3	4	0,4	2	0,2	2	0,2
B	20%	2	0,4	3	0,6	1	0,2	3	0,6
C	25%	2	0,5	3	0,75	3	0,75	1	0,25
D	15%	3	0,45	3	0,45	4	0,6	2	0,3
E	30%	3	0,9	1	0,3	1	0,3	3	0,9
Total Rate	-	2,55		2,5		2,05		2,25	
Ranking	-	4°		5°		9°		7°	

Criteria	Weight	Brand Companies									
		Hipercor	%	Alcampo	%	Aldi	%	Eroski	%	Ahorramas	%
A	10%	4	0,4	3	0,3	3	0,3	3	0,3	4	0,4
B	20%	3	0,6	2	0,4	1	0,2	2	0,4	4	0,8
C	25%	5	1,3	3	0,75	2	0,5	2	0,5	4	1
D	15%	5	0,8	4	0,6	3	0,45	2	0,3	4	0,6
E	30%	3	0,9	2	0,6	3	0,9	2	0,6	5	1,5
Total Rate	-	3,9		2,65		2,35		2,1		4,3	
Ranking	-	2°		3°		6°		8°		1°	

Search; Author, own research

The results of the analysis are:

1. Ahorramas
2. Hipercor
3. Alcampo
4. Lidl
5. Carrefour

6. Aldi
7. Dia
8. Eroski
9. Mercadona

After the analysis, the two companies that can be potential customer are **Ahorramas** and **Hipercor**. Vertical L-G will try to contact with them and make a fair deal for both parts.

Next, it will develop an introduction to these two companies about their history and business figures.

- **Ahorramas** started for a group of small Madrid merchants who joined forces to develop a new concept of local supermarkets with quality of service as the main objective. The company opened the first store in 1980 in Madrid, now they have more than 200 stores around the Community of Madrid and Castilla-La Mancha. (Ahorramas.com, s.f.)

The company closed 2020 with a gross business figure of 1,784 million €, which could present a new record for the company and an increase of 3.5% compared to last year. In addition, Ahorramas is going to invest 90 million euros this year, which represents an increase of 5.9%, compared to 2020. (The (positive) forecasts of Ahorramás for this year, 2021).

- **Hipercor** was inaugurated on 1980 in Seville, as new format of the Corte Ingles Group (Hypermarkets Company in Spain), to satisfy the needs of a society that is growing every day in purchasing habits and behaviours. Currently the company has 42 supermarkets around the country and ten of them in the Community of Madrid.

The Corte Ingles Group has reached a turnover of 15,783 million euros, 1.1% more than the previous year. The positive evolution of the business have boosted the group's net profit to 258.2 million euros, 27,7% more than last year, while Ebitda grew 2.2% to 1.075 million. (Group, 2020)

