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DELIVERABLE

Final replicability and transferability plan

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Executive Summary

The LIFE GAIA Sense's technology replication and transferability plan has been developed. This plan defines the transfer methodology, identifies the projects results to be transferred, the key actors and sectors to be addressed by these transfer actions, the stakeholders outside the partners' areas to be contacted, and other necessary information to be considered for an efficient transfer of the technology.

This means going further than simply committing to project continuation through commercialization. It entails a clear and sound plan supported by project activities that would allow market replication/transfer to other sectors, entities, regions or countries.

An innovative product such as gaiasense that has been shown to be effective in one setting may turn out to be ineffective somewhere else, even supposing it can be implemented there. Therefore, systematic reviews of relevant interventions should appraise the applicability of the intervention process and the transferability of the intervention effectiveness to other localities.

Communication and dissemination activities, having a transversal function, have an important role in enhancing the replicability and transferability strategy by enabling to reach a wider audience and by providing long-term dissemination tools.

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Definitions, Acronyms and Abbreviations

Acronym/Term	Explanation
AC	Agricultural Cooperative
EU	European Union
GAIA	GAIA EPICHEIREIN ANONYMI ETAIREIA PSIFIAKON YPIRESION
MIRABELLO	Agricultural Cooperative Partnership Mirabello Union S.A.
NP	NEUROPUBLIC AE Pliroforikis & Epikoinonion
PO	Producers Organisation
SF	Smart Farming

1. Introduction

1.1. Project Summary

The main objective of the LIFE GAIA Sense project is to demonstrate gaiasense, an innovative “Smart Farming” (SF) solution that aims at reducing the consumption of natural resources, as a way to protect the environment and support Circular Economy (CE) models.

More specifically, this project will launch 18 demonstrators across Greece, Spain and Portugal covering 9 crops (olives, peaches, cotton, pistachio, potatoes, table tomatoes, industrial tomatoes, almonds, kiwi) in various terrain and microclimatic conditions. They will demonstrate an innovative method, based on high-end technology, which is suitable for being replicated and will be accessible and affordable to farmers either as individuals or collectively through Agricultural Cooperatives.

Moreover, LIFE GAIA Sense aims to promote resource efficiency practices in SMEs of the agricultural sector and eventually, contribute to the implementation of the Roadmap to a Resource Efficient Europe. This project will demonstrate a method on how the farmer will be able to decide whether to use or avoid inputs (irrigation, fertilizers, pesticides etc.) and more specifically how to apply them in a most efficient way, without risking the annual production. The focus is on the resource consumption reduction side of CE, and the results will be both qualitatively and quantitatively, considering the resources’ efficiency in agricultural sector.

1.2. Document Scope

This deliverable presents the final replicability and transferability plan for LIFE GAIA Sense project. Replicability Strategy is designed with principal objective will be the transfer of technical knowledge, results obtained in the project, problems encountered and lessons learned during (and after the end) of the project. It is the aim that this Strategy will be a multiplier of the impact of the project, offering solutions, which can be applied to other places, both at a European as well as at a global level.

The aim of Action B8 is to incorporate information obtained in this action and action B9 such as business scenarios emerging from the LIFE GAIA Sense project, incorporating business model, cost-benefit analyses as well as a MATRIX analyses.

