FLEXIGROBOTS

D7.3 Business modelling and commercial exploitation report (I) (M24)

Document Identification			
Status	Final	**Due Date**	31/12/2022
Version	1.0	**Submission Date**	29/12/2022

Related WP	WP7	**Document Reference**	D7.3
Related Deliverable(s)	D7.3	**Dissemination Level (*)**	PU
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Co-funded by the Horizon 2020 Programme of the European Union

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Document History			
Version	Date	Change editors	Changes
0.1	28/07/2021	Thomas Gitsoudis	Table of contents and first draft version created.
0.2	08/09/2021	Kęstutis Skridaila	Partners' inputs incorporation and second draft version created.
0.3	01/04/2022	Kęstutis Skidaila	Partners' inputs incorporation and third draft version created.
0.4	01/09/2022	Kęstutis Skidaila	Incorporating partners updates received in GA and the fourth draft version created.
0.5	05/12/2022	Thomas Gitsoudis	Internal review version ready.
1.0	15/12/2022	Thomas Gitsoudis	Final version to be submitted.

Quality Control		
Role	Who	Approval Date
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List of Acronyms

Abbreviation / acronym	Description
AI	Artificial Intelligence
ADS	Agricultural Data Space
CA	Consortium Agreement
CAGR	Compound Annual Growth Rate
DIH	Digital Innovation Hub
DIAS	Copernicus Data and Information Access Services
DOs	Designations of Origin
FMIS	Farm Management Information System
GDPR	General Data Protection Regulation
GUI	Graphical User Interface
HaaS	Hardware-as-a-Service
HPC	high-performance Computing
IAM	Identity Access Management
IP	Intellectual Property
KER	Key Exploitable Result
OGC	Open Geospatial Consortium
OGC	Open Geospatial Consortium
SaaS	Software-as-a-Service
SAM	Serviceable Available Market
SME	Small and Medium Enterprise
SOM	Serviceable Obtainable Market
TAM	Total Available Market
UGV	Unmanned Ground Vehicle
UAV	Unmanned Aerial vehicle

Executive Summary

This deliverable encompasses the results of the first round of activities related to the exploration and development of business models applicable for commercial exploitation of the FlexiGroBots platform, the pilots within the project and their separate hardware or software components. During this process, such business models as Hardware-as-a-Service (HaaS) and Software-as-a-Service (SaaS) have been explored as viable alternatives to conventional approaches and business practices. During modelling, particular focus has been given to the activities and operational models of agriculture and/or robotics-focused Digital Innovation Hubs (DIHs) throughout Europe. These DIHs are foreseen among the main partners in joint innovation exploitation by providing direct outreach to prospective end-users (farmers and agriculture industry) within their regions of operation, sustaining pilot demonstrations and promoting the test-before-invest approach to the uptake of new products and services by the interested parties. In accordance with the DIH focused business model development strategy, an ecosystem of networked stakeholders and interested parties has been and will continue being established and maintained throughout the project.

1 Introduction

1.1 Purpose of the document

The aim of this deliverable is to present the outcomes of a process that was initiated on M06 of the project and it will be continued up until the end of it. This particular process revolves around two main pillars: i) the development of the appropriate and efficient business models for the FlexiGroBots platform and the solutions provided by the pilots within the project, and ii) the establishment of the appropriate ecosystem – with particular focus on the DIHs – that could enable the exploitation of the Key Exploitable Results (KER) of FlexiGroBots. Additionally, D7.3 provides a first glance of the sustainability strategy of the project and the upcoming plans for its long-term operation.

1.2 Structure of the document

D7.3 “Business modelling and commercial exploitation report” version I (M24) is structured in 8 major sections:

Sections 1-5: present the business model track primary information;

Sections 6-8: present the ecosystem building primary information;

Section 9: presents the project’s sustainability and long-term operation

1.3 Interim review comments

During the development of this deliverable, the consortium received the results of the interim review meeting of the project. There are two comments in the review report related to T7.3 “Business models and ecosystem building”, outcome of which this deliverable is.

The first one refers to the identification and presentation of the key stakeholders and the target groups that the FlexiGroBots solutions are addressed to. To this end, a specific section is included in this document (see section 4 “Customers and end-users profiles”) where a detailed presentation is given on the actors identified as the main potential customers of the FlexiGroBots solutions, their needs and requirements and the reasons that they would be willing to invest on such solutions (see Table 4).

The second comment refers to the engagement of DIHs in the go-to-market process for the FlexiGroBots solutions and the actions of the consortium towards this directions. Section 6 of this document addresses the need for a commercialization and exploitation strategy via the utilization of DIHs. Section 6.2 specifically presents the actions that have already been taken up until M24 regarding the engagement of the DIHs in this process and also an upcoming plan of actions for the remaining duration of the project.

2 Main services

2.1 Main services description

The main services structure is described in the following table and picture.

Platform (services)		
Figure 1 shows the main services provided by the FlexiGroBots Platform within the two main capabilities (HaaS and SaaS); they are managed within the following six groups: • Operator GUI (Graphical User Interface elements for the human operator to remain in the control loop) • Mission Supervision (including semi-autonomous processes such as the adaptive mission planning and the fault recovery) • Mission Planning (to facilitate the definition, instantiation and enactment of plans for complex multi-robot configurations) • Geospatial data processing toolset (for handling georeferenced satellite and UAV images) • AI Platform (comprising libraries and tools to cover the whole ML model life cycle, including the AutoML functionality) • Common Data Space services implementing IDSA reference architecture. The last one has been designed by IDSA to realise a data value chain which maximises synergies, collaboration and trading around data while ensuring data sovereignty, data governance and security in data sharing / exchange across companies, domains and national borders; they represent a collection of enabling services for data-powered digital ecosystems.		
Service based on Pilot 1	Service based on Pilot 2	Service based on Pilot 3
A fleet of heterogeneous robots, that will work in a coordinated way, will be used to carry out different agricultural activities: On land, small unmanned ground vehicles (i.e., UGV) will be used to inspect and actuate on the ground; in the air, semi-autonomous unmanned air vehicles (i.e. UAV or drones) will be responsible to gather data to plan and monitor autonomous ground vehicles data to be used in the planning of the scouting and treatment tasks to be performed by the terrestrial robots.	UGVs platforms will be responsible for performing the following tasks: -Close recognition and spraying of areas with possible insects in rapeseed. -Rumex plant weeding in grasslands. UAVs platforms will be responsible for performing the following tasks: -Grass and rapeseed status mapping. -Close range insect spotting.	By using drone and satellite data processed by AI algorithms to divide a blueberry field into management zones and determine soil sampling locations. Modular soil sampling tool, mounted on a robotic platform, will conduct on-site, georeferenced soil sampling, analysis and estimate main nutrient (N, P, K) content in the soil. Analysis results will be uploaded to relevant decision support tools, helping farmers optimise fertiliser use and decrease environmental damage.

The information from different data sources, UAVs and UGVs, IoT sensing systems placed in the vineyard, climate observation and weather forecast data from public stations, and satellite images, will be collected automatically and integrated in the software platform Cultivar Decisions, providing warnings of climatic conditions or spread of diseases risks. This will be the single point of access for the winegrower to all the information of interest in the vineyard. Additionally, it will integrate direct connection mechanisms with the automated systems developed in the project, so it can send detailed action plans to the robots.	-Situation awareness of tractor fleets. -Pesticide spraying. Robotized ISOBUS-tractor platforms will be responsible for performing the following tasks: -The robotized tractor will perform typical precision farming ISOBUS-tasks.	Precision spaying modular tools will be mounted on the robotic platform during fertilisation and pesticide or herbicide application periods. Based on field monitoring and decision-support data, the robot will be able to move to the problematic areas of a blueberry field and apply agrochemicals precisely, thus reducing farmer's expenses and contributing to global sustainability goals. Production will be monitored throughout the season using UAVs and the FMSs (farm management systems). UAV images will be used for analysis of vegetation indices and yield prediction, which will be crucial inputs for farmer's decision-making.