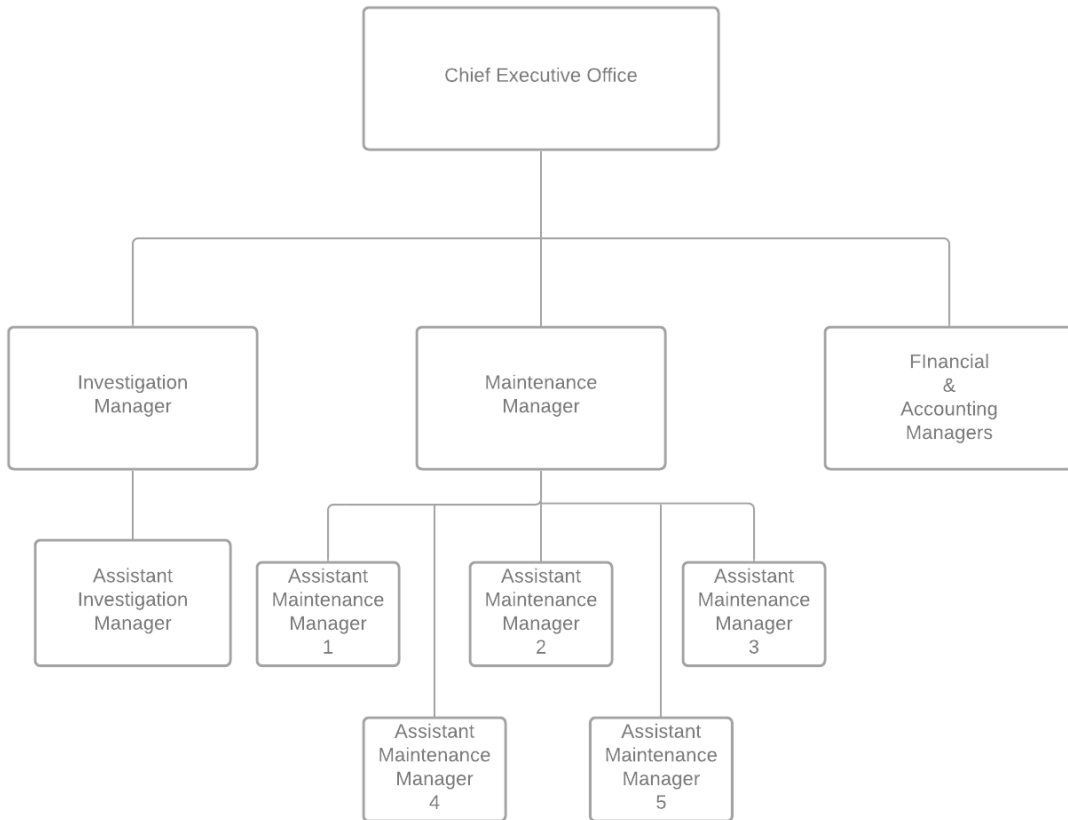
4.6. Operations Plan

4.6.1. Personal plan

- **Chief Executive Office** will be responsible for supervise all the departments, for operations in the business, be in contact with the supplier and customer, for hiring new employees, ensure a good environment at work and stay in touch with all workers.
- **Investigation Manager** will be responsible for improve the system, study new plants or create our seed for farming, investigate about vertical farming, study and understand other companies using this technology.
- **Assistant Investigation Manager** will be responsible for help to success in the investigation process
- **Maintenance Manager** will be responsible for the operation and maintenance of the part cultivation with all the processes that it carries and coordinate its team.
- **Assistant Maintenance Manager** will be responsible of recollect the product, package, clean the system and delivery. It will be 5 people with this role.
- **Accounting Manager** will be responsible of the accounting of the company.
- **Financial Manager** will be responsible for produce financial reports, direct investment activities, develop strategies, and plans for long-term. In conclusion is responsible for the financial health of the organization.

In the next imagine we can appreciate the structure of the *Vertical L-G* company.

Image 18. Vertical L-G company structure



Source: Lucidchart, my own research

4.6.2. Project schedule

January-April 2022

- Developing Business plan
- Hiring employees
- Preparing premises of the factory
- Training courses for the employees
- Contact with the suppliers

May-September 2022

- Ensure that the system works obtain the product with required quality and solve possible system failures.
- Examine worker`s performance and work environment during these months ago and hire or lay off staff

October- December 2022

- Prepare de first consign of products in order to teach potential customers the product, facilities and close deals.
- Find the possible customer

January 2023

- Finishing all the preparations, solve all the possible failures and run the company
- Start farming the zone 1.

4.7. Financial Plan

In this point, it is going to explain the budget and economic viability of this business plan.

4.7.1. Initial costs

The initial costs from this project are:

- Rent or buy the Industry Building: In this case, it is possible two option for buy or rent the industry building. The total cost of the building is 3.400.000 € but the owner give a discount of 18% that´s mean the price will be 2.800.000 €. The other option is a lease purchase contract (is a type of legally documented transaction which is leased in exchange for a weekly or monthly payment with the option to purchase at some point during the agreement). The price per month will be 13.500 €.

The purchase price is high and would be a great economic burden for the company in its beginning. That´s why the second option is the best for the company.