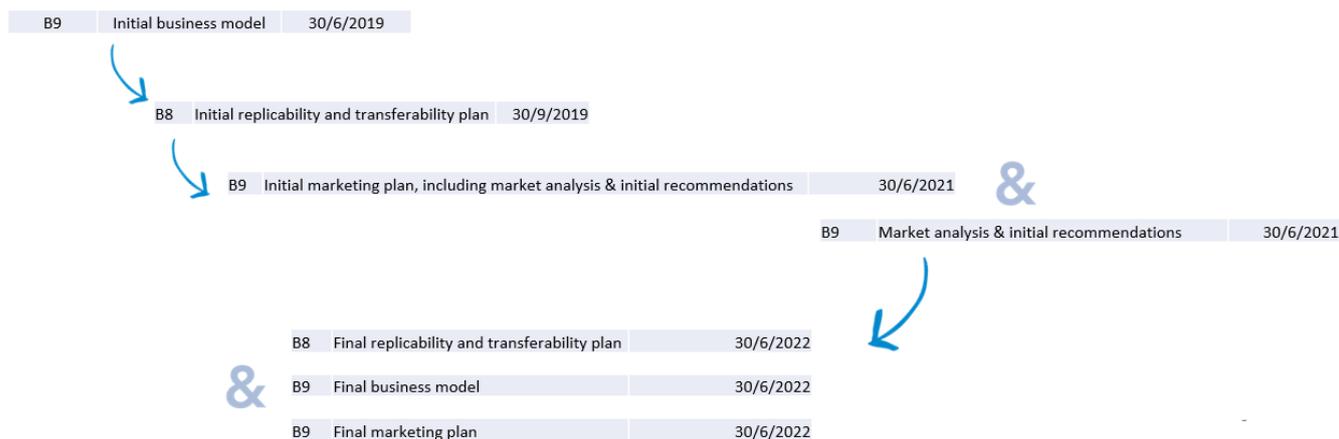


Figure 1 LIFE GAIA Sense's Final replicability and transferability plan work plan scheme

1.3. Document Structure

This document is comprised of the following chapters:

Chapter 1 presents an introduction to the project and the document.

Chapter 2 presents the Final replicability and transferability plan Strategy.

Chapter 3 presents the target market of gaiasense

Chapter 4 presents the international target- countries for the replication of gaiasense SF solution

Chapter 5 presents the other sector that gaiasense solution could be transferred

Chapter 6 presents the studies/activities regarding the access to financing sources as well as the physical identification of sites for replicability and transferability

Chapter 7 presents the conclusions

2. Final replicability and transferability plan Strategy

The goal of the replicability and transferability strategy is to multiply the impact of the Project results during its implementation and to replicate and transfer its findings after its end, in order to reach a wider audience and implement its results in further sites, regions and sectors, other than the Project demo sites.

It was evident since the start of the project that the process of conceiving a replicability strategy would require interactions with stakeholders, as their inputs and involvement was considered crucial both for the development of a replicability plan and for the actual implementation of the replicating effort in the future. Actions performed in the context of LIFE GAIA Sense, helped to sound the ground for the feasibility of a replication effort in the areas of transferability of the project identified in the workplan (below), to conceive a methodology for its implementation. Also, the training, the Policy Uptake event, the lobbying activities with policy makers at EU level and the final conference were key part of this process, especially for the stakeholders' involvement.

Growth is crucial to the long-term survival of any business, and so its expansion is a significant undertaking that comprises of many rewards and certain risks. Therefore, careful measures with a foolproof strategy have been designed in order to minimize the risks.

Research

LIFE GAIA Sense Final replicability and transferability plan Strategy has, first of all, taken up actions to discover new target audience with proper research. Research of the most feasible region, sectors, the demographics, culture, market and so on. The aforementioned will be duly analysed in the following sections.

Competitors analysis

Market/Competitor analysis is absolutely essential in order to identify competitive market in agriculture. Smart farming market is facing immense competition affecting margins and sales. Thus, an assessment of the competitive landscape and its practices has been carried out, whereas the services /products that rival businesses provide have been taken into account for the final replicability and transferability plan.

Market Testing

Test markets are an established part of marketing folklore and an accepted piece of the marketing armory, that is performed in order to mitigate risk, but also to see if something will actually be successful at disrupting the "industry" and driving the bottom line.

LIFE GAIA Sense consortium members through their participation to other EU co-funded projects have explore the possibility of replication and transferability to other potential markets/ sectors.

Local Approach/ Strategic partners

Stakeholder engagement was critical for the successful implementation of projects actions. Moreover, they play a key role regarding input for making decisions to support business objectives related to growth, risk management and operational excellence, and for collaborating to address local stakeholder priorities. Simply put, constructive stakeholder relationships are essential for gaisense to creating mutually beneficial outcomes. Our approach to stakeholder engagement is to systematically identify our stakeholders and engage with them through ongoing dialogue to share information about gaisense, respond to questions, listen to their observations and act on their concerns, as appropriate. In general, we prioritize our level of engagement with different stakeholder groups based on their proximity to – and interest in – our activities.