Table 1: Main Services Structure Description

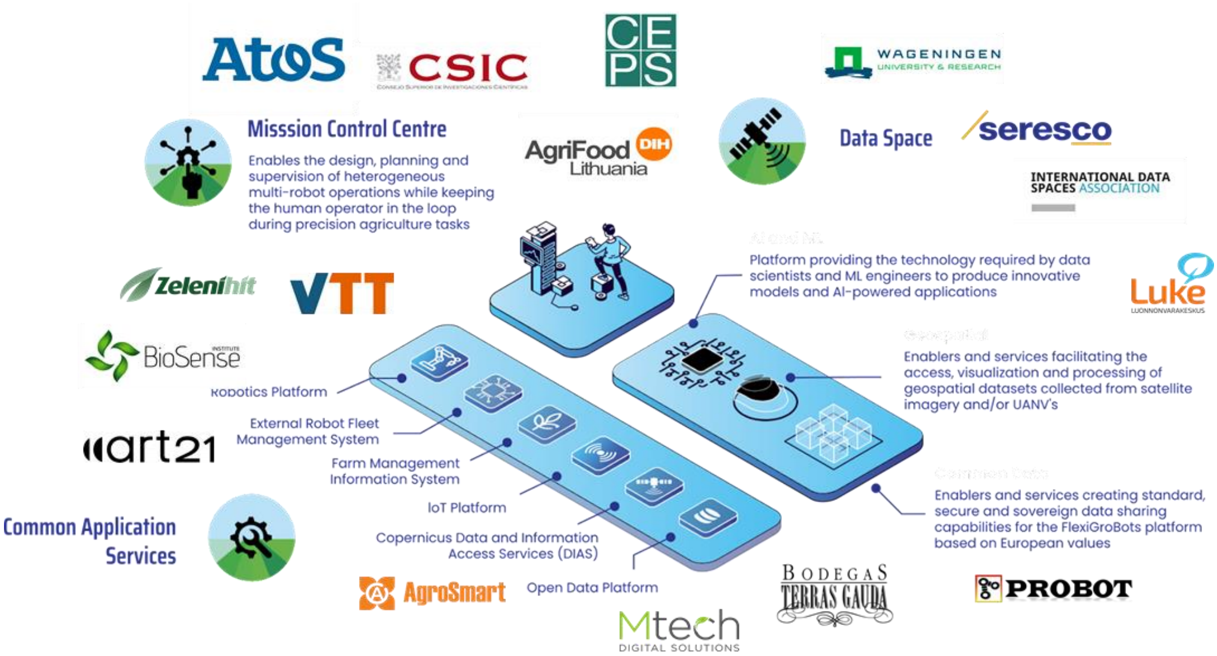

Figure 1: The Main FlexiGroBots Structure

2.2 Key exploitable components

Identification of the main components of the overall solution that could be exploited fully or partially independently is described in the following table.

	Component	Component and exploitation potential description
Product - Platform (components)	AI platform services	Repository for AI/ML methods (Docker containers, algorithms and models), AI development environment, AI toolbox with AutoML functionality.
	Agricultural Data Space (ADS)	Complements current platforms and technologies by providing services for agricultural data sharing and trading, and their processing. Furthermore, following International Data Spaces (IDSA) recommendations, data analytics (also known as data intelligence or cognitive services) is considered within the ADS. Open source with implemented components.
	Geospatial processing services	Processing engine, geospatial data cube, data connectors to the geospatial data platforms such as DIAS (Copernicus Data and Information Access Services), OGC (Open Geospatial Consortium) interfaces. Consultancy service (to help customers use/integrate the services and tools).
	Common application (models)	For use case piloting, where the external stakeholders could use these models for their own solutions, and use the platform for quicker development and entry to the market.
Service based on Pilot 1	Early detection and treatment of Botrytis using UGVs	UGVs will perform a detailed inspection of the areas indicated by the UAVs which will send a heat map to the UGVs. UGVs will detect grapes affected by Botrytis by image processing since their inspection is very close to the vineyard and, therefore, they can manage good resolution images. The UGVs will also carry out treatment operations in those areas where Botrytis is detected. AI models for Botrytis detection in real time from ground images. Precision treatment system. Outdoor navigation system capable of safely navigating through the vineyard following a predefined route (plan) to be taken for getting from one position to another
	Early detection of Botrytis using UAVs' imagery	Early detection of Botrytis will be improved using crop health information maps based on the NDVI index, from images collected by UAVs. The position of potential infected vines will be computed from the crop health information map.
	Autonomous multi-robot system for manual harvesting assistance	Outdoor navigation system capable of safely navigating through the vineyard following a predefined route (plan) to be taken for getting both operator encounter and grape unloading. AI procedures to detect a specific operator. Generation of reactive behaviour in the robot to follow the operator, maintaining a safe

	Component	Component and exploitation potential description
		distance from the operator and the crop. Continuous weighing system for harvested grapes.
	DSS in agriculture interconnected with robotics systems	Agricultural decision support systems (AgriDSS) for continuous observation of the vineyard, providing an agile system for communication and information exchange with the interconnected fleet of heterogeneous robots.
Service based on Pilot 2	Rapeseed pest detection and spraying system with imaging	Rapeseed pest detection system with imaging. Combination of drones, cameras, AI services for pest detection from images, and operation practices that allow the detection of pests in Rapeseed fields and precision spraying planning.
	Silage production fleet management and harvesting optimisation	We decrease the number of required drivers by using an autonomous tractor in relevant cases in the fleet. Service capable of defining the best harvesting timing for the silage. Timing affects the quality of silage.
	Autonomous machines deployment in agriculture	Weed mapping - drone and image analysis service for detection of weed location in grasslands. Application specific actuation and mobility on field with UGV - Multipurpose robot platform with robotic arm that can execute various tasks on field when equipped with different tools.
Service based on Pilot 3	AI-based algorithms and models	Models for analysis, segmentation and recognition of patterns in UAV images. Calculation of vegetation indices, delineation of management zones within a field (clustering), detection of blueberry rows and inter-row spacing, detection of problematic areas (outliers). These algorithms respond to the requirement of users (farmers, advisors and other stakeholders)
	Early-stage blueberry disease detection	By using hyperspectral data from UAVs and satellite images, in combination with deep learning based image processing models to remotely identify diseases at their early asymptomatic stage. Alternatively, using remote sensing to identify potentially problematic areas in the field and send a robot mounted with a camera and/or a proximal multispectral sensor (BioSense's Plant-O-Meter) to conduct precise and georeferenced blueberry plant status assessment.
	Automated field soil sampling and analysis	By using drone and satellite data to divide a blueberry field into management zones and determine soil sampling locations. Modular soil sampling tool, mounted on a robotic platform, will conduct on-site, georeferenced soil sampling, analysis and estimate main nutrient content in the soil (N, P, K and other parameters). Analysis results are provided to farmers in near-real time, helping farmers to swiftly optimise fertiliser use and decrease environmental damage.
	Targeted weed detection and autonomous	The module for weed eradication will include the tank with herbicide, sprayers, and an on-board camera which is used for detection of weed and positioning the sprayers with the help of

	Component	Component and exploitation potential description
	agrochemical spraying	machine vision and image processing. Precision treatment will ensure that no harm is imposed on blueberries and that significant saving in agro-chemicals is achieved.
	Yield prediction	Yield will be predicted using machine learning, deep learning and conventional image processing algorithms applied on drone and satellite images. Yield maps from the end of the season are crucial for determining the fertiliser amounts for the following season and offer precious insight into the expected quality of produce.

Table 2: Identification of the Main Components

3 Markets and value proposition

3.1 Overview of the main target market(s)

Precision agriculture, also known as “smart farming” or “precision farming,” is a key component of sustainable intensification of agricultural production. It combines remote sensing, IoT devices, **robotics**, **big data analytics**, **artificial intelligence**, and other emerging technologies into an integrated crop production system in which decisions are made at a high resolution. One of the biggest drawbacks of industrial-scale farming is the use of large, heavy machinery such as tractors, sprayers, and harvesters, which compact the soil and compromise a crop plant’s ability to develop a healthy root system. Soil compaction is an important factor—perhaps the most important—in the slow-down of the pace at which crop yields have been increasing in recent decades.

According to the Goldman Sachs Global Investment Research, a technology-driven crop yield improvement of 70% is achievable by 2050 via a combination of precision planting, fertiliser application, irrigation, spraying, and autonomous driving applications, with adoption starting in developed markets. This translates (under certain assumptions) to a total addressable market of $240 billion by 2050, with the following major components (Figure 2).

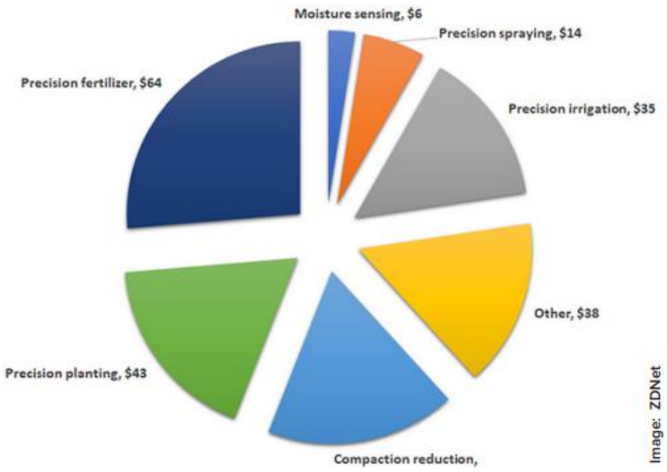

Figure 2: Precision Farming Addressable Market by Technology ($ Billion)

FlexiGroBots encourages exploration for alternative business models and practices to enable adoption of robotic solutions within agricultural settings. Key to this approach are business models based on the **Hardware-as-a-Service (HaaS)** and **Software-as-a-Service (SaaS)** concepts**.**

The aim during the project is to adapt the aforementioned models and further develop them to fit the specifications of the FlexiGroBots platform and its individual pilots, as well as align with the overall DIH-based exploitation strategy.