- The building will need a reconstruction for be ready to the vertical farming, the price for that will be 30.000€. Also in the roof of the building it will made a photovoltaic installation for supply electricity and be more efficient. The installation will be 300 kilowatts and will costs 180.000 €
- Materials: All the materials necessary to start the production, whether lights, cables, shelves, the hydrogens system, computer, office material ...

The whole equipment for the office will be from IKEA and Media-mark (Electronic big shop in Spain), which is not very expensive (it´s planned to spend around 7.500 € on informatics equipment and 3.500€ on office equipment).

NGS will provide and installation the production material for the factory, the cost of that will be 94.273,76 €.

- The company will need two trucks for delivery the product to the customer. The model of the truck will be Mercedes-Benz Atego 1523 L including the fridge part. The price per truck will be 34.900€ with 1 year warranty.
- The salaries expensive of the company can be appreciate in the next table. The employees will have two incentives one in June and the other one in December.

Table 4: Salaries expensive

Company roles	Salary per month	Salary per year
Maintenance Manager	2.400,00 €	33.600,00 €
Investigation Manager	2.530,00 €	35.420,00 €
Financial Manager	2.050,00 €	28.700,00 €
Accounting Manager	2.050,00 €	28.700,00 €
Assistant Investigation	1.560,00 €	21.840,00 €
Assistant Maintenance	1.400,00 €	20.000,00 €

Source: Author, based on research

- The total initial cost for the business plan can be resumed in the next table:

Table 5 : Initial investment

Items	Price
Reconstruction of the building	30.000,00 €
Office equipment	10.000,00 €
Informatic Equipment	7.500 €
Hydroponic system	94.273,76 €
Trucks	69.800,00 €
taxes for the constitution of the company	3.200,00 €
Informatic systems (2 years)	1.500,00 €
Photovoltaic Installation	180.000,00 €
Financial Reserve	26.000,00 €
TOTAL	415.773,76€

Source: Author, Based on research

- All expenses that will made until January of 2023, which is when everything is expected to be ready, is summarized in the following table.

Table 6: Expense until setting up

items	Price
Construction	210.000,00 €
Material	176.573,76 €
Salaries	204.260,00 €
Taxes	3.200,00 €
Rent	162.000,00 €
variable expenses	188.400,00 €
TOTAL	944.433,76 €

Source: Author, my own research.

- Annual amortization the plant and equipment of the company.

Table 7: Amortization value of the company

Plant and equipment	Cost of the invesment	Amortization period	value of the amortization per year
Informatic Equipment	7.500,00 €	4	1.875,00 €
Hydroponic system	94.273,76 €	10	9.427,38 €
Trucks	69.800,00 €	5	13.960,00 €
Photovoltaic Installation	180.000,00 €	6	30.000,00 €
Office Equipment	3.500,00 €	7	500,00 €
TOTAL	355.073,76 €	X	55.762,38 €

Source: Author, my own research

4.7.2. Sales Forecast

The next table explain the sales forecast for the next 6 year of the company. In the first and second year, the yield per m² is expected 23 kg of tomato; on the third and fourth year, the yield per m² will increase to 25 kg thanks to the laboratory investigation; in fifth

and sixth year, the yield per m² will increase again to 27 kg. The production calculation is; 5.600 m² * Yield per m² * 3 life cycle.

Normally the 5% of the tomatoes harvesting is losing from different reasons, the closing stocks will be the Kg of tomatoes will be useless.

The price per kg of the rose tomato is around 2.55-3.00 € in the market during last years. I suppose the price will be constant price during the next 6 year but it may vary due to the variations that the market may suffer.

