

PLANTSHUB- SOIL-LESS AEROPONIC GROWING SYSTEM

01

// PUBLIC OVERVIEW



1.1

IDENTIFICATION - "PUBLIC INFORMATION"

Solution's Website

www.plantshub.it

How would you describe your solution in one sentence?

An aeroponic system for the production of leafy plants to be used in the food retail industry

What is your client buying? The Solution is a:

Product, Service,

Rationale: Which problem is the Solution trying to solve?

Global food waste is estimated at 33% (€25B/yr.) during storage, processing, and transportation. Aeroponic systems aim at substituting current obsolete cultivation methods, by bringing an innovative approach focused on agro-engineering. The main principle is using an aerosol (mist) in a closed or semi-closed environment, which is sprayed directly onto the plant's roots. The principle is similar to hydroponic systems, where roots are placed in a liquid solution, but has the advantage of significantly increasing the nutrients' uptake, reducing stress related to drought/flood, as well as stress due to variations in oxygen concentrations. The rationale of this Solution is to have an in-house system capable of producing high quality products with 95% less water compared to traditional agriculture (field-grown or greenhouse-grown products). The environmental benefits are significant, in particular the Solution aims at promoting soil and land conservation and reducing the CO2 emissions related to transport/distribution. Lastly, aeroponic systems (and in particular vertical farms) are also capable of achieving a higher crop yield; for instance, lettuce grown on an agricultural field (1x1 meter) yields 3.9 kg of product/year, while when grown on the same acreage but via aeroponic system about 41 kg/year can be harvested.

What is the state of maturity of your Solution?

C - Initial market commercialization,

In which geographical areas the Solution is currently available (tested) or sold?

Eastern Europe, Northern Europe, Southern Europe, Western Europe,

Select here the UN's Sustainable Development Goals (SDGs) subcategories that fits best your Solution's application.

Clean water and sanitation

- Water distribution and use
 - Smart irrigation
 - Aeroponics
 - Water-saving appliances

Responsible consumption and production

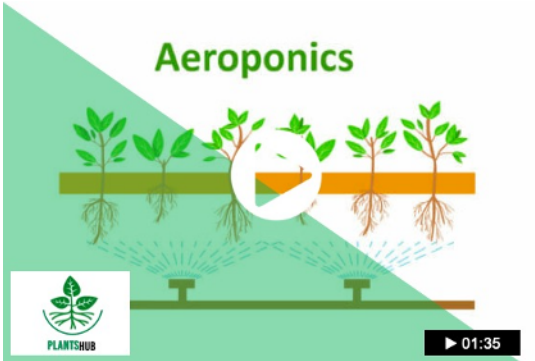
- Agriculture and farming for food production
 - Crop farming innovation
 - Accuracy of planting
 - Precision irrigation
 - Precision fertilization
 - Land management
 - Aeroponics
 - Vertical farming
-

1.2

MEDIA - "PUBLIC INFORMATION"

Videos (optional)

Photos



2.1

BUSINESS OPPORTUNITY & STRENGTHS**What are the characteristics of your business opportunity?**

This Solution is aimed at customers such as small, medium, and large food retailers that wants to produce locally grown, pesticide-free products – in particular leafy greens – with the best quality of indoor farming. Consumers perceive that food grown locally is fresher, healthier, and better for the environment, therefore our customers are highly interested in purchasing this product. Indeed, growing locally guarantees that the product is fresh (it hasn't been sitting on a truck for a week) and local (it wasn't grown in a different country) thus with a low carbon footprint. Vertical farming is becoming more and more popular, as it can produce the same quantity and quality of crops all year round, and, effectively takes-up less space compared to greenhouses. A major advantage is the possibility to set it up and operate it in densely populated areas or land which is unsuitable for agriculture (e.g. brownfield and former industrial sites). Even though the advantages of this technique are clear, vertical farms are not widely implemented yet. As per the report published by Allied Market Research (The global aeroponics industry) the key players include : AeroFarms, Aeroponics (AERO Development Corp), BrightFarms Inc, Evergreen Farm Oy, LettUs Grow, CombaGroup SA, Altius Farms, Ponics Technologies, Living Greens Farm, and Freight Farms. Our direct competitors are companies based in Europe who offers a similar product (aeroponic and hydroponic systems), for instance Jones Food Company (JFC) in UK and Intelligent Growth Solutions (IGS) in Scotland. We expect that with the constant increase in population, which is forecasted for the coming years, similar Solutions will effectively be able to co-exist in the market. Overall, compared to other competitors on the market, our Solution offers an advanced monitoring system linked to AI/forecasting model that can effectively predict and thus adjust parameters in real time.