One of the key barriers to adoption of robotic solutions in the agricultural sector is the cost of such solutions. The initial investments on purchase and operating agricultural robots are high and they can often exceed the benefits. Furthermore, due to the specialised nature of robotic systems, small and medium size farmers cannot utilise these robots up to their full functionality potential and capacity. Therefore, ownership of agricultural robots is usually financially unfavourable for small and medium sized farms. HaaS and SaaS business models are based on the principle of providing solutions on a pay-per-use basis – the farmer does not buy the robotic solution but rents it for a given time and price from a specialised agriculture robotics service provider. This approach removes high entry barriers – the initial investment costs from the farmer while also increasing the exploitation rate of robotic solutions.

In FlexiGroBots it is foreseen that the main partners in commercial exploitation of the developed platform and separate pilot solutions will be DIHs. By operating in close relationship with farmers, the agri-food industry and other associated stakeholders, DIHs have a direct exposure to the agriculture robotics markets and their needs. DIHs provide their local agriculture markets with innovation validation, demonstration and are, to some extent, technology and innovative solutions brokers. Therefore, DIHs are targeted as key distribution channels for the FlexiGroBots platform and products and services emerging from the 3 pilot cases. During the project, detailed business models will be developed to encourage DIHs, their member organisations and companies not involved in the project, to engage in mutually beneficial commercial activities with the FlexiGroBots consortium and provide specialised, robotics-based services to local farms and the industry. Exploration and exploitation of such business models will not only contribute to the exploitation goals of the FlexiGroBots project, but also forge new partnerships and establish new commercial distribution channels for agriculture robotics SMEs around Europe.

In addition to the HaaS and SaaS business models, FlexiGroBots will also explore commercial exploitation opportunities offered by conventional business practices, such as cooperation with major agriculture technology distribution channels, direct hardware sales to farmers, licensing of the platform and pilot software components, reusing individual components separate from the wider solution, etc.

Key figures and prospects

A model for market sizing can quickly provide a sense of the opportunity before making deep investments in pursuit of it. The model requires developing 3 graduated estimations of the market:

- Total Available Market is the total market demand for a product or service **(TAM)**;
- Serviceable Available Market **(SAM)** is the segment of the TAM targeted by our products and services which is within our geographical reach;
- Serviceable Obtainable Market **(SOM)** is the portion of SAM to planning capture.

3.2 TAM - The global market of robotics and AI in agriculture

The global market of robotics and AI in agriculture.

Agricultural Robotics: Agricultural Robotics is the logical proliferation of automation and cost-effective technology into bio systems such as agriculture, horticulture, and livestock. The market is valued at USD 3.42 billion in 2017 and is expected to register a compound annual growth rate (CAGR) of 21.1 by 2023.

Artificial Intelligence: The global AI in Agriculture Market in 2019 was approximately USD 750 million. The market is expected to grow at a CAGR of 20% and is anticipated to reach around USD 2,400 million by 2026. Top market players are Gamaya, Precision Hawk, Microsoft, Agribotix (A AgEagle Company), IBM, John Deere, ec2ce, Descartes Labs and others.

Farming is the oldest and one of the most important professions in the world. With the growing population, it is very important to produce more crops on less land and increase productivity. With the introduction of AI technologies, farmers can increase the yield and produce healthier crops, monitor their soil and growing conditions in real time, and control pests. AI in agriculture helps the farmer by organising data for farmers; it helps with the workload and enhances a wide range of tasks which are related to agriculture and the entire food supply chain. Artificial Intelligence in agriculture is used for various applications such as driverless tractors, rural automation, computerised water system frameworks, optimisation of fertiliser use, etc.

AI and Robotics Market Segmentation:

By Farming Type. The farming type segment in the application for artificial intelligence in agriculture market is expected to be dominated by field farming. The majority of the farmers around the world still engage in traditional farming, which is expected to drive artificial intelligence in agriculture market in the forecast period. However, high-value crop growers are usually very digitally literate and they often invest a lot in production technologies.

By End Use. The end use segment in the application of artificial intelligence in agriculture market is expected to be dominated by crops, fruits, vegetables, and other plants. The primary focus of all farmers around the world is to increase agricultural production, which is expected to increase the adoption of artificial intelligence products in the agricultural industry.

By Product. The global artificial intelligence in agriculture market in the product segment is expected to be dominated by software products. The high market share and growth potential associated with software products in the agriculture industry is expected to drive the global artificial intelligence in agriculture market.

By Region. North America generated the highest revenue of $598.7 million in 2020, which is attributed to the technological advancements in the North America region. In the region, government support along with technological advancement has helped in the growth of the market. The region is expected to witness high growth of CAGR 29.88% during the forecast period 2021-2026.

Key Market Players and Competition Synopsis:

Deere & Company, Microsoft Corporation, CNH Industrial NV, Robert Bosch GmbH, Granular Inc., Harvest Crop Robotics, LLC, Agrivi, CropIn Technology Solutions Pvt. Ltd, Alibaba Group Holding Limited, The Climate Corporation, Descartes Labs, Inc., PrecisionHawk, Inc., Ceres Imaging, IBM Corporation, Prospera Technologies.

3.3 SAM for platform

European high-performance computing (HPC) and AI enterprises in the agricultural sector.

The European Union noted that HPC is one of the keys to increased agricultural production. The European Commission states that HPC is becoming critical in agricultural activity, plague control, pesticides design and pesticides effects [6]. For example, it notes that HPC enables numerical simulations of plant growth that help seed companies achieve superior varieties, without doing costly field trials that can harm the environment.

To be able to reduce the negative impact to the ecosystem, seed companies are on the lookout for new plant varieties that produce more yield. Companies normally find such new varieties through field trials. These field trials are a simple method but they cost a lot of money and are time consuming, taking years to find the best ones.

Using HPC the Curie supercomputer is able to provide the most efficient solution to this problem. HPC enables numerical simulations of plant growth that help seed companies to achieve superior varieties instead of doing field trials which are more expensive and time consuming.

This is the type of research that could help farmers increase yields and operate more efficiently, and it's only possible with the power of HPC, AI and other advanced technologies. As an Intel article notes, "**From detecting pests to predicting what crops will deliver the best returns, artificial intelligence can help humanity confront one of its biggest challenges: feeding an additional 2 billion people by 2050**, even as climate change disrupts growing seasons, turns arable land into deserts, and floods once-fertile deltas with seawater."

In terms of revenue, the Global High Performance Computing Market is probable to reach USD 50.3 Billion by 2028, growing at CAGR of 6.3% from 2022 to 2028.

3.4 SAM for Pilot 1 - The Grapevines market in Europe

Viticulture and the cultivation of vines (*Vitis vinifera L.*) is a very important sector worldwide. It is not only important economically, but also socially and culturally, due to the employment it generates and the area planted. According to the Statistical Report on World Vitiviniculture of The International Organisation of Vine and Wine, the area of vineyards used for the production of grapes, in production or awaiting production, was 7.4 million hectares in 2018. Moreover, of all this area, five countries account for 50% of the world's vineyard plantings, and four of them are European countries (Figure 3).

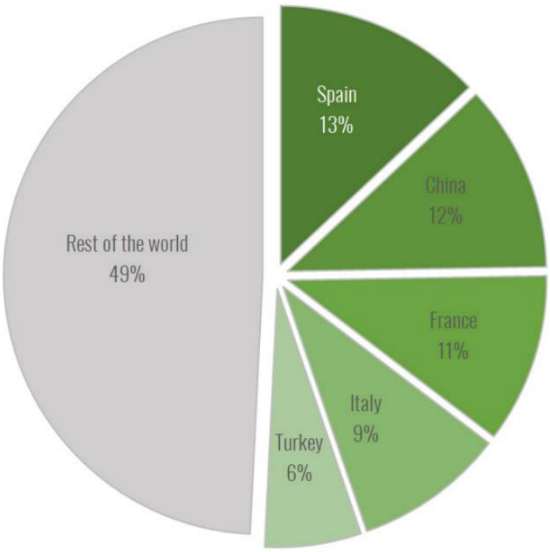

Figure 3: Area of Vineyards for the Production of Grapes, in Production or Awaiting Production

Overall stability can be observed in the European Union (EU) vineyards, which stand for the seventh consecutive year at 3.3 million of ha. The EU vineyards have been undergoing a global balance between grubbing up and new planting since 2015. This stability can be attributed to the management of viticultural production potential, which since 2016 has enabled EU Member States to authorise planting of up to an annual growth of 1% of the vineyard already planted (OIV, 2021).