Without prejudice to others that may be identified afterwards a number of entities that constitute the target audience of the Strategy to be developed are already identified as strategic elements for replicability and transferability, including: farmers, agricultural cooperatives, advisors, researchers and developers of smart farming solutions. Moreover, consortium members seek new partners with complementary capabilities to gain access to new markets and channels and build entire portfolios of practical and value-creating partnerships.

With the information obtained in actions B8, B9 and D2, an assessment of the demand and studies of the different markets, in terms of the geographical areas and sectors as well as the different market segments was undertaken. The summary of these studies results in a definition and preliminary evaluation of the different business scenarios, studying all different variables that make one scenario different from another. These results, allowed the design of new business models that was adapted to each new region and final customer, including the appropriate pricing strategies.

2.1. Research- Target market

Gaiasense target market consist of people or sectors who are connected in agriculture and rural activity. When the project started and activities were being planned, we put great effort in influencing and spreading awareness by being integrated in the existing networks of stakeholders, as information is spread within such networks effectively. In addition to this, project partners are more than confident that the many participants in various LIFE GAIA Sense events have assimilated knowledge from us and used it in their own contexts.

The stakeholders that LIFE GAIA Sense has worked with during the lifetime of the project included farmers, agricultural cooperatives, advisors, researchers and developers of smart farming solutions. Bearing in mind that every area or country faces similar problems, we have roughly sketched out the potential stakeholders and target groups as it is depicted at the following Figure.

