SMART AGRICULTURE

Digitalizing the entire agriculture chain, from the field to production, up to the management of national and international funds

ENGINEERING

WHAT ARE WE DISCUSSING?

AUTHORS

Alessandro Scandurra

Senior manager, Technical Director PA Central Italy, Engineering

alessandro.scandurra@eng.it

Alessandro Scadurra

For about 23 years in the IT sector, Alessandro has held roles in Consulting, Accounting and Project management. With 15 years of experience in Agriculture for Public Administration, he entered Engineering 5 years ago. Here he was technical manager for various Regions; today he is in charge of Central Italy LPA Administrations (DGs, Agencies, Universities, Institutional and instrumental bodies) and since 2021 he is also director of the national competence center for agriculture.

Stefano Picchio

Business Development, PA & Healthcare Department, Engineering

stefano.picchio@eng.it

Stefano Picchio

PhD in New Technologies for Territory, City and Environment, graduated in Geographic Information Systems and Remote Sensing at the IUAV University of Venice where he is still professor in Remote Sensing. He has been dealing for years with GIS and innovation for Local PA and the Industry market. He published the book "Territorio Cibo Salute" which deals with the issues of food safety and territorial and environmental health and new technologies.

Chiara Ruffino

Innovation Lead, Business Development & Solutioning, Engineering D.HUB

chiara.ruffino@eng.it

Chiara Ruffino

Within Engineering D.HUB Chiara is an Innovation Lead with skills in IT architectures and Digital Platforms. The scouting of new technologies and the experimentation of new solutions for customers are constant elements that guide her in her work. She works to align the solutions to the real business needs in the Smart Agriculture field with the DE4Vines project and in the HPC field for Genomics with the CMP3VDA project.

Morena Pietraccini

Senior Project Manager, Industries eXcellence Global, Engineering

morena.pietraccini@eng.it

Morena Pietraccini

Morena has over 30 years of experience in IT solutions and services for the Manufacturing plants. She is currently focused on the design of a new family of Industry 4.0 compliant products taking the best out of the newly available technologies and models but still solidly based on the context specific knowledge and experience that Engineering has built over years.

William Fillipe Rocha da Silva

Agribusiness Account Manager, Engineering Do Brasil

william.rocha@engdb.com.br

William Fillipe Rocha da Silva

William is Sales Manager for Agri-food sector, in particular, in the dairy segment with over 40 customers in Brazil. With more than 10 years of experience with technology projects, he has worked on IT and digital transformation projects in large companies. He graduated in Project Management from IETEC, with a specialization in Agile Project Management.

Angelo Marguglio

Research Area Manager "Smart Industry and Agrifood", Research & Innovation, Engineering

Angelo.Marguglio@eng.it

Angelo Marguglio

Since 2006 Angelo has worked in the Research and Development laboratory of Engineering. Now he is Research Area Manager of the "Smart Industry and Agrifood" Unit, where he coordinates a group of over 30 researchers. He is also Co-chair of the Smart Industry Mission Support Committee within the FIWARE community, and a strong advocate for the activities of the International Data Spaces Association and the Smart Manufacturing Group within the Big Data Value Association.

Giulia Antonucci

Business Developer, Research & Innovation - IS3 Lab, Engineering

Giulia.Antonucci@eng.it

Giulia Antonucci

Giulia holds a Master in Business Management, is a member of the “Industry and Security Technologies, Research and Innovation (IS3) Lab” team, where she defines new business strategies for Agri-food and Cybersecurity. She has been working in the ICT sector since 2012, also in London; she co-founded a consulting start-up SmartCity with Chairperson and business developer roles, and Living Lab Puglia Smart Lab, where she participated in international co-creation processes.