2.2

SOLUTION'S TECHNICAL DESCRIPTION**Provide information on operation, function, and use of your Solution.**

Our Solution is both a product (the actual aeroponic system/setup) and a service, as we provide technical support in setting-up, maintaining and improving yields of the vertical farm system. We have built a strong database (based on public and private data) collected over the past years in collaboration with multiple stakeholders, that can effectively and efficiently support the prediction model. We are awaiting more clients/users and adopters to provide details/highlights and measurable data to provide further details of the measurable benefits. The plants are grown without sun or soil in a fully controlled indoor environment; the system relies on the latest technologies applying smart-light, smart-nutrition, and smart-pest-management. Indeed, the whole system is constantly monitored (through continuous data collection) and data points are used to test and improve the growing system using AI and forecasting models. The real-time monitoring can also ensure that high pressure pumps, sprinklers, and timers are constantly controlled to prevent costly break down that would result in crop-loss. The patent for this solution is available under ID-EU1009:12 at <https://worldwide.espacenet.com/>. Lastly, the sale strategy of the subscription fee aims at increasing subscribers' usage and enjoyment of their subscription service. We are constantly collecting feedbacks from our clients and improving the product based on their needs. We operate an internal subscription management platform which offers deeper subscriber and business insights, as well as improved operating efficiencies and billing continuity that's accurate and efficient. As a result we are flexible and capable to adapt subscription plans, pricing, and promotions based on data around what drives

subscriber behaviour. We do not rely on external parties or supplier for the provision of this service.

2.3 — SPECIFICS

Provide a technical description of the Solution, please include details on the followings:

For our physical product (aeroponic system) - the systems can be purchased on several dimensions, according to the needs and size of the customer (food retailer); we offer units from 80 m2 to 800 m2. The key components of the aeroponic system are : water sensors, spray timers, hydro-atomizing spray jets, microchips, and computer interface for data collection. These components are outsourced (third party suppliers) and assembled in house, with the exception of hydro-atomizing spray jets which are manufactured and assembled in house. The leafy green plants grow on a special medium, supported by a reusable cloth and designed to improve germination/ growth, the cloth ensure that both minimal evaporation and correct temperature are maintained. In particular, the solution chamber (where the nutrient and water mist are sprayed onto the plant's roots) is made from BPA-free recycled plastic material obtained from one of our key suppliers based in Europe. The material used has a lifetime of 15 -18 yrs, and the modularity of the system allows for small changes, replacements and upgrades without having to dispose of the whole structure. Lastly, we have a very efficient recollection and recycling system in place, which allows customers to dispose of the damaged/end-of-life components in exchange for seeds-vouchers or online workshops. For the service (technical support and data collection) - our technology is a software in the cloud, that turns in real time (thanks to artificial intelligence) raw data collected from sensors/meters into personalised action plans, in order to achieve better harvesting results, without need for further investment. We directly sell a monthly subscription to the client (average 15-50 EUR/month), and provide real-time data visualisation, predictive analytics and recommendation for managing at best their vertical farms. The amount of the subscription fee depends on the number of data streams connected to the platform, as well as features chosen.

2.4 — SUPPLY CHAIN

Where in the supply chain do you fit?

We purchase our raw materials and key components from raw material suppliers based in Europe, we produce and assemble the components of the aeroponic system in house and sell a turnkey Solution to our client (food retailers). As previously mentioned, we offer complete support during installation and full maintenance as well as customised data analysis. We have a reliable set of suppliers across Italy, and some located in Europe, that ensure high-quality and long-lasting material is used to produce our product. The system is built in a way that individual components can easily be replaced – if needed – and all of them fully guaranteed and replaced without additional charges for 3 years.

2.5

TECHNICAL LIMITATIONS & AREAS OF IMPROVEMENT

If the Solution maturity is below TRL 9 (commercialization stage), please detail further the technical constraint(s) or challenge(s) that still need to be overcome in order to achieve commercialization.

The Solution maturity stage is slightly above TRL 9; however, we would like to point out that the biggest downside of aeroponic culture, and more in general of vertical farms, is the large amount of energy it takes to grow crops: between 30-176 kWh per kg more than greenhouses. On a good note, the energy used in vertical farms is not wasted, as effectively vertical farms are more energy-efficient compared to regular greenhouses. Nevertheless, vertical farms have a higher yield (10X) and overall less plant waste generated. Lastly, we are working toward improving the quality of the material used, as well as ensuring a proper and efficient energy monitoring system and data collection is implemented to be able to reduce the energy consumption, prevent and forecast energy shifts to optimise the process. To be noted that the indoor farming, to date is still facing technical limitations that have the potential to be overcome in the future, however it cannot completely substitute every line of products, but it should be seen as a complementary technique to implement for specific crops. Indeed, fruits and vegetables are the most suitable plants for vertical farming, as they require less time to grow, low water supply, and less sunlight. Crops, such as sugarcane, rice, and wheat, among others, require high amount of water and more harvesting time, and are hence, difficult to cultivate under vertical farming conditions.