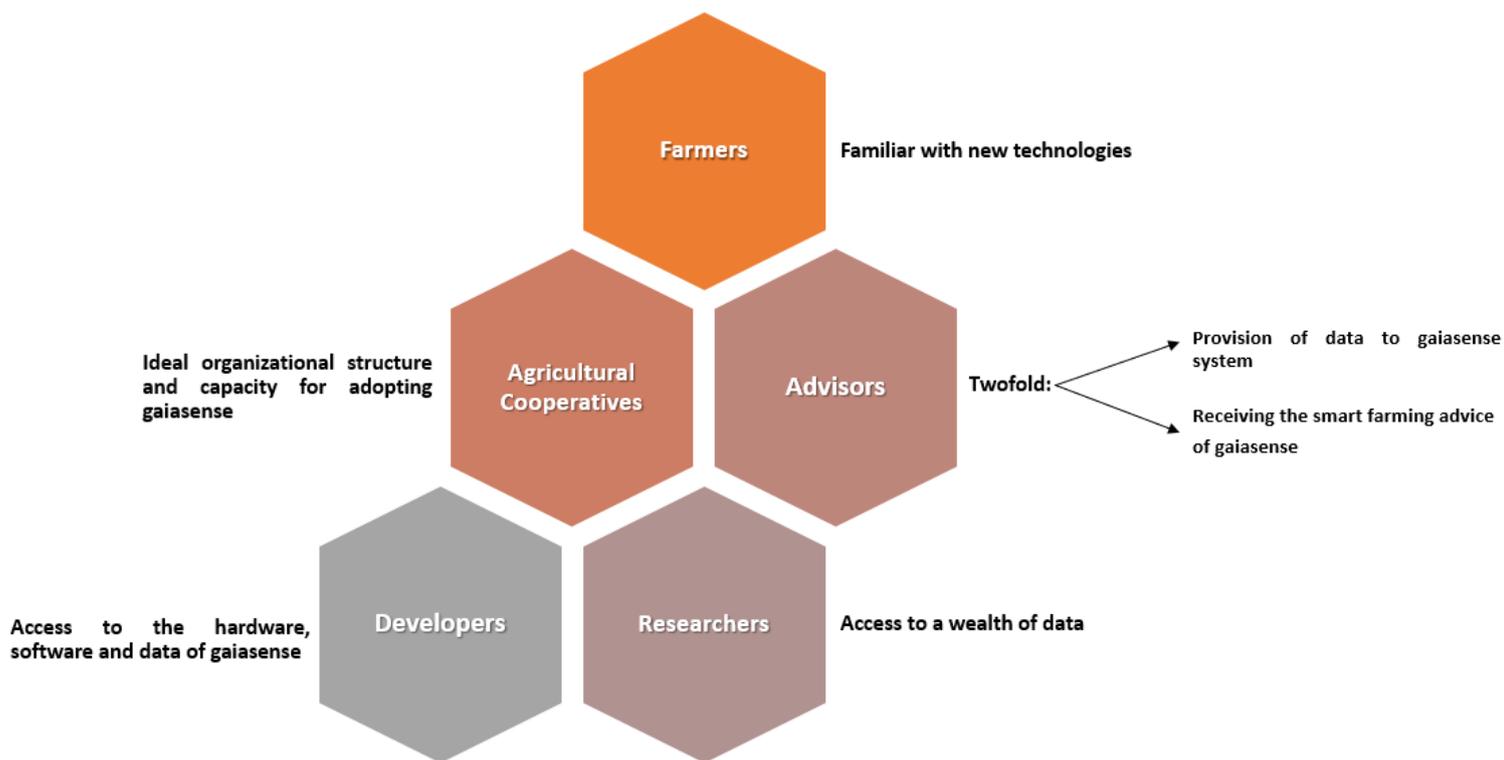


Figure 2 LIFE GAIA Sense's User Types

3. People connected in agriculture and rural activity

3.1. Farmers

Farmers are the main targeted group of gaiasense solution as they form the end users who will apply the outcomes of the project and will use the provided services. Farmers could be benefited in various ways from using gaiasense solution, as smart farming and gaiasense as a pioneering smart farming solution allows for better use of inputs, improved product quality and added value of the production, which translates into increased profit for the producer. Furthermore, smart farming comes to support the existing quality systems and standards, by facilitating the quantification of various parameters required by these systems, through the digitization of production.

3.2. Farmers' cooperatives

Agricultural Cooperatives are another main target group of the gaiasense solution as they, in contrast to individual farmer of rather small farms, will use the services in an extended area, and the agronomist/agricultural advisor do have the skills to guide farmers through the implementation of a smart farming advice.

3.3. Agronomists- Agricultural advisors

Agricultural advisors are expected to give scientific, efficient and accurate advices to producers. Smart farming highlights the role of the agronomists in the decision-making process for optimizing the production, as it is heavily based on their experience. Agricultural advisors, through smart farming, take on a more scientific role based on the collection and interpretation of data as well as on the guidance of farmers. In addition to this, gaiasense SF solution provides to agronomists/agricultural advisors all the needed tools that allows for better use of inputs, improved product quality and added value of the production, which translates into increased profit for the producer.

3.4. Researchers

Gaiasense enables researchers to apply their research results in practice. Also, gaiasense provides to researchers the ability to have access to real data (such as atmospheric and soil data) in order to be able to design, customize and validate their scientific models. This is not always feasible, as the necessary data either do not exist or are not accessible. The gaiasense platform enables researchers to test their research results in real-world conditions in fields of collaborated producers. At the same time, they gain access to valuable data that will help them validate or control their research results in practice.

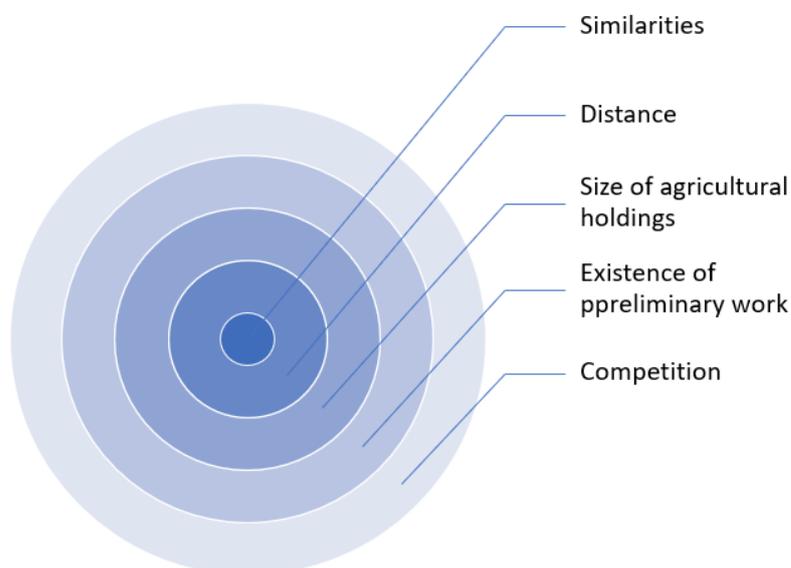
gaiasense is a dynamic, extensible platform that can integrate new scientific models and ensure their experimental application on large-scale land fields and specific crops. It offers an enormous amount of data that can be accessed by researchers for research purposes. With gaiasense, research in the agro-food sector can now be supported and verified under real conditions.