Spain is the country with the **largest** planted area of vineyards in the **world**, with **13%** of the world surface area of vineyards used for the production of grapes, in production or awaiting production, with just over **969,000 ha**. Other mayor European countries regarding vineyard surface area are, in descendent order, **France, Italy, Turkey, Portugal, Romania, Moldova, Greece, and Germany** (Figure 4). According the last report of the state of the world Vitivinicultural sector in 2020, within the EU, the latest available data for 2020 indicates an increase in the area under vines in **France (797 000 ha +0.4% /2019)** and **Italy (719 000, +0.8% /2019).** The vineyard surface areas in **Spain (961 000, -0.6% /2019), Portugal (194 000, -0.2% /2019), Romania (190 000, -0.4% /2019), Bulgaria (66 000, -1.8% /2019) and Hungary (65 000, -3.9% /2019),** on the other hand, have decreased with respect to 2019. **Germany's** surface area in 2020 is stable and it is estimated at **103 000**, a value in line with the last twenty-year average. In Eastern Europe, **Moldova** continued its downward trend started since 2018, reaching a vineyard surface area of **140 000 (-2% /2019)**, which can be explained by the ongoing process of restructuring and transformation of its vineyards. Russian vineyards on the other hand, in 2020, have marginally increased to 96 000 (+0.6% /2019). Turkey, the fifth vineyard in the world, once again, saw the size of its vineyard area decreasing in 2020 by 4.7 000 (-1.1%), to a total surface of 431 000. This is the seventh year in a row that Turkey shrinks the size of its vineyard, recording a total reduction of more than 70 000 since 2013. Vinified production in the EU in 2020 is estimated at 165 mhl, registering an increase of 8% (+12 mhl) compared to the low volume registered in 2019. Italy (49.1 mhl), France (46.6 mhl), and Spain (40.7 mhl), which together account for 53% of the world wine production in 2020, saw a sharp rise in their wine production with respect to 2019. The production volumes in these three countries recorded increases of 1.5 mhl (+3%), 4.4 mhl (+11%), and 7.0 mhl (+21%) respectively compared to 2019.

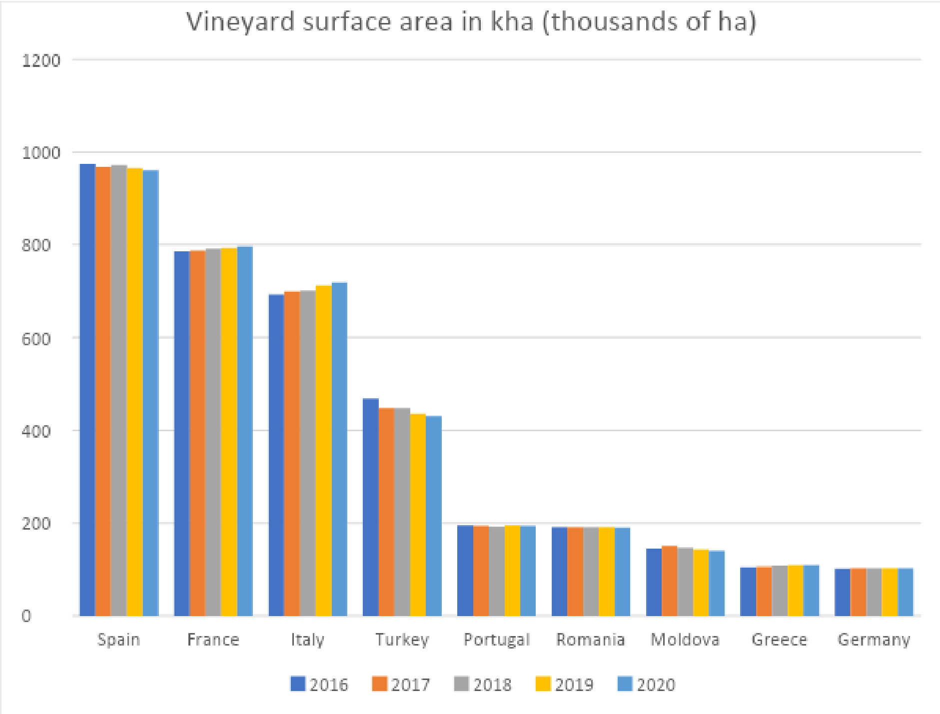

Figure 4: Vineyard Surface Area of Major European Vine-growing Countries. Own Elaboration. Data source: OIV, 2021

Since the end of the 20th century, the world vineyard area has remained relatively constant, with a certain downward trend, meanwhile the demand for wine has grown slightly. According to data from the OIV (2019), in traditional wine-producing countries, consumption has increased in Spain, Italy and Portugal since 2014, while remaining stable in France, as at the global level. In this context, it is of vital importance for wineries to obtain competitive advantages through technological innovation, allowing them to compete in the market. Especially when in the last century, especially in the second half of the last century, there have been two approaches to viticulture worldwide: on the one hand, an activity based on a traditional, technified type of cultivation, linked to centuries of history and rooted in its social culture, whose exponent are the European producer countries, and another more strictly technical, competitive and practical approach, focused on solving the needs of the crop, represented by the "New World" viticulture countries, mainly Australia, Argentina, Chile, the United States and South Africa. However, in the last decades of the 20th century, the deepening interconnection of the world wine market, of the companies in the sector, of the transmission of new techniques and information, and of the advances made by researchers, has led to the gradual linking of the two viticultures and the acquisition of each other's approaches in order to gain more market share, thus generating a very strong competition in which all aspects of cultivation must be optimised. Therefore, due to the great weight of the wine sector in the world, any measure, management improvement or technological development aimed at improving vineyard cultivation efficiency and adaptability will result in global benefits, not only economic, but also in terms of labour and the environment.

Just as technology has been implemented differently in the two production models worldwide, so has the quality. The European production model is largely based on Designations of Origin (DOs), with exhaustive quality controls, limited and highly regulated production, while in the new emerging producer countries, production is much more liberalised. The objective of the DO is to ensure the quality and origin of the raw materials, establishing various controls. Each DO has its own regulations, more or less exhaustive, in order to control the final quality of the wines produced within its borders. This quality of the final production is based on factors such as the sanitary state of the plant and the grape, the development of the plant or its photosynthetic capacity. In addition, DOs have differentiated varieties and a tendency to diversify the supply of wines from different areas to facilitate their adaptation to market demand. It is therefore useful for both producers and the regulatory bodies of the DOs to have tools based on new technologies, such as remote sensing, to control this whole process and its quality quickly and accurately.

Additionally, in the coming years, the sector will face one of today's most important challenges: climate change. With the appropriate use of new technological tools brought to the market, it will be possible to better adjust costs and produce according to the capabilities of farms and to better adapt to the effects generated by changes in the climate. In addition, these technologies can improve the understanding of the crop in order to try to increase quality and provide added value to improve the differentiated image of wines.

3.5 SAM for Pilot 2 - Rapeseed and silage grass in Europe

Rapeseeds need up to daily supervision about the pest status. Pest management is done for good measure: spraying just in case. Automating pest monitoring at a sufficient level would remarkably decrease the usage of pesticides, limit the environmental load, protect other insects such as bees, and decrease the workload.

The timing of silage grass harvesting in Finland is very critical. The harvest is timed with two factors: digestibility and dry matter yield. As grass grows the digestibility decreases and usually farmers have target value for digestibility and that target is usually coming from the type of cattle grown on the farm. As grass grows dry matter yield increases and defines the amount of yield in the harvest. Due to these two parameters developing in different directions the optimal time window for harvest is usually very narrow which furthermore lead to high demand for the workforce. Typically, there can be seven different types of machinery involved almost simultaneously. Robotization will decrease the demand for employees and increase the usage rate of machinery.

These two tasks are particularly crucial from the point of view of the business because of the risks and consequences they have on farming.

Rapeseed production in the 27-country EU is now expected to reach 17 million tonnes, compared with the 16.82 million tonnes forecast a month ago and 3.3% above last year's crop,

Strategy Grains said in an oilseed report. Rapeseed is the biggest oilseed crop in the EU and used for making edible oil, biodiesel fuel and livestock feed.
The consultancy made a slight cut to its forecast for EU sun seed output this year to 9.82 million tonnes from 9.88 million tonnes, but that would still be 13.2% above 2020's drought-affected crop. European rapeseed prices are expected to ease from current high levels in the run-up to harvesting, strategies Grains said.
Agricultural production is practised on about 2.3 million hectares, and the main crops are cereals and grasses. The yield level varies a great deal in the different parts of the country. Most of the cereals are spring sown, with barley, oats and wheat as the most important spring sown species. Rye and also wheat are cultivated as winter cereals.
The grass area is about **0.7 million hectares**, of which over **⅔ (0.46 million hectares)** is under **silage**, the rest is dry hay, pasture or under other production. The main grasses are timothy and meadow fescue. The most important forage is red clover.