Alessandro Castiello D'Antonio

Group Portfolio Innovation Advisor, Engineering

alessandro.castiello@eng.it

Alessandro Castiello D'Antonio

Alessandro works on enhancing the Group’s portfolio by developing content and closely working with all market units. He developed an innovative Portal to enable agile access for all client facing professionals to all of marketing’s resources (Presentations, Webinars, White Papers, etc.). He previously worked in consulting after completing Innovation & Business studies.

Emiliano Coraretti

Content Specialist Group Marketing, Engineering

emiliano.coraretti@eng.it

Emiliano Coraretti

Emiliano has over 20 years of experience in journalism and communication. He worked for the Editorial Group l'Espresso. For Engineering he managed several communication projects and web portals. He is currently producing specialized content.

1

TRENDS, CHALLENGES AND OPPORTUNITIES

The story of mankind can be narrated through the story of agriculture. The agricultural landscape represents the very essence of the agricultural and cultural heritage of the different populations that live and work in it.

Food, land, water, environment and population growth are challenges to which institutions and governments are required to respond. In the past, the combination of measures and instruments used to support agriculture proved insufficient due to high climate variability and an inflated market, but today new technologies can come to the rescue with sustainable solutions.

By **Smart Agriculture** we mean the use of digital techniques to reinvent, govern and optimise agricultural production processes. Digital Transformation boosts human intervention in agriculture and helps to reduce the workload, to carry out specific measures, to calibrate the use of chemical products on the soil and crops, in addition to guaranteeing and increasing the harvest. It also helps to manage all those processes that enable or support agricultural production, including economic-administrative processes.

The objective of Smart Agriculture is to offer solutions that can be applied to all farmers, regardless of the size of the farm, region or sector, leveraging scale effects and keeping the cost of technology low. In this context, policies are needed to ensure high speed data transmission and harmonised interoperability, the adoption of standards at European level to promote connectivity in rural areas, accompanied by adequate infrastructure and services for data processing.

So far, the benefits expected from the introduction and integration of technological processes in agriculture have been attributed to **greater production and quality efficiency, the reduction of company costs, optimisation of inputs and minimisation of environmental impacts, and the creation of job opportunities for specialised personnel**. However, thanks to the support of agricultural policies and the growing awareness of the economic and ecological benefits they can produce, new technologies in agriculture really have the potential to spark off a process of **radical transformation in the sector.** According to analysts*, the global Smart Agriculture market, which was worth almost $10 billion in 2017, will exceed $23 billion in 2022.

*Source: Statista dossier on Smart Agriculture

Furthermore, Precision Farming market is expected to hit $9.5 billion in the next few years, growing by 2025 more than 15% in Asia and 11% in North America. South American market, which is already worth over $600 million, will observe a growth of over 16% in Argentina, Mexico and Brazil.

New technologies and Precision Farming are benefiting also the African continent, where more than a quarter of the world's arable land is found and where agriculture contributes to 15% of the gross domestic product (about $100 billion dollars a year). For example, Ethiopia, Kenya and Rwanda are adopting technological tools that innovate agricultural practices to address and prevent the issues generated by climate change and population growth.

By 2025, Precision Farming market is expected to grow by over 13.5% in Europe. The **Common Agricultural Policy (CAP)** represents the set of rules that the EU has sought since its inception, acknowledging the crucial role of the agricultural sector for a fair and sustainable development of its Member States.

The CAP aims to **help farmers to produce sufficient quantities of food for Europe, guaranteeing its safety and quality at affordable prices**. It aims to ensure a fair standard of living for all operators in the sector, protecting them from excessive price volatility, market crises and imbalances in the food supply chain. This is why it is essential to invest in the modernisation of farms to maintain prosperous rural communities throughout the EU and to create and maintain jobs in the food industry. However, we also need to **protect the environment, animal welfare and biodiversity, and mitigate climate change through a sustainable use of natural resources**.

The CAP is structured in two pillars: the first provides direct income support through funding to farmers who cultivate their land in compliance with safety regulations regarding food, the environment and animal welfare; the second pillar is focused on rural development and promotes the modernisation of farms, the promotion of vocational training, technology and innovation, providing risk management tools.