3.5. Developers

A small but important market segment is the one consisting of developers of smart farming solutions. In collaboration with gaisense, they can have access to the hardware, software and data of gaisense so that they can develop new functionalities that provide added value to the services. The gaisense smart farming system is designed in an open way, so that third-parties can collaborate and use the existing resources, building new tools on top of them.

4. International Target

After evaluating the local, peripheral results of project's application in Greece, Portugal & Spain, new potential markets will be explored. Starting from the succeeded investment on the small scale, the project intends to be expanded in potential markets inside EU. With the purpose of reaching a transferability and replicability more efficient of the project in other EU territories, the following criteria have been used:



- ✓ Similarities with Greece: landscape characteristics, the climatic conditions, the soils fertility and composition and all those characteristics that are related to the cultivation of a crop
- ✓ Distance from Greece: Distance plays a role and is important at this stage in terms of the most direct contact but also as far as logistics is concerned.
- ✓ Size of agricultural holdings: As it is clearly mentioned at the smart farming market research report a major factor restraining the growth of the smart farming market, according to the report, is the necessity for expensive initial investments: Currently, smart farming tools are expensive, making it unaffordable for smallholder farmers in developed regions. The gaiaSense smart farming system has addressed this challenge, as it follows the “Smart- Farming-as-a-Service” model. In this way, farmers do not need to invest in expensive technological tools and infrastructure; instead, they only have to pay a relatively small annual subscription in order to have access to the smart farming services of gaiaSense.
- ✓ Existence of preliminary work in the context of others EU projects
- ✓ Competition- The constantly growing smart farming ecosystem results in a competitive environment. There are various companies which develop and offer a wide variety of smart farming offerings, with a diverse set of characteristics. Thus, competition is one of the criteria for the selection of the most appropriate countries to transfer gaiaSense.

Afterwards, a weighted Factor & MATRIX Analysis was performed- whereby competing alternatives were evaluated by scoring each offer against a series of criteria that are weighted to reflect the importance to the final decision of LIFE GAIA Sense's transferability plan.

In the context of LIFE GAIA Sense's Final Replicability and Transferability Plan, a study has been carried out in order to investigate the smart farming market in Spain, Portugal, Cyprus and Romania that have been indicated as attractive countries for the expansion of gaiasense Smart Farming system at the Initial Replicability and Transferability Plan.

This report focuses on each country individually and, based on several factors, concludes on whether the countries are attractive to expand into, require a closer look, or are probably not attractive to expand into. There are a number of general country-specific factors that are likely to support arguments for expansion, such as a large amount of small and medium landholdings, a strong cooperative movement, a favourable/supportive policy environment for smart farming, existing investments in smart farming infrastructure, scope for improvements in agricultural productivity, a smart farming market that is not very saturated or well developed. Information contained within this report is drawn from a variety of sources including agricultural censuses, databases, internet articles, and reports. The following subchapters provide an overview of the companies that provide smart farming products and consulting services in each country, smart farming projects and quality systems in each country, major/international agricultural trade fairs and exhibitions in each country, and sites that function as market observatories, a more detailed analysis of the state in which smart farming is in each of the countries, and a section about international smart farming companies and international competitors.