3.6 SAM for Pilot 3 - The Blueberries market Europe

Spain and Poland are the strongest European suppliers and growing fast in production volume (see Figure 5), but there is blueberry production all over Europe. In fact, blueberry production is on the rise in most European countries.

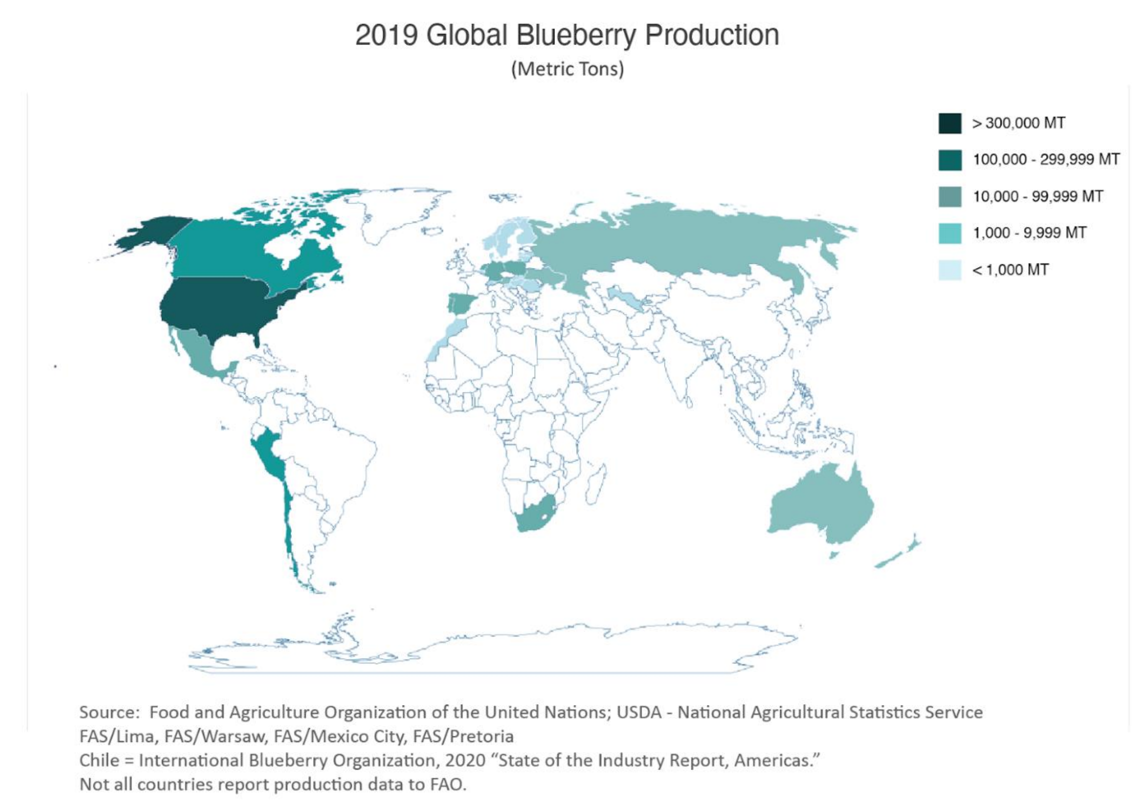

Figure 5: Global Blueberries Production in 2019 (metric Tons)

An increase in blueberry production can also be seen among a number of Eastern European countries. In **Latvia,** the area has even more than doubled: from **200 to 500** ha. **Croatia's** also showing a good increase from **90 to 250 ha.** In **Serbia**, where growers are established as well, the production area rose from 344 ha in 2017 to the current **2000 ha**. However, Serbia's figures haven't been taken into Eurostat's account yet.

The major producers of blueberries in Europe include **Spain, Poland, Germany, Portugal, Netherlands, France, and others**. Germany, the United Kingdom, Spain, Netherlands, France, Austria are some of the major importers of blueberries in Europe.

The market for fresh blueberries in the European Union (EU) is demonstrating strong growth in terms of imported products over the last five years experiencing a compound annual growth rate CAGR of 21.5% from 2010-2014. Alongside rising disposable incomes and health consciousness, the appeal of fresh blueberries is quickly gaining ground. **The blueberry market in Europe is projected to register a CAGR of 2.4% during the forecast period (2020-2025).**

Blueberries have become one the most popular fruits for cultivation projects in **Ukraine,** whose production is growing at an increasing rate. Most blueberry plantations in Ukraine started in recent years. **The current planted area is around 3,000 hectares and will triple over the next five years**, says the Ukrainian Horticultural Association (UHA). At **1.8 thousand tons in 2019**, the supply to Europe is **still limited**, while the last harvest in 2020 has been affected by frost.

Climate in Ukraine is less suitable for growing berries than in the EU – this negatively affects productivity indicators. **The fact that almost all the components of the technology of the Ukrainian berry market are imported, is somewhat negative.** Moreover, labour was earlier an advantage of Ukrainian berry farmers, but there is not enough of it today and it is no longer much cheaper than in the EU. If we consider the lower yield of blueberries, its harvesting per 1 hectare can be even more expensive in Ukraine than in the European Union. **Moreover, the investment climate in Ukraine is the worst in Europe.**

However, Ukraine, one of the world leaders in expanding areas of blueberries, found itself in the top three countries in terms of the rate of blueberries export decline. The average annual reduction in Ukrainian exports for blueberries is 16% per year.

In addition to Ukraine, Serbia and other countries in Eastern Europe have been receiving foreign investments and subsidies, resulting in a fast growing and modern blueberry production using the latest technologies, yet small in volume for the time being.

In summary, the potential market countries are defined: **Latvia, Lithuania, Poland (as one of the main producers), Ukraine, Romania, Serbia, Croatia, Italy and Spain** (as one of the main producers). With a total of more than 20 000 ha blueberries production area.

Country	Total utilised agricultural Area 2019, ha	Blueberries Area from total utilised agricultural Area 2020 (SAM), ha	SAM portion from total utilised agricultural Area, %	SAM production quantity 2020, tonnes	SAM Yields, tons/ha
Serbia	3,481,570.00	2,500.00	0.07%	6,000.00	2.40
Lithuania	2,890,543.21	1,470.00	0.05%	2,340.00	1.59
Latvia	1,816,689.19	500.00	0.03%	700.00	1.40
Poland	14,142,257.14	9,700.00	0.07%	55,300.00	5.70
Ukraine	41,329,000.00	3,000.00	0.01%	9,000.00	3.00
Romania	8,912,793.10	400.00	0.00%	1,170.00	2.93
Croatia	1,341,916.67	360.00	0.03%	720.00	2.00
Italy	12,556,927.63	1,090.00	0.01%	6,750.00	6.19
Spain	21,465,701.03	4,210.00	0.02%	48,520.00	11.52
Total:	107,937,397.97	23,230.00	0.02%		
Average Yields, tons/ha:		**4.08**			
Number of harvestings:		**3.00**			
Price, Euro/ton		**6,000.00**			
Total Serviceable Available market (SAM) size estimate, Euro		**1,706,729,881.87**			

Table 3: Service Target Market Penetration in Agriculture and In the Blueberries Area

Price lists of importing companies calculate bulk wholesale prices of €6 to €7 euros on the low side, up to €11 to €15 euros in a good market for 12 x 125 g packages (1.5 kg). In reality, the actual prices may be lower when supply is very high. If you work with an importing company or trader, expect to pay them around 8% commission plus handling costs.

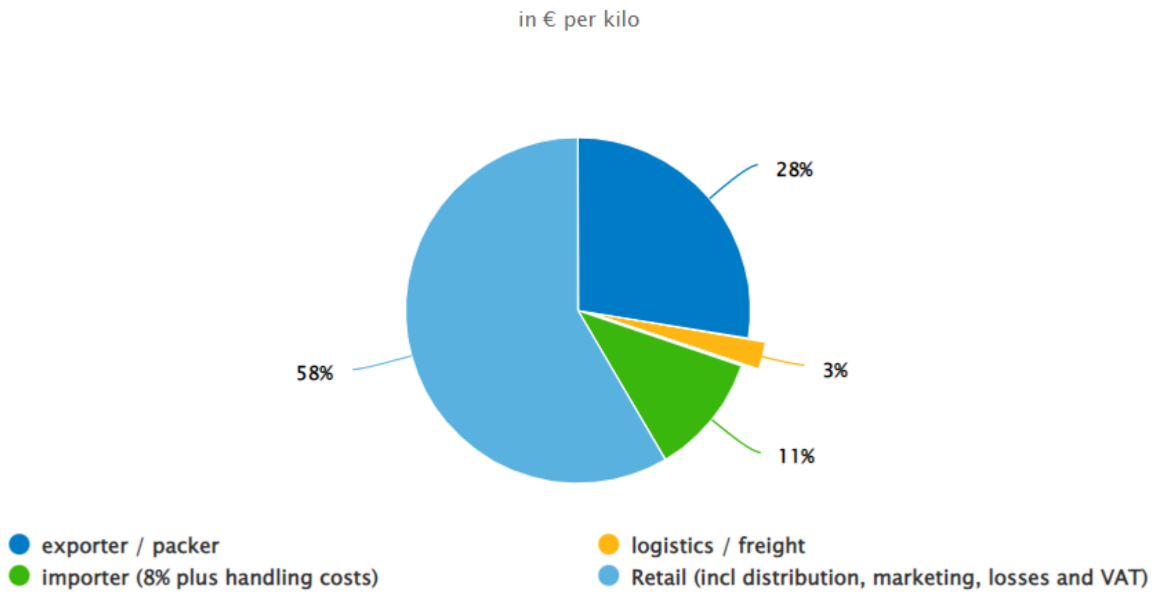

Figure 6: Indicative Price Breakdown for Consumers Packaged Blueberries

Retail prices are usually between €12 and €24 per kilo. Small packages with premium blueberries are the most expensive. Organic blueberries are sometimes sold for more than €24/kg. Be aware that retail prices have no relation with trade prices. When availability is very high, supermarkets tend to have additional promotions to help sell the extra volumes.