3.1 — CASE STUDY

What would be one representative example of use of your Solution?

The Solution was installed at the beginning of 2020 for a client: FOODITALY in Milan. FOODITALY owns three large concept stores across the city, with the biggest located in the heart of Milan, which combines top quality restaurants with one of the largest fresh-products market in the country collecting the best products from Italy. The customer wanted to make FOODITALY a place where the consumer can discover the greatest Italian biodiversity and food culture on a fascinating gastronomic journey. Thus, FOODITALY invested in four units of 800 m2 of our vertical farming to ensure fresh leafy vegetable are delivered daily to their markets all year around. The aeroponic farm was built in the city centre around November 2019 and it is effectively running since 1st of January 2020, serving the FOODITALY's markets on daily basis. With over 10.000 visitors per week, the main shop holds a sales record, maintaining affordable prices and high-quality products all year around. The project, while still in its infancy, showed that there were several advantages, including high production efficiency per area (over 900 plant per m2), self-optimisation of water consumption since onset (17% less from Jan 2020 – May 2020) thanks to the AI monitoring, as well as a complete reduction of several lines of products previously purchased from external suppliers (no trucks for transport, and no CO2 emissions). Preconditions for the successful adoption of this technology with other partners that uses a similar business model across Europe are under evaluation. The impact on the users was also measured through monthly surveys collected in January, February, March and April 2020, and was also deemed to be positive. The Results show that for the consumer eating non treated fruits and vegetables grown locally with a slow perishability (rated 9/10), as well as reducing the CO2 emissions (rated 8/10) are highly important.

3.2 — MAINSTREAM ALTERNATIVE

Define the unbranded mainstream alternative to the Solution which currently serves a large share of the market (at least 40%) in the same geographical context. Please make sure this is in line with what you have described in the section above (case study).

The mainstream alternative to vertical farming is to use primary resources as soil and water through the classical farming system (field-based or greenhouse-based cultures). In the case study provided above, our client (FOODITALY) prior to our contract would rely on 20 different suppliers, spread across the whole country, to bring to their main market fresh greens (e.g. leafy greens, herbs, and certain type of vine plants). The mainstream alternative, which relies on production off-site as well as distribution to the final retailer's shop is highly dependent on climate change (availability of primary resources such as water and soil) as well as highly demanding in term of carbon footprint (due to the high impact of packaging as well as transport). Indeed, in order to maintain and improve nutritional standards globally, there is the urgency to implement more sustainable food supplies, which are capable of being flexible and adaptable to unknown climatic and commercial challenges.

3.3 —

ENVIRONMENTAL BENEFITS

Have you done a Life-Cycle Assessment?

No

If Yes, Please upload below your Life-Cycle Assessment documents.

If No, (a Life-Cycle Assessment is not available yet) we still need to understand the Environmental impact of this Solution compared to the mainstream alternative described above. Therefore, please fill in the details in the simplified LCA attached.

In both cases, use this space to further elaborate the quantitative data provided:

We have submitted an LCA request to an external party, which is currently working on this project (expected results Dec 2020). In the meantime, we have completed the « Simplified LCA » as requested by the Solar Impulse Foundation. The goal of the information included in the LCA is to evaluate the environmental performance of a high-yield vertical aeroponic farm, and to compare it to conventional agriculture. The simplified analysis shows whether and to what extent this type of aeroponic is able to produce leafy greens, herbs and vine plants with a lower environmental impact than Soil-based conventional agriculture. To be noted that aeroponic farming, will not be capable of fulfilling the entire food requirements of this market (FOODITALY – Milan market store) thus evaluating different crops than the one described is out of scope.

Please highlight any other additional environmental benefits of the Solution compared to the mainstream alternative (optional).

The CO₂ emission were more complex to calculate, as many factors come into play, however the reduction or elimination of transportation, as well as operating tractors, tillers, and harvesters, to washing machinery can reduce emissions up to 92%. Generally, but also for the case study provided, we build the vertical farms on major distribution channels and near population centres to bring local, fresh greens directly to the consumers. While the benefits must be better quantified through a proper LCA, we are confident that we have built a system that makes efficient use of local resources such as water and land and is capable of providing a number of environmental benefits compared to greenhouses and conventional agricultural methods.