The smart farming market across Europe is fragmented with some countries having a relatively well-developed smart farming sector and others a relatively underdeveloped one. Overall, richer countries have more developed smart farming markets and infrastructure as compared to others. Additionally, it is important to note that there are a multitude of competitors/actors operating in each country providing different smart farming services and models. Many of these competitors provide smart farming services which target large farms and largely ignore smaller farmers. Indeed, a common trend among all countries covered in this analysis shows that the larger farms in all countries covered generally utilize smart farming management platforms, as well as other smart farming technologies such as drones and tractors, on the other hand the incidence of farms using these technologies drops rapidly the smaller the farms are. This is significant as it illustrates that a successful model for targeting small farmers that acquires scale is missing in all the selected countries, but it also suggests that gaiasense's model in Greece, working closely with cooperatives, could be replicated in other countries if the right partners are found.

Furthermore, even though smart farming technologies have been around for a number of years, there is significant recent interest in smart farming initiatives across Europe from a wide range of actors including governments, research institutions, NGOs, private companies, global multinationals, venture capitalists, farmers, etc. This report also shows that a few large multinationals are getting involved beyond just building the traditional smart equipment (tractors, drones, etc.) but are also entering the market for smart farming management platforms as well as starting to target smaller farmers. This is important as these multinationals, due to their scale and resources, can have an advantage over other competitors.

4.1. Spain

Spain has very large agricultural sectors, a mixture of small and large landholdings (with less well-developed smart farming market for smaller farms), a Mediterranean farming context, strong cooperative movements and a civil society interested in smart farming. The main drawback to entering this market is that the smart farming market in these countries is relatively well developed (as compared to other countries) and already contains a number of potential competitors to gaiasense. Even though none of these potential competitors seems to have a very large market share their existence may make it hard to expand into. Moreover, Spain appears to have the highest levels of institutional support among EU 27 (projects supported by civil society and government) for smart farming initiatives.

- 4.1.1. Farming Characteristics/ Context
- 4.1.2. Competitor analysis- Smart farming
- 4.1.3. Major/International Agricultural Trade Fairs and Exhibitions
- 4.1.4. Strategic partners

4.2. Portugal

Portugal is an interesting country for gaiasense for many reasons, it has a large and growing agricultural sector, small average land holdings and farming characteristics (crops, soil, climate) that are similar to Greece's. Partners from Portugal reported that the main issue for Portuguese farmers is the reduction of inputs for economic reasons (i.e referring to the financial sustainability of their production) and environmental reasons, i.e. to demonstrate an environmentally-friendly farm management approach; it seems that many opinion makers and politicians in Portugal have a critical discourse on the impact of farmers in the environment.

- 4.2.1. Farming Characteristics/ Context
- 4.2.2. Competitor analysis- Smart farming
- 4.2.3. Major/International Agricultural Trade Fairs and Exhibitions
- 4.2.4. Strategic partners

4.3. Cyprus

Cyprus is an attractive country for gaiasense to expand into as its farming characteristics are very similar to Greece's and therefore there should be many possible synergies to facilitate the expansion. These synergies include small average landholdings, similar crop and production environment and a comprehensive cooperative movement. The one potential drawback is Cyprus' small agricultural sector which would likely cause a low return on investments.

- 4.3.1. Farming Characteristics/ Context
- 4.3.2. Competitor analysis- Smart farming
- 4.3.3. Major/International Agricultural Trade Fairs and Exhibitions
- 4.3.4. Strategic partners

4.4. Romania

Romania has a number of attractive characteristics including a potentially large untapped market, relatively small average landholding size, and very little competition. It is likely that there will be some difficulty in finding Romanian partners to cooperate with, especially considering that its cooperative movement is not very well developed. With regards to very small farms, an opportunity arises in Romania where more than half of all the very small farms in the EU 27 are located in this country but the issue of the absence of agricultural training of farm managers remains.