4 Customers and end-user profile

The main customer and end-user relationships are estimated through the platform (Figure 7). Where product/service (FMIS) providers and agriculture advisors using platform infrastructure and services will reach the end-user - farmers to provide their developed services and products.

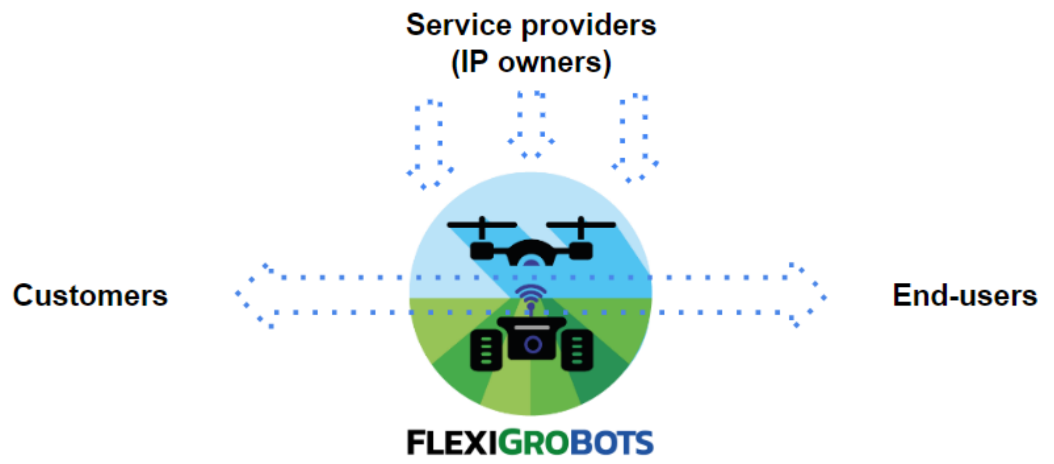

Figure 7: Customers and End - Users' Relationships Using FlexiGroBots Platform

The services from all platform components will have the possibility to be provided after the project. One of the first services will be developed during Piloting by IP owners (as a start-up) and based on developed platform segments. The implementation and exploitation of pilot services will show the functionality and capability of the platform. Furthermore, the developed services and results based on their good practices will help involve more different service providers and expand the platform's versatility and superiority.

The FlexiGroBots worldwide portfolio of offerings and customers is available for disseminating the project results on one hand but also for exploring potential users and business partners to adopt and exploit the project solution *(see the Commercialization Plan and Exploitation Models section*).

The main customers' and end-user groups' profiles, their needs/requirements and willingness to pay are described in the table below.

	Customer group			End-user group
	Product/Service (FMIS) providers	Technology developer	Agricultural consultants and advisors	Farm
Profile description	Different agricultural technology and solution providers—including integrators and vendors—			The target end-users and main service beneficiaries are medium-

	Customer group			End-user group
	Product/Service (FMIS) providers	Technology developer	Agricultural consultants and advisors	Farm
	platforms and systems—including robots, machinery and FMIS—could collaborate and integrate in heterogeneous multi-platform (e.g., multi-robot or FMIS) solutions. It is expected that one of the main possibilities of involvement of robotic systems providers via FlexiGrobot platform is via product/equipment rent. Knowing that it will be financially more attractive and optimal for the end user - the farmer. Also, third-party robotics and farm management application developers will be able to develop solutions for farmers through the robotics platform; external robot flat management system; FMIS; IoT platform; Copernicus Data and Information Access Services (DIAS); Open Data Platform independent APIs and SDKs provided by the FlexiGroBots Platform; this means different developers can create applications based on the FlexiGroBots Platform, so that the deployment of robots and management in the agri-food sector is facilitated. Furthermore, the Platform would be open source to facilitate the uptake, creation of community and a marketplace of FlexiGroBots applications.			and large-sized arable agriculture farmers pursuing higher productivity and operational efficiencies through precision agriculture. The service is intended to enable this by providing farmers with smart decision-making, planning and direct implementation.
Needs and requirements	The costs associated with robotics technologies are too high to justify the economic return on investment. Therefore, it is the most crucial factor slowing the adoption of robotics systems and technologies within the Agri-Food sector. It is necessary to propose new business models that allow access to technology without the need to make significant investments, for example, through offering services by providers that include payment for the use of robots or drones or the pay-per-use monetization models proposed by the service providers.			The data processing technology is a significant improvement on existing methods. It can provide farmers with more detailed insights on plant stress factors, on exactly which micro or macro nutrients are missing and in which parts of the field. Despite the rising farmer investment in farm/agricultural robots, most deployable robotic systems are meant to automate only specific tasks. The wide variety of tasks that need to be fulfilled in a single-precision agriculture operation or mission makes it extremely unprofitable to

	Customer group			End-user group
	Product/Service (FMIS) providers	Technology developer	Agricultural consultants and advisors	Farm
				address its automation with task-specific robots.
Willingness to pay explanation	FlexiGroBots will overcome the customers' needs barrier by establishing flexible and scalable business models based on HaaS and SaaS, reducing the costs at the operational level and promoting the use. The customer's willingness to pay depends directly on needs and specific services with their pricing. See the general pricing structure in the section below. We assumed that **technology developers and FMIS** providers would form the main portion of the target market penetration from the estimated field (assumed 5 %).			**Farmer gains.** The service is expected to increase the income of the farmer via decreased expenses and increased yields. Concerning the steep increasing trend line in labour costs, FlexiGroBots services' value proposition will only grow stronger in the years to come.

Table 4: Main Customers

The Identified main stakeholders - Product/Service providers.In general, products/services can be identified into two main categories:

- Robotic solution and systems developer and provider.
- Farm management information system (FMIS) developer and provider.

Agriculture has a broad range of stakeholders that reflect the diversity of robotic products and the diversity of farm management solutions without just being limited to hardware and software developers but including the whole system solution development as a final service. Combining these services and products will allow expansion and ensure FlexiGrobots platform's financial sustainability.

5 Business strategy

In addition to the HaaS and SaaS business models, FlexiGroBots will also explore commercial exploitation opportunities offered by conventional business practices, such as cooperation with major agriculture technology distribution channels, direct hardware sales to farmers, licensing of the platform and pilot software components, reusing individual components separate from the wider solution, etc. (see the *Commercialisation Plan and Exploitation strategy* paragraph in the document below).
After project end, the resulting FlexiGroBots platform and individual pilots based on it will be commercialised based on the business models developed during the project. The FlexiGroBots

platform itself will be further exploited by consortium partners to improve on existing products and services, or develop new ones based on the newly gained technical capabilities. The platform and its components will also be made available for 3rd party SMEs developing agriculture robotic solutions, allowing the use of the platform data aggregation, analysis, decision making, mission planning and control capabilities via a licence fee. Robotic solutions developed and demonstrated in FlexiGroBots pilots will pursue individual exploitation and commercialization efforts, with cooperation with specialised DIHs in the targeted markets and agricultural subsectors.

5.1 General pricing strategy

The fallowing figure is presenting the general pricing structure.