4.1 — FINANCING

What type of financial resources do you rely on?

Public Financing,

How is the construction or setup of your Solution funded at present (CAPEX: equity, bank financing, loans, grants,...)?

When we created our legal structure in 2018, we launched a crowdfunding campaign that reached 145% of its objective thanks to 300 contributors and a company from the Etiad Group (Public Financing). The crowdfunding campaign was made in order to launch our proof of concept (at small-scale) in the south of Italy. We then developed our next operations with 4 new clients and early adopters, including the one mentioned in the case study above (FOODITALY). We are also backed by strategic investors and private and institutional Venture Capital firms. We went through an initial seed funding and an A-round in 2018-2019 (Private Financing). Lastly, we received awards and been accredited by many private and public organizations such as Italian CleanTech, VentureKick and, Startup Top 100.

4.2 — HUMAN ASSETS

How has the size of your team grown in the past years?

The company started in 2018 with 2 founders, and the team today is constituted of 40 people, with very different profiles and backgrounds. Under the leadership of the CEO, the company is structured in three teams: 5 PhD graduates and 5 Post-docs from prestigious universities and 10 engineers with over 20 years of experience coming from different industries working on R&D. In addition our team is composed of 5 graduates from the best business schools in the marketing and sales team and 15 experienced technicians in the manufacturing team (also in charge of setup and maintenance).

4.3 — CURRENT PROFITABILITY

Is your solution already commercialized profitably?

No

IF YES, please indicate the year in which profitability was achieved and the volume in units sold in that year, as well as the volume in units sold in the current year.

"Not relevant" the Solution is not profitable yet - we have filled in the next section about forecasted profitability.

If profitable, please indicate the purchase price of your Solution, then describe the factors that will sustain sales volume at a profitable level.

"Not relevant" the Solution is not profitable yet - we have filled in the next section about forecasted profitability.

4.4

FORECASTED PROFITABILITY

What is your plan to achieve the breakeven sales volume? Please also indicate any regulatory or legal barrier preventing today the commercial development of the Solution.

Regarding the first point - Total cost to deliver an unit to a client and Sales price per unit – we cannot be entirely specific on the cost of our Solution, as it is highly dependent on a wide variety of factors (size, customisation), however we can give indicative estimates of the costs and savings involved (e.g. an 800 m2 facility cost around EUR 1000-1500/m2 for a total investment of 1M EUR). The Client (as per example of FOODITALY) will save over 350'000 EURO of inbound freight per year. Our financial prevision sets 2021 as our breakeven year. Our OPEX are comprised between 200.000€ and 400.000€ per year depending on the number of projects on the field. They cover the expenses for local salaries for the installation of the vertical farm structures, and the AI monitoring. Our target is to reach 10 projects per year to generate a profit. We are confident that the European market is a sufficient starting point to launch and expand out business in the next 12 months.

What is the forecasted breakeven sale (indicate: time and revenue) for your Solution?

2021

Please provide details about the market analysis in the context of your business plan.

Europe is traditionally the largest market, that is implementing advanced techniques in hydroponics smart greenhouse horticulture. The major vegetable and fruit crops that are grown using hydroponics in European countries include, cucumber, tomatoes, roses, and peppers among others. As consumers are becoming increasingly aware of the quality difference in greenhouse-grown vegetables, the demand for hydroponics culture is increasing in Europe. The demand for aeroponics industry is expected to increase rapidly, owing to rise in popularity of organic food and disease-free environment in the agriculture sector. The technologies used in this farming enable to keep track of plant growth and harvesting, which further drives the market growth. As per the report published by Allied Market Research, the global aeroponics industry was projected at \$578.7 million in 2018 and is anticipated to hit \$3.53 billion by 2026, registering a CAGR of 25.6% from 2019 to 2026. The region across Asia-Pacific held the largest market share in 2018, accounting for nearly half of the total market share. On the other hand, the Europe is estimated to register the fastest CAGR of 28.8% during the forecast period. Europe was the largest producer of hydroponic crops in 2018. It is still the largest market for hydroponically produced crops. Europe has traditionally been at the forefront of implementing advanced techniques in hydroponic smart greenhouse horticulture. Lastly, regulatory and legal barriers, at date, the European market lacks in unification concerning construction and operation of hydroponics and aeroponics facilities, thus impacting the commercialisation of their products. A number of different EU policies exists, but unification and standardisation remains a challenge. We hope that in the future insitutional conditions could be improved to better implement and support these emerging technologies. We are part of the European Aquaponic Association (<http://europeanaquaponicsassociation.org/>) in order to keep ourselves updated with the latest developments in the field as well as regulations. By being

part of the network we are also capable of initiating relationships and conversation with practitioners, researchers, and public parties.