Table 8: Sales Forecast

Concept	1º year	2º year	3º year	4º year	5º year	6º year
Production (Kg)	386.400	386.400	420.000	420.000	453.600	453.600
Sales	367.080	367.080	399.000	399.000	430.920	430.920
Closing stocks	19.320	19.320	21.000	21.000	22.680	22.680
Unit price	2,55 €	2,55 €	2,55 €	2,55 €	2,55 €	2,55 €
Total Closing stocks	49.266,00 €	49.266,00 €	53.550,00 €	53.550,00 €	57.834,00 €	57.834,00 €
Total Funds	936.054,00 €	936.054,00 €	1.017.450,00 €	1.017.450,00 €	1.098.846,00 €	1.098.846,00 €
Net Total	936.054,00 €	936.054,00 €	1.017.450,00 €	1.017.450,00 €	1.098.846,00 €	1.098.846,00 €

Source: Author, own research

4.7.3. Income statement

In the income statement (table 9), explain the income and expenses that will have place for the company in the next 7 years.

Table 9 Income statement of the company for the next 6 years.

Income statement	0 year	1 ^o year	2 ^o year	3 ^o year	4 ^o year	5 ^o year	6 ^o year
A) Continuing Operations							
1. Total revenue	- €	936.054,00 €	936.054,00 €	1.017.450,00 €	1.017.450,00 €	1.098.846,00 €	1.098.846,00 €
a) Sales	- €	936.054,00 €	936.054,00 €	1.017.450,00 €	1.017.450,00 €	1.098.846,00 €	1.098.846,00 €
2. Variation in inventory of terminated and ongoing products	- €	- 49.266,00 €	- 49.266,00 €	- 53.550,00 €	- 53.550,00 €	- 57.834,00 €	- 57.834,00 €
3. Procurement	- 3.000,00 €	- 4.500,00 €	- 4.500,00 €	- 4.900,00 €	- 4.900,00 €	- 5.200,00 €	- 5.200,00 €
a) consumption of raw material	- 3.000,00 €	- 4.500,00 €	- 4.500,00 €	- 4.900,00 €	- 4.900,00 €	- 5.200,00 €	- 5.200,00 €
4. Other operating income	- €	- €	- €	- €	- €	- €	- €
5. Personal Expenses	- 204.260,00 €	- 248.260,00 €	- 248.260,00 €	- 248.260,00 €	- 248.260,00 €	- 248.260,00 €	- 248.260,00 €
a) Maitenance Manager	- 33.600,00 €	- 33.600,00 €	- 33.600,00 €	- 33.600,00 €	- 33.600,00 €	- 33.600,00 €	- 33.600,00 €
b) Investigation Manager	- 35.420,00 €	- 35.420,00 €	- 35.420,00 €	- 35.420,00 €	- 35.420,00 €	- 35.420,00 €	- 35.420,00 €
c) Financial Manager	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €
d) Accounting Manager	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €	- 28.700,00 €
e) Assitant Investigation	- 21.840,00 €	- 21.840,00 €	- 21.840,00 €	- 21.840,00 €	- 21.840,00 €	- 21.840,00 €	- 21.840,00 €
f) Assistans maintenance	- 56.000,00 €	- 100.000,00 €	- 100.000,00 €	- 100.000,00 €	- 100.000,00 €	- 100.000,00 €	- 100.000,00 €
6. Operating costs	- 188.400,00 €	- 383.600,00 €	- 388.100,00 €	- 401.600,00 €	- 406.100,00 €	- 421.300,00 €	- 425.800,00 €
a) Mantein	- 13.400,00 €	- 13.400,00 €	- 13.400,00 €	- 14.600,00 €	- 14.600,00 €	- 17.500,00 €	- 17.500,00 €
b) production costs	- €	- 193.200,00 €	- 193.200,00 €	- 210.000,00 €	- 210.000,00 €	- 226.800,00 €	- 226.800,00 €
c) informatic systems	- 4.500,00 €	- €	- 4.500,00 €	- €	- 4.500,00 €	- €	- 4.500,00 €
d) Rent	- 162.000,00 €	- 162.000,00 €	- 162.000,00 €	- 162.000,00 €	- 162.000,00 €	- 162.000,00 €	- 162.000,00 €
e) other expenses	- 8.500,00 €	- 15.000,00 €	- 15.000,00 €	- 15.000,00 €	- 15.000,00 €	- 15.000,00 €	- 15.000,00 €
7. Amortization	- €	- 55.762,38 €	- 55.762,38 €	- 55.762,38 €	- 55.762,38 €	- 53.887,38 €	- 39.927,38 €
8. Grants Related to Non-financial Non-current Assets and toher Grants	- €	- €	- €	- €	- €	- €	- €
9. Surplus production	- €	- €	- €	- €	- €	- €	- €
10. Impaiment Losses and gains/losses on disposal of non current	- €	- €	- €	- €	- €	- €	- €
A. 1) Operating Results. (1+2+3+4+5+6+7+8+9+10)	- 395.660,00 €	194.665,62 €	190.165,62 €	253.377,62 €	248.877,62 €	312.364,62 €	321.824,62 €
11. Financial income	- €	- €	- €	- €	- €	- €	- €
12. Financial expenses	- €	- €	- €	- €	- €	- €	- €
13. Change in Fair Value of Financial Instruments	- €	- €	- €	- €	- €	- €	- €
14. Exchangue rate differences	- €	- €	- €	- €	- €	- €	- €
15. Impaimen losses and income from disposal of financial instruments	- €	- €	- €	- €	- €	- €	- €
A.2) Fincancire Results (11+12+13+14+15)	- €	- €	- €	- €	- €	- €	- €
A.3) Income before taxes (A.1+A.2)	- 395.660,00 €	194.665,62 €	190.165,62 €	253.377,62 €	248.877,62 €	312.364,62 €	321.824,62 €
15. Income Tax	- €	- 29.199,84 €	- 28.524,84 €	- 63.344,41 €	- 62.219,41 €	- 78.091,16 €	- 80.456,16 €
A.4) Results for the year from interrupted operations	- 395.660,00 €	165.465,78 €	161.640,78 €	190.033,22 €	186.658,22 €	234.273,47 €	241.368,47 €
B) Interrupted operations							
17. Result for the year from interrupted operations.	- €	- €	- €	- €	- €	- €	- €
A.5) Result of the year (A.4 + 17)	- 395.660,00 €	165.465,78 €	161.640,78 €	190.033,22 €	186.658,22 €	234.273,47 €	241.368,47 €