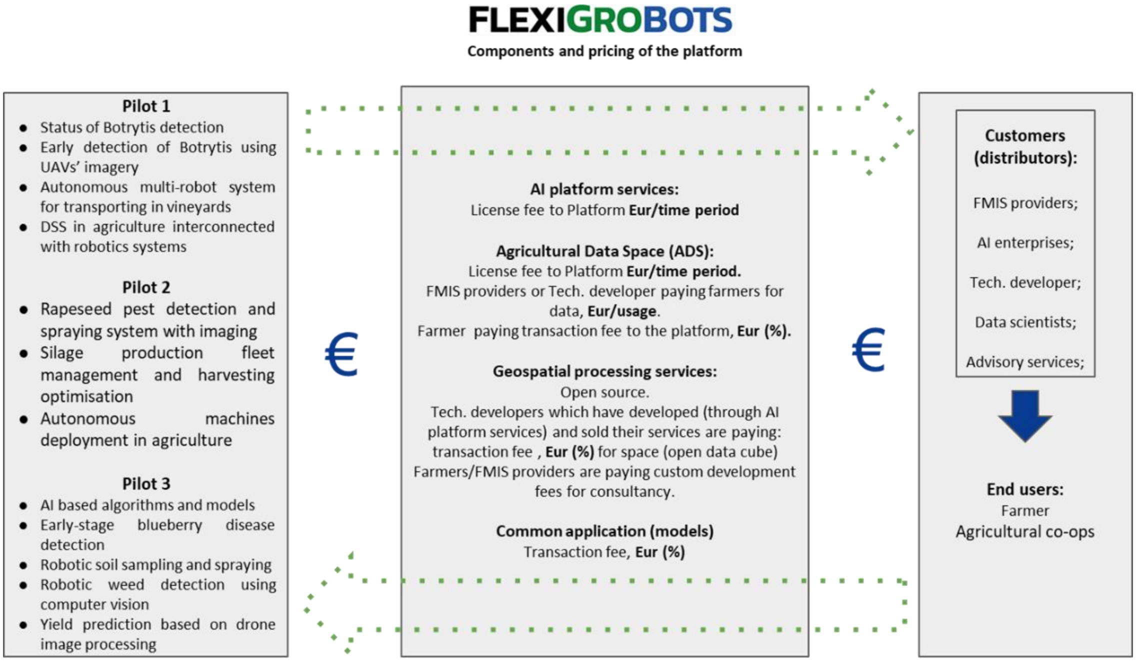

Figure 8: General Pricing Structure

6 Commercialization plan and Exploitation models

6.1 The overall strategy guideline for commercialization and Exploitation using DIHs support

One of the main goals of a DIH is to be a critical actor of the regional/national innovation ecosystem. To achieve this goal, the DIH needs to establish and maintain partnerships with actors with complementary competencies and specialisations on a regional, national and European level. It should be able to act as a doorway providing access to knowledge and expertise not available locally but via the network of DIHs across Europe.

Service definitions. DIHs are one-stop shops acting as innovation intermediaries for the matching of demand and offer of advanced digital services and technologies, in order to support digital transformation processes. At the heart of the DIHs' functions is the goal of creating awareness about business or production opportunities with digital technologies and to act as trusted and neutral actors in providing relevant advice.

The DIHs are both a means to reduce search costs for appropriate solutions, by serving as knowledgeable brokers that can analyse someone's need for digitalisation, and to provide appropriate services either through in-house expertise or through a partner. A DIH can prepare a not very technologically advanced SME, realise its potential and demand suitable technologies from more advanced suppliers.

At the same time the services of a DIH should be complementary to and not replace existing commercial services. A DIH could also choose to dedicate resources to a potential niche and serve a need, by providing something additional that did not exist before. In many regional innovation ecosystems, a large variety of actors and initiatives already exist. Therefore, the introduction of a DIH should not create further fragmentation and complexity, or confusion among existing actors and potential beneficiaries as regards provision of digitalisation services already existing in the region. An important task is rather to map, structure and align different services to make it more coherent to the beneficiary-SMEs, i.e., to better coordinate the offer with a view to satisfy the latent demand previously identified.

The four main categories of services that DIHs can provide to the local SMEs/public sector beneficiaries are:

- Test before investing;
- Skills and training;
- Support to find investment and;
- Innovation ecosystem and networking.

Test before investing - The provision of test facilities should be one of the primary and well-defined services of DIHs. DIHs should be able to provide services and facilities to raise awareness and provide access to digital transformation expertise and testing and experimentation facilities so that potential beneficiaries can make better decisions for investments that will help them develop new improved products and services.
The testing services include the provision of facilities for experimentation of hardware and software, where companies and public actors can come and try out new digital technologies that they may want to start utilising in their processes or incorporate in their services and products. They can also serve as environments where suppliers can showcase technologies for future users, as well as facilities where pilot scale solutions can be tested for development purposes.

Skills and training - An essential part of the DIH services is training and skills development. The DIHs can coordinate with education providers the release of short-term training for workers and internships for students. Activities in relation to training and skills can cover the whole employment spectrum but should be based on an analysis of the regional needs.
The rationale for the DIH to secure these types of training is to overcome incentives issues around who will pay for the training and who will receive the benefit (company or employee, or future employers), and the eventual lack of universities and other public or private training institutions able to provide educational services tailored to the specific needs of SMEs.

Support to find investment - DIHs should support companies, especially SMEs and start-ups to access regional, national and/or European funding (i.e. ERDF and ESF) to make use of new technologies. This can also include access to public and private financial institutions and investors, including InvestEU and the Enterprise Europe Network (EEN). The support can also be directed towards the public and wider public sector.
This category of activities also covers finding funding to finance the DIHs' own support activities or to develop a tech start-up company. Financing services consist of different ways to provide funding assistance for digitalisation activities, ranging from provision of subsidised services or innovation vouchers that can help companies procure digitalisation support from external actors, to assisting companies in applying for grants and other forms of R&D support, and to connecting companies with investors. If the solution providers from the three Pilots decide to commercialise their systems through spin-offs/start-ups, DIHs will serve as facilitators for matchmaking between private investors/business angels/venture capitalists and them. Alternatively, these solutions can be commercially exploited through patents, which can be subsequently licensed to other tech companies, especially the large ones with a strong position on the market.

Innovation ecosystem and networking - DIHs can be seen as platforms that facilitate transactions between users and producers and reduce transaction costs, by making it easier to find what one is looking for, by gathering a wide range of services and goods in one place. Many platforms also have mechanisms to create a secure and trusted environment. The DIH can provide opportunities for actors to meet and initiate collaboration, either spontaneously or in a more directed way. The DIH can be a tool for coordination, but also for prioritisation of publicly available support. DIHs can function as platforms and one-stop shops and can provide market and technology intelligence and advice to agencies when they develop new programmes.

In general, all these DIHs offered services for supporting the realisation of innovative products/services are identified as - Commercial exploitation strategy development support. The cross-border expertise of DIHs supports **FlexiGroBots** project IEs (services/products) and prospective investors in developing commercial exploitation strategies, business models, value propositions, commercial benefit analysis, investment readiness services and market entry plans of their technologies, products or services.

The guidelines consist of: **Go-to-market plan; Distribution and sales channels; Marketing strategy; Customer and end-user relations will be described in upcoming report (M36). The commercial exploitation strategy development support applied to the business models of each IE analysed during the FlexiGroBots project.**

6.2 DIH engagement strategy

DIH engagement strategy was implemented through these steps:

- Identification of key partners and networks.

  The identification strategy prioritises partner networks and partner countries. All inputs from partners collected on internals and externals networks and results from the survey was considered as priority.
- Additional research on possible Ecosystem entities performed.

  There are around 700 registered DIHs in EU. Most of them non-operational, created for the projects. Around 80 DIHs recognized as DIHs that work in robotics/ agri-food sector, are on some level operational and can potentially be a part of FlexiGroBots ecosystem.
- Contact initiation with possible partnering DIHs.

  Contacting strategy involved prioritizing partners' networks and piloting countries with additional 80 DIHs from the research in case there will be still lack of involvement. 17

DIHs positively responded to collaboration with FlexiGroBots and can offer support on some level.

- Consultations with DIH's on the service they can offer - key indicators collected from the ones that on-board (17 DIHs).
  In general, DIHs that replied and agreed to a contact, were collaborative and enthusiastic to support FlexiGroBots ecosystem, and all of them could offer at least a Communication and Dissemination services or inclusion FlexiGroBots into their internal networks. Unfortunately, not all of DIHs could offer Commercialization services, depending on their expertise and operational profile.

The DIH engagement strategy was prepared considering the DIHs activity and divided into two main segments. See the following table.