4.5

CLIENT'S ECONOMIC INCENTIVE

What is the financial impact of your Solution for your client compared to the mainstream alternative? Please indicate: Sales price, Use cost over lifetime, and Payback time.

As mentioned in the section above, it is not simple to calculate exactly the sales price, given the that each aeroponic farm is designed around the client's needs. The up mentioned calculation (340'000 EURO savings of inbound freight per year) does not include additional savings related to climate-change impact on products and supply-chain situation across the country (e.g. failed or low harvesting periods, lack of supply, spoilage of products during transport). The Solution, as previously mentioned, offers a higher yield, meaning that our customer will be able to provide more fresh greens to the market (over 50% more), compared with the previous supply chain strategy, savings are estimated to be between 300'000 and 500'000 EUR/year. This rough estimate does not include additional potential savings and improved efficiencies (achievable over time) driven by the AI monitoring system that controls the smart-light, smart-nutrition, and smart-pest-management. As previously mentioned, the monthly subscription cost on average 15-50 EUR/month and provide real-time data visualisation, predictive analytics and recommendations for managing at best the vertical farm. The amount of the subscription fee depends on the number of data streams connected to the platform, as well as the duration of the commitment and the number of features chosen. We are confident that the Solution offers strong financial returns, which is expected to generate a 20% Return on Capital Employed within 7-9 years (depending on local construction and energy costs).

Is your Solution providing hidden benefits / added value for society that would translate into quantifiable savings? (optional)

Aeroponics is an environment-friendly and profitable technology. Indeed, vertical farming reduces over ripening of vegetables and fruits and minimises the use of chemicals, fertilisers, and pesticides sprayed on the crops, which could lead to health issues. Also, no insects or agricultural pests can attack the plants in vertical farming. It has been promoted by the various governments and non-governmental organisations for its benefits in terms of food security. The need for food supply against the explosive population increase by 2050 has catalysed the growth of the hydroponics market. Another interesting point, which has not been addressed in this application, is the potential for large-scale production of biopharmaceutical proteins to be used for making new drugs and vaccines. Conventional methods of manufacturing biopharmaceuticals involve use organisms, which are highly expensive. However, using existing agricultural technologies, such as vertical farming to produce biopharmaceuticals in plants is cost-effective, requires less time and efforts, is pollution-free, and easy to measure. While difficult to establish quantifiable savings, it is clear that this technique holds several advantages that can positively impact society.

4.6

NEEDS

How can Solar Impulse support you?

Enhance credibility/recognition, Provide investment opportunities, Meet potential new clients,

Provide details if necessary

There are several limiting factors which restrains the growth of the vertical farms' market, including: initial investments to setup the vertical farm, requirement for skilled workforce, and lack of information/awareness around the operational and technological benefits of complete aeroponics farming method. As a result, we are looking for enhancing our credibility through the label and meeting new potential clients.

5.1 — SOLUTION

Solution description

In traditional farming, growing an adequate amount of healthy food is a big challenge. Moreover, protecting the crops from inclement weather, reduction in fertile land due to growing industrialisation and urbanisation, and low availability of cultivable land, are big hurdles for traditional farming. The increasing consumer demand for pesticide- and herbicide-free food and the growing requirement to reduce the carbon footprint of traditional agricultural practices are among the major factors supporting the wide adoption of aeroponics farming across the globe. The Solution aims at providing a sustainable, profitable, and ecologically healthy option to traditional farming for small, medium, and large food retailers. This Solution relies on indoor farming techniques and controlled environment agriculture technology, to improve plant development stages, growth, and health. - Customisable units from 80 m2 to 800 m2 - higher yield (10X) and overall less plant waste generated

Market application

The demand for aeroponics industry is expected to increase rapidly and to hit \$3.53 billion by 2026, as a result PLANTSHUB- Soil-less Aeroponic growing System aims at becoming established in Europe in the coming years and to implement 5-10 new projects per year.

Clients

B2B,

5.2 — IMPACT

Environmental benefits

- High production efficiency per area (over 900 plant per m2);
- BPA-free recycled plastic material with lifetime of 15 -18 years;
- Can reduce emissions up to 92% and water consumption up to 95%;

Economic benefits

- 340'000 EURO savings of inbound freight per year;
- 20% Return on Capital Employed within 7-9 years;

5.3 — LOOKING FOR

How can Solar Impulse support you?

New clients, Visibility, Credibility,

Provide details if necessary

No additional requirements.

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