- 4.4.1. Farming Characteristics/ Context
- 4.4.2. Competitor analysis- Smart farming
- 4.4.3. Major/International Agricultural Trade Fairs and Exhibitions
- 4.4.4. Strategic partners

5. Others sectors

LIFE GAIA Sense's transferability plan consists in the search of other sectors in which this technology could also be successfully applied. The located potential sectors for applying the giasense solution could be the greenhouses and the indoor farming. In particular, the transferability study of giasense has identified other sectors in which this technology could also be successfully applied and the assessment of the technical-economic performance of the different characteristics of each industrial sector based on its location, treatment technologies, is completed.

Thus, for the analysis of the potential sectors to transfer the proposed process, three main phases were followed:

- 1) Performing a preliminary analysis of different sectors of smart farming services where the technology could be applicable.
- 2) Preparing a simulation of the preselected alternatives, in which the economic performance is assessed according to aspects such as management costs, amortization costs, etc.

3) Results analysis, determining the different sector into which the propose technology would find an interesting use.

5.1. Greenhouses

Greenhouse provides farmers with an option to provide optimum cultivation condition by offering a controlled environment according to the crop's requirements. However, many farmers fail to get good profits and desired yield from greenhouse crops because they cannot efficiently monitor and control important factors like light, air, temperature etc., that determine plant growth and productivity. Some of the major challenges faced by traditional greenhouses:

- Temperature going higher or below than a certain degree
- High humidity – resulting in crop transpiration
- Condensation of water vapor
- Water evaporation from the humid soil

With traditional greenhouses, growers can control the environmental parameters through a proportional control mechanism which involves manual intervention, often resulting in production loss, energy loss and increased labor cost. There are several limitations of having to manually control all the factors that can affect the quality of plants and their yields. Hence, an automated monitoring and controlling system is a solution that enhances greenhouse farming which will take guesswork out of the job.

Gaiasense's holistic service for smart greenhouses is expected to provide advanced microclimate control and energy optimization. Growers can monitor and control the parameters mentioned below to ensure better growth rate of the crop:

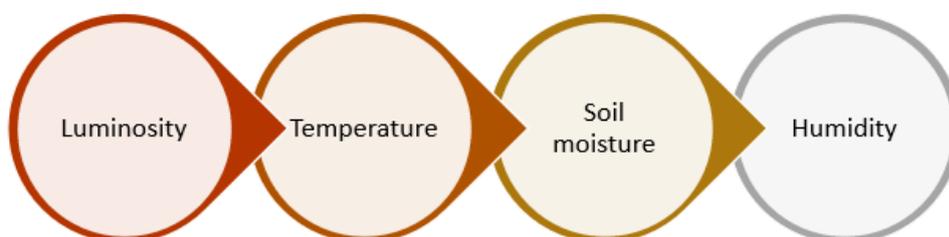


Figure 3 Gaiasense's Smart Greenhouse solution benefits

Growers can monitor the following parameters to understand the plant growth cycle and take proactive measures if any of the factors are affected:

- Nitrogen monitoring to measure the puffiness of the produce

- Phosphorous deficiency to measure soil fertility
- pH Value
- CO2 level

The benefits of using a smart greenhouse solution, as gaisense, could be the creation of the right environment for better yield. Moreover, farmers can tailor an environment for their crops that offers a climate-smart and nutrition-sensitive atmosphere to increase the quality of crops and use water correctly- water wastage is one of the major challenges that the agriculture sector faces today. By quantifying water usage, gaisense Smart Greenhouse could help growers to increase crop yields while conserving water. Gaisense Smart Greenhouse ensures apt conservation of water by setting a schedule based on the type of crops, quality, yield and local weather parameters. In addition to the aforesaid, through smart greenhouse the consumption of resources could be monitored. An automated control system of a smart greenhouse uses a network of sensors to monitor and measure the run-off. The insights gathered are used to measure energy consumption which in turn helps growers to use the resources optimally. Furthermore, growers will have the opportunity to monitor their parameters that are crucial for healthy growth of the crop, send alerts when there's a problem and allow them to manage everything remotely on any device.