No	DIH	Country	Communication and Dissemination Activities	Development and Commercialization of service
1.	*RoboCity*	Spain	Yes	No
2.	*DataLife Galicia*	Spain	Yes	Yes
3.	*Air4S*	Spain	Yes	No
4.	*Agrobofood*	Finland/Europe	Yes	Yes
5.	*Super IoT*	Finland	Yes	No
6.	*BioSence DIH*	Serbia	Yes	Yes
7.	*Science and Technology Park (NTpark)*	Serbia	Yes	No
8.	*AgriFood Lithuania DIH*	Lithuania	Yes	Yes
9.	*Visoriai DIH*	Lithuania	Yes	No
10.	*Robotics DIH*	Lithuania	Yes	No
11.	*EDIHNET.lt*	Lithuania	Yes	Yes
12.	*AgriFood Croatia*	Croatia	Yes	Yes
13.	*GIL*	Germany	Yes	No
14.	*Digital SME*	International/Europe	Yes	No
15.	*RI4EU*	International/Europe	Yes	No

No	DIH	Country	Communication and Dissemination Activities	Development and Commercialization of service
16.	*DIHNET.EU*	International/Europe	Yes	No
17.	*Kok project*	Turkey/East Europe region	Yes	Yes

Table 5: DIHs Identification

The next practical steps of the DIHs' engagement process are the following:

- Establish a regular and continuous communication with the DIHs that are already on-board;
- Introduce the partners that are involved in the implementation of the pilots and the development of the platform to the DIHs and organize sessions/workshops where they will present the current status of their solution and explore potential synergies with them;
- Involve the DIHs from the respective countries where the pilots are implemented to their demonstration activities;
- Expand further the current DIHs network via the recruitment of additional DIHs throughout Europe – the focus will be directed to utilizing already existing DIH networks specifically involved in the development and/or implementation of Robotics solutions in the agri-food sector (agROBOfood, SmartAgriHubs, Robs4Crops, etc.)

The above mentioned actions will be initiated by M25 and will be continued up until the end of the project (M36) with the submission of the second version of this deliverable, although, it is expected that the main workload will take place within the first half of 2023, since the aim is for the actions of T7.3 to actively interact with the demonstration actions of T7.4 "Technology transfer and demonstrator roll-out".

7 IP management process

7.1 Methodology

FlexiGroBots pays significant attention to innovation management and intellectual property rights, and will approach IP management on two levels – at the project/consortium level and at the pilot level.

At a project/consortium level the main goal is to ensure that the generated results (foreground) are efficiently, identified, classified, protected and subsequently exploited. In addition, it is of key importance for all consortium partners to have a clear idea of the background they bring to the project, the access rights they provide to other consortium partners, how to ensure that dissemination and communication do not raise risks of loss of IP rights, how ownership of generated IP will be assigned and in case of dealing with co-ownership of results, to have a clear picture of best practices, recommendations and future implications to ensure a successful long-term relationship and a profitable exploitation of results. Throughout the project, issues related to the management of knowledge and intellectual property (IP) follow the general provisions of the Grant Agreement and are defined in the Consortium Agreement (CA), in which specific rules will be set in force to protect the work resulting from FlexiGroBots. The Agreement is closely following the Commission's recommendations on intellectual property matters and is anticipated to have the following general provisions:

- ***Protection*** of foreground. Ownership of foreground IP and exploitation rights will remain with the project partner who generated it,
- ***Confidentiality.*** Any information of a confidential nature which may be shared among project partners will not be disclosed to other third parties without explicit permission from the proprietor.
- ***Publication*** of foreground. Foreground IP will be published solely by its proprietors (during and/or after the project). Under no circumstances will a partner publish the foreground of another project partner.
- ***Access rights to foreground***. To support the realization of the project's objectives, project partners receive nonexclusive, royalty-free access to foreground IP developed within FlexiGroBots. Upon the completion of the project, partners may be granted access rights for use (e.g., exploitation) of such IP either under fair and reasonable conditions or royalty-free (in accordance to terms defined in the CA).
- ***Access rights to background***. To carry out their own work under the project, other consortium partners shall enjoy access rights to knowledge and to pre-existing know-how. Access rights for use purposes will be granted either under fair and reasonable conditions or royalty-free (in accordance to terms defined in the CA) in order promote

an efficient IP management, a smooth collaboration between consortium partners and to maximize the exploitation perspectives of the project.

At the pilot level the aforementioned recommendations will be considered on the protection, ownership and assignment issues related to intellectual property rights of end-users participating in piloting activities. In this regard it will be of key importance to streamline the IP requirements that help collaboration take place while building trust regarding sharing of IP and other confidential information. The first step will be to raise IP awareness by providing specific IP advice both to end-users and stakeholders taking part in pilots and the second will be to set the required steps before engaging them in FlexiGroBots activities such as signature of an NDA or MOU, acceptance of IP provisions, definition of background IP, classification of information and access rights, etc.

Post-Project IPR Strategy: Systematic management of IP risks and contractual environment is one of the building blocks of post-project sustainability. Responsible partner will offer services for the whole IPR lifecycle to FlexiGroBots partners concerning appropriate protection of results, provided that protecting them is possible, reasonable and justified (given the circumstances).

8 Business prospects

8.1 Business risks and risk mitigation

Identification of main business associated risks and description of risk mitigation strategies are specified in fallowing table.

Risk	Risk description	Risk mitigation strategy
Access management	Access management is critical for every SaaS application due to the presence of sensitive data. SaaS customers need to know whether the single point of access into the public cloud can expose confidential information.	**Risk assessment.** Effective risk assessment includes everything from identifying the right technology assets and data to recognizing where the data is stored and how it links with business processes and other internal applications. Conduct security audits regularly and address any security risks that you find identified.
Regulatory compliance	Ensuring that suppliers have strong endpoint security measures in place.	**Policies and standards.** Today, there are many resources available to help SaaS users create information security policies and guidelines. To have a dedicated cloud security team in place or to develop basic policies and supporting standards to guide users when they use a SaaS application.
Storage	The unsafe place where all the data is stored.	**SaaS security checklist** is a part of reviewing potential partners and should be considered for two already approved partners (when creating a new integration or connected service). • Check for recommendations from national or regional authorities • Review access and security information published by SaaS provider • Inspect the data security of provider • Conduct legal review to ensure compliance with data protection regulation • Confirm compliance with relevant international standards • Conduct a technology audit Having a solid SaaS security checklist will help determine whether or not the cloud service provider can be trusted.
Disaster recovery	Disasters can happen out of the blue and have the capacity to shake the foundations of the business.	**Disaster recovery plan.** A disaster recovery plan is a subset of the business continuity plan, a must-have tool in every organization's arsenal. It involves creating processes, policies, and procedures that will prepare an organization to recover the usage of its tech infrastructure in the event of a natural or human-induced disaster.
Privacy and data breaches	Security and data breaches are a common security threat that organizations face every day.	**Identity access management.** Identity access management (IAM) covers aspects like authentication, authorization, and auditing.

Risk	Risk description	Risk mitigation strategy
		Authentication has long passed beyond traditional password-only authentication, and now, it must include steps like enabling multi-factor authentication. Multi-factor authentication demands users to submit at least two pieces of evidence that verify their identity.
Financial risk	Ensuring the finance stability during implementation and exploitation period.	**SaaS is a subscription-based or pay-per-use model** that user can access through online via web-browser. It has a significant lower upfront cost compared to a one-time fee for an on-premises solution, which is a large capital investment and has a lengthy (and often complicated) implementation process. The SaaS model decreases the financial risk as it is paid either monthly, quarterly, or annually and can be cancelled anytime, compared to a one-time fee for traditional software.
Governance	With scalability, as the company grows, the number of users that use the software grows as well, meaning, a lot of data is just floating around, and that data needs to be organised. Risk of losing money due to the lack of knowing if the platform is being used to its fullest.	**Data governance performed according to the best practices.** To have well-structured governance and data privacy that compliant with data privacy laws such as GDPR.
Continuous development	The SaaS market is constantly evolving; with new services will reflect on the developed business value in the end.	**Adoption to the current state of the market.** To use business and commercialisation experience and knowledge to adapt to changes on time.
Economic crisis and the big players	Smaller SaaS's, who are on the path of becoming profitable, face two more risks. The first one is if an economic crisis would occur, smaller companies do not have the cash reserves to withstand a serious market downfall, where the need for their services will rapidly decline.	**Resilience to market shocks.** Economically strong and experienced consortium and business and business developers; maintaining a good position in the agri-food value chain – with food being a basic human necessity, this market is least risky compared to others.

Table 6: Risk Identification and Description

9 Project sustainability and long-term operation

As part of the activities under “WP7: dissemination and exploitation”, task T7.5 is focused on ensuring the sustainability and long-term operation of the FlexiGroBots project. This task will start in January 2023 (M25) and its outcomes will be reported in deliverable D7.8 at the end of the project (M36). Task T7.5 will have three parts:

- The consortium will design a strategy with the objective on ensuring the project sustainability and its long-term operation. The sustainability of a project has several aspects such as adaptability, extensibility, scalability, maintainability. The strategy for obtaining **financial sustainability** has already been designed in task T7.3 and it is explained in Sections 5 and 6.
- The partners will contact the DIHs listed Section 6.2 to present the technology and methods developed within the project. The DIHs will be asked for feedback regarding the applicability and readiness of said technologies to the market. They will also be asked to serve as intermediaries between the project and the market for communication, visibility and marketing purposes, as explained in Section 6.1.
- The partners will propose actions and measures that aim to increase the number of final users that adopt the technologies and methods developed within pilots of the project.

Task 7.5 will build on the work done by tasks T7.3 and T7.4, collaborating closely with them throughout its development.

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