After the recent expiry of the CAP that was active until December 31st, 2020, we are moving towards a transition period of two years which will have to lead to a renewed version. The debate at European level is animated by two major themes: the utterly central role attributed to **climate neutrality**, which has been put into practice through the initiatives grouped together in the European Green Deal, and the need to mitigate the negative effects of the **current pandemic crisis** (also through the Next Generation EU programme). The new CAP will also adopt a more result-oriented approach, specific support measures for small farmers and in particular for young people, as well as higher penalties for repeated cases of non-compliance with EU requirements.

The value of data

The process of Digital Transformation in agriculture is about digitalizing information in order to build up a knowledge base with which informed choices can be made about process automation. The information recorded generates value in the different steps of the production chain: consider as an example the area of food traceability through an Augmented Reality application, which by scanning the label of a bottle offers a virtual tour of the winery that produced the wine and a map of the performance of the production year.

The farm (in this case the winery), is the central entity of the system for the collection, analysis and management of agricultural data, while collaborative models designed for consortia, cooperatives and distributed and shared services play a key role in the strategy of generating value from data derived from the agri-food chain. **Digital agriculture represents an unprecedented opportunity to create value and business opportunities with data-driven solutions**, although data sharing between different stakeholders needs to be regulated by transparent and fair rules.

The EU is working on a code of conduct for agriculture. Data sharing will cover the **general principles for sharing agricultural data** that are generated by processes on the farm and within the agri-food chain (e.g. agronomic data, compliance data, data relating to livestock, data generated by machinery, data derived from services and data related to the products used). Smart Agriculture platforms that endorse such a code of conduct can gain the trust of farmers by clearly stating the type of data sharing policy they adopt and the responsibilities involved.

In 2018, the EU promoted a Code of Conduct on Agriculture. The document illustrates the general principles and the contractual relationships for sharing agricultural data that are generated by processes on the farm and within the agri-food chain: agronomic data, compliance data, data relating to livestock, data generated by machinery, data derived from services and data relating to the products used). The code specifies the rights of access and use of information, representing an important step towards the recognition and protection of the value of agricultural data. The central role of data-driven innovation in the sector is also demonstrated by numerous other initiatives.

In February 2020, the European Commission published the European Data Strategy at the same time as the White Paper on Artificial Intelligence. Both documents, which are to be considered part of a unified approach, represent a fundamental plan for the use of data and the development of technologies that can fully exploit their potential in accordance with European legislation and values. The most important initiatives include the creation of Common Sectorial Data Spaces, data sharing infrastructures organised by sector, which will support the development of new products and services. Among these, there is a specifically planned Data Space focused on agriculture, which aims to support the sharing of and access to data relevant to agricultural production, improving the sector's economic and environmental performance, and promoting activities of common interest such as research, innovation and policy generation.

The sharing of data in agriculture is considered an important factor in achieving the objectives of environmental sustainability contained in the Green Deal and, in particular, in the Farm-to-Fork Strategy, which focuses on food systems taking into account the inseparable relationship between the health of people, the health of communities and the health of the planet. In November 2020, the Commission published the Data Governance Act, a regulatory framework that aims to enable the implementation of the various Data Spaces and focuses on defining the conditions for the re-use of specific types of data held by public sector organisations, on methods of notification and supervision of the provision of data sharing services, and on the registration of entities that collect and process data and make them available for non-profit purposes.

The complex strategic and regulatory system finds a concrete technological support in GAIA-X, a European initiative aimed at developing common requisites for a EU-wide data infrastructure, through the federation of data sharing and data processing service providers, thus enabling new business models in line with European values. Engineering strongly believes in the potential of GAIA-X and is a founding member of the project.