Source: Author, my own research

Data to highlight from the income statement:

- The 0 year is the setting up year of the company. In this year, the company will have only expenses. The 5 assistants maintenance will be hired on May (salary expenses will be for 7 months plus one extra pay check).
- The amortization will start in the 1^o year.
- The cost per kilo is 0,5 € therefore the company's producing cost is 0,5€ per kilos harvested.
- In Spain, the general type for income tax is the 25% but new entities has a type of 15% during the first two years of benefits.
- The licence of the informatics systems is for 2 years.

4.7.4. Internal Rate of Return

Internal Rate of Return (IRR) is the rate of interest or profitability offered by an investment. It is the percentage of profit or loss that an investment will have for the amounts that have not been withdrawn from the project. A value of more than 15% of the IRR means that the investment is very good and will be attractive to investors. In this case, the IRR value is really good 21%.

Table 10 Calculation of the IRR

Year	Sales	Expenses	Net cash flow
1	936.054,00 €	685.626,00 €	250.428,00 €
2	936.054,00 €	686.076,00 €	249.978,00 €
3	1.017.450,00 €	708.310,00 €	309.140,00 €
4	1.017.450,00 €	712.810,00 €	304.640,00 €
5	1.098.846,00 €	732.954,00 €	365.892,00 €
6	1.098.846,00 €	737.094,00 €	361.752,00 €

Initial costs	1	2	3	4	5	6
- 944.433,76 €	250.428,00 €	249.978,00 €	309.140,00 €	304.640,00 €	365.892,00 €	361.752,00 €

Source: Author, my own research

Table 11 Value Of the IRR

IRR	21%
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Source: Author, my own research

5. Summary and Discussion

Based on the financial part, after the third year of production the company will have finished paying with all the initial costs of the investment. The financial plan has been developed with unbiased expectations of the future business, with not positive or pessimistic scenario.