5.1.1. Competitors

5.1.2. Testing of transferability of gaisense to greenhouses

5.2. Indoor farming

Indoor farming is an alternative growing method where crops are grown in a controlled environment. It is employed to produce several vegetables and fruits, microgreens and herbs, and ornamentals on vertically inclined surfaces or under greenhouses and container farms. In the case of indoor farming, vegetables and other fruits are grown on a single level, such as in a field or a greenhouse. Indoor farming technology involves the integration of numerous technologies such as big data analytics, robotics, artificial intelligence (AI), and the internet of things (IoT) so that crops can be produced perfectly without any agronomic constraint. Aquaponics, aeroponics, and hydroponics are alternate farming techniques under indoor farming in which plants are grown in a non-traditional way. The key advantage of using indoor farming technologies is that it increases crop yield with a smaller unit area of land. With the advancement of technology, equipment such as heating, ventilation, and air conditioning (HVAC), LED grow light, aeration system, and irrigation system, sensors, monitors, and others are being utilized for efficient crop growth through indoor farming.

The indoor farming technology market by technology category is dominated by the hardware system segment. These hardware systems are known as the complete substitute of the natural conditions for traditional farming. The hardware systems play a key role in regulating these factors manually. Hence, sensors, controllers, climate control devices, lighting systems, irrigation systems, and other devices

play a major role in this case. Gaiasense might offer a unique concept based on industrial ecosystem services for mimicking nature indoors in an optimized way to produce top quality and locally grown herbs and leafy greens.

The global indoor farming market size was valued at USD 39.5 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 13.5% from 2022 to 2030. Increasing consumer awareness regarding the advantages of consuming fresh and high-quality food is expected to drive the growth of the market¹. Regarding the European indoor farming market size was valued at USD 10.38 billion in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 10.4% from 2021 to 2028. The market growth can be attributed to the changing climatic conditions across Europe. Changes in temperature and weather adversely affect crop yield. These factors are promoting the demand for indoor farming in Europe. Various aggrotech companies are making efforts to curb the challenges imposed by climate changes on crops by adopting indoor farming practices². Developed countries such as the U.K., Germany, the U.S., and Canada are the rapid and early adopters of farming technologies. However, emerging economies such as India, China, Mexico, and Singapore are observing a substantial growth in the adoption of technologies integrated into indoor farms, owing to the rising demand for fresh crops. The supply chain of most of the industries across the globe got impacted due to the COVID-19 pandemic, including the indoor farming industry. Even though produce are grown in a controlled environment in indoor farming, due to supply chain disruption, farms could not deliver the products to the market in the first stage of COVID-19.³

5.2.1. Competitors

¹ <https://www.grandviewresearch.com/industry-analysis/indoor-farming-market>

² <https://www.grandviewresearch.com/industry-analysis/europe-indoor-farming-market-report>

³ <https://www.globenewswire.com/news-release/2022/01/31/2375458/28124/en/Global-Indoor-Farming-Technology-Market-Report-2021-2026-Focus-on-Hydroponics-Aeroponics-Aquaponics-Soil-Based-Hybrid-Methods.html>

6. Studies/activities regarding the access to financing sources for replicability and transferability

Both NP and GAIA have developed a plan/strategy for resource mobilization that is expected to lead to creative efforts in using their own local assets to gain support for both organizations. Multiple sources of funding can increase the independence and flexibility to implement of gaiasense's transferability and replicability strategy and reduce reliance on external (or foreign) funding. As it was mentioned at the *Initial Replicability & Transferability plan*, resource mobilization will ensure the continuation of gaiasense's transferability and replicability strategy by supporting organizational sustainability and allowance for improvement and scale-up of products and services of gaiasense.

7. Conclusions

The replicability and transferability strategy of the project is intertwined with several actions of the project that ensure a solid development of trust relationship, networking and future cooperation opportunity throughout the whole project lifecycle and beyond it. This deliverable provides the final replicability and transferability plan of the LIFE GAIA Sense project and the way the consortium organizes its activities towards the effective promotion of the project's results. To this end, a relevant strategy has been defined, incorporating the objectives, management, target audience, and sectors that will be targeted. It will serve as a blueprint and internal practical guide for replication of gaisense and will also ensure that partners put effort to the right direction.

Lastly, within strategic management, the following KPIs have been set in order to measure the key activities that are combined with gaisense's transferability & replicability plan.