For the farmer entering the world of Smart Agriculture from scratch, the significant advantage of being able to access existing data from both production and other sources, such as open data and other public data, lies in **being able to draw on a vast knowledge base to help make decisions, improve and optimise the use of resources**. The process of Digital Transformation in agriculture is about digitalising information in order to build up a knowledge base with which informed choices can be made about process automation. The information recorded generates value in the different steps of the production chain: consider as an example the area of food traceability through an Augmented Reality application, which by scanning the label of a bottle offers a virtual tour of the winery that produced the wine and a map of the performance of the production year.

2

ENGINEERING IN SMART AGRICULTURE

The use of big data, satellite and aerial images are revolutionizing precision agriculture. New technologies increase production efficiency by finding the right balance between productivity and environmental protection.

We at Engineering, as a system integrators, combine technological experience and strong and solid business skills that cover both the public and private sectors. We support our stakeholders in building new ecosystems starting from our knowledge of the context, regulations, administrative and production processes, up to the implementation of software solutions.

Alessandro Scandurra
Senior manager, Technical Director PA Central Italy, Engineering

SMART AGRICULTURE

Farms have more and more data which, when analysed using new technologies, help to optimise and streamline the cultivation of the product, product traceability, marketing and distribution.

Through an integrated ecosystem of technologies and data systems, **we at Engineering help players in the sector to exploit the advantages of Digital Transformation along the entire agri-food chain**, from day-to-day farming activities to the management of national and international funds, in addition to providing support with sales operations, logistics and maintenance of farm assets. For example, thanks to our expertise and knowledge of new technologies, we assist companies in making use of the **Internet of Things**, encouraging the transversal application of Precision Farming: the application of enabling technologies in the fields, through the constant supply of data from the machinery, provides immediate feedback in sectors such as viticulture, cereals and fruit and vegetables, where the new technologies enable capillary control of the soil and monitoring of the entire production chain.

Our knowledge of new **wearable technologies, GIS, and data analytics** allows us to provide support also in the livestock sector. In fact, through the proper collection and analysis of information, we optimise the monitoring of animals, improving management processes and directly affecting product quality.

By implementing new technologies, we contribute to innovating the Regional and Private Information Systems offering, adopting advanced technological frameworks and integrating the most advanced GIS / Remote Sensing, AI & Advanced Analytics, Mobile, Cloud, IoT, RPA and Blockchain technologies.

For example, we help the Public Administration to guarantee and monitor the correct disbursement of economic funds to farms, which favours their growth and development.

Our mission is to promote the combination of sustainability and productivity in the agri-food business. The skills we have acquired together with the projects, services and products we have developed over the last decade enable us to offer fully comprehensive solutions that cover the needs of all players in the sector, from private companies to public administrations.

The figure below describes the Portfolio Map, in other words the full range of our skills in Smart Agriculture.

At Engineering, we are able to bring value to our customers in different areas related to Smart Agriculture not only through our vertical and transversal competences, but also thanks to:

- **a differentiated operating model tailored to the specific needs of the customer** to address both the need for reliability and operational efficiency through a more traditional, solid, accurate and secure model, and the need for speed and effectiveness through an agile and innovative model
- **technology and business partners**, which enhance the capabilities offered by Engineering to build complete, innovative solutions, integrating skills, best-of-breed technologies and geographic proximity
- **activities of Research and Innovation** that make it possible to explore innovative services, solutions and business ideas: by moving ahead of the market, it offers innovation and competitive advantage to customers.

The role of R&I for Smart Agriculture

The potential of digital technology used in the agricultural sector represents a significant opportunity for operators in the sector to optimise the use of resources, maximise the income from their work and above all raise the guarantee of quality for the end user. Agriculture 4.0 is not only based on technological solutions, however, as it also envisages a major role in the **integrated use of techniques, models, best practices, training, and above all sharing models**.

It is no coincidence that, over the last 5 years, the European Commission has planned significant investments in the creation of large-scale pilot projects in order to provide answers to challenges faced by society in various sectors, including the construction of platforms to support digital innovations in the agricultural sector.