The only part of the financial part that can be considered optimistic is the yield per m². This system currently achieved 23 kg per m², but not 25 or 27 kg per m². My forecast with my investigation team is to reach the yield per m² in the next year. Let's hope that this technology continues to develop and get the funding it needs.

The IRR value is 21%, which demonstrates the economic viability and profitability of this business plan. This will increase investor's curiosity to invest. Normally a higher value of 10-15% IRR is a good investment.

6. Conclusion

The aim of this diploma thesis was to develop a business plan for the first agricultural company focusing on vertical agricultural technology in Spain. The business plan is developed based on real market information and designed to evaluate the potential of the business.

The first section of the thesis was focused on the theoretical background definition in relation to business, business planning, structure of the business, market analysis, SWOT analysis, segmentation and the financial part. The theoretical section also includes the need for a change in the agriculture system to foster the growing population of the planet in the future and the planet's population. To conclude this section, it is explained that to combat the problem vertical farming and the different farming systems that are used.

The second section of the thesis was focused on the practical part of the business plan. The main goal in this section was to demonstrate the economic viability of this new technology and the competitive advantage it can achieve over the current market. The second goal was to demonstrate the need for a change in the Spanish agricultural methods; to make them more efficient, ecological and environmentally responsible. Although, I could have done it with over vegetables or plants, for the purpose of achieving goal in reflecting the need and possibility of a change in the agriculture in this thesis, I have chosen tomato as the main product.

To sum up that the possibility and economic profitability of this enterprise has been demonstrated in the research thesis. The hydroponic system at urban farm has proven to be a reality and a necessity. This system is able to offer a fresh, high quality tomato, without the usage of chemicals and grown in an efficient and intelligent method.

The final diploma thesis can serve as a simple guide for students interested in starting a business in this field. After conducting extensive research and conducting in-depth analysis in this particular sector, which I have done in this thesis. I am convinced that the topic turns out to be viable and feasible and it will be of ample interest to the potential investors.

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8. Appendix:

8.1. Appendix A: Truck photos

Image 19: Trucks



8.2. Appendix B:

Image 20. Mobile scaffold in mechanical scissors



Source: <https://www.milanuncios.com/otros-motor/venta-plataforma-tijera-elevadora-102969760.htm>

8.3. Appendix C: Spanish map and division

Spain is divided into seventeen autonomous communities, in addition to two African autonomous cities (Ceuta and Melilla). The Communities have their own parliaments and regional governments with wide legislative and executive powers. Every communities has their own capitals. The communities can be divided in different provinces; there are 50 provinces in Spain.

Image 21. Autonomous communities map in Spain



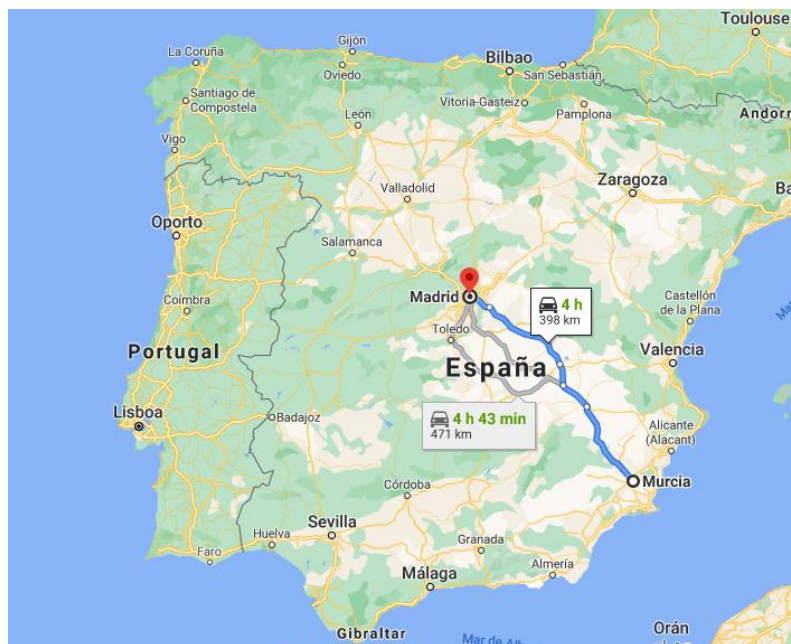
Source: <https://www.websaber.es/geografia/espana/mapas/comunidades/comunidadesautonomas-espana.php>