There are numerous European projects for which it is crucial to manage a wide range of use cases with the aim of driving the digitisation of agriculture in Europe, fostering scientific excellence, a competitive industry and providing answers to the challenges facing society:

- **IOF2020** (19 pilot projects), launched in January 2017, aims to facilitate the adoption of the Internet of Things (IoT) in food and agriculture;
- **SmartAgriHubs** (9 DIHs involved and 28 pilot projects), launched in 2019, aims to achieve the digitisation of agriculture in Europe by fostering an agricultural innovation ecosystem dedicated to excellence and sustainability;
- **DEMETER** (20 pilot projects), launched in 2019, aims to demonstrate the potential of digital and interoperable solutions in agriculture, ensuring safety, privacy and commercial confidentiality throughout the value chain;
- **ATLAS** (13 pilots), launched in 2019, aims to build an open digital services platform for agricultural applications, allowing the flexible combination of agricultural machinery, sensor systems and data analysis tools and promoting interoperability;
- **OPEN DEI**, which started in 2019, considers agriculture, as well as manufacturing, energy and health, as key sectors for the implementation of the EU's digitisation strategy. The project aims to identify gaps, encourage synergies, and support regional and national cooperation. It also aims to improve communication between IA (Innovation Action) projects that implement the EU strategy on digital transformation;
- **Med Food TTHUBS** (7 pilot projects), launched in 2020, aims to assess the applicability and efficiency of its e-Platform as a "one-stop-shop" for the traceability and authenticity of food products from 7 Mediterranean countries.

Such innovation actions reach far beyond the mere development of solutions for the market, because they pervade the European agricultural sector with initiatives that can create adequate conditions for the applicability of the technology: awareness and training of end users, user acceptance, transparency, possibility/freedom of choice between solutions available on the market, increased competitiveness of farmers who gain full control of their needs and data, but above all the creation of an open and 'co-operative' environment, which is better suited to the proliferation of new business models and opportunities.

With the aim of playing a key role in European innovation policies in the area of agriculture, in recent years, the Research and Innovation activities of Engineering, through our dedicated Management, have been focused on the construction of a network of strategic European partners and on the search for new opportunities for applying its know-how in the context of European funding opportunities.

We continue to cooperate with research organisations, companies (farms, as well as technological and industrial companies), associations, cooperatives and consortia throughout the European Union. An important partner of Engineering is Coldiretti (Italy's National Confederation of Independent Farmers), which is involved in two ongoing projects, DEMETER and IPM DECISIONS.

Our research activities for Precision Agriculture thus have an integrated and open approach, with the aim of creating a Europe-wide ecosystem of solutions and expertise to offer to the Group's customers, providing the best innovations for specific areas of application.

Regarding solutions, the Research & Innovation Department pursues its initiatives on two levels:

- **a horizontal level** for the integration of technologies for agriculture and livestock farming that do not yet communicate with each other, with the aim of providing flexible, complete and accessible tools from a single access point. In this context, it is worth mentioning the IPM DECISIONS project (funded under the SFS-06-2018 Stepping Up Integrated Pest Management H2020 programme), in which Engineering supports system integration and data sharing activities, as well as the technical part of user interaction.

- **a vertical level** on the supply chain, which considers the entire agro-industrial supply chain in the research activities. For example, one major project (financed by MISE) in which Engineering plays an important role is CiTrace, the scope of which is to ensure the traceability of the orange supply chain.

CASE STUDY

DEMETER: data in the field for Smart Agriculture

DEMETER, funded under the European programme, aims to drive Digital Transformation in the European agri-food sector through the rapid adoption of advanced technologies, such as IoT, Artificial Intelligence, Big Data, Decision Support, Benchmarking, Earth Observation, etc., in order to ensure the long-term profitability and sustainability of the agricultural sector.

The main "enabler" of DEMETER is interoperability, which is