Image 22. Provinces map of Spain



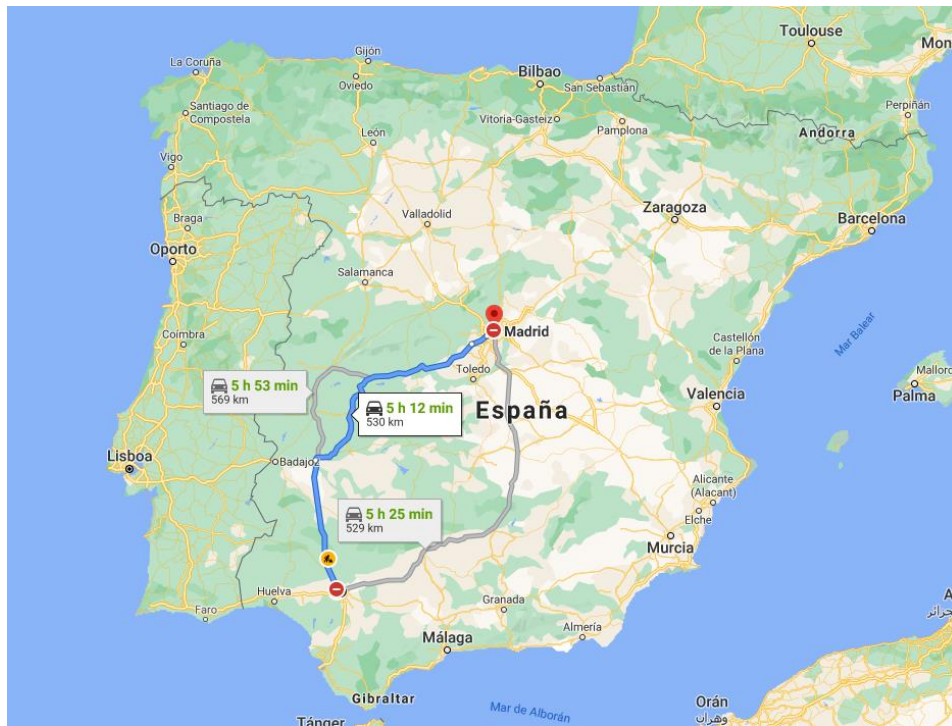
Source: <https://www.pinterest.es/pin/309763280590300658/>

Image 23. Trip by car Murcia to Madrid



Source: <https://www.google.com/maps/dir/murcia/madrid/@39.1986877,-3.5476338,8z/data=!3m1!4b1!4m1!3!4m1!2!1m5!1m1!1s0xd6381f8d5928c7f:0xd627129b38c4ab9a!2m2!1d-1.1306544!2d37.9922399!1m5!1m1!1s0xd422997800a3c81:0xc436dec1618c2269!2m2!1d-3.7037902!2d40.4167754>

Image 24. Trip by car Sevilla to Madrid



Source: <https://www.google.com/maps/dir/Sevilla,+Espa%C3%B1a/Madrid,+Espa%C3%B1a/@40.9875855,-4.6403771,6.49z/data=!4m14!4m13!1m5!1m1!1s0xd126c1114be6291:0x34f018621cfe5648!2m2!1d-5.9844589!2d37.3890924!1m5!1m1!1s0xd422997800a3c81:0xc436dec1618c2269!2m2!1d-3.7037902!2d40.4167754!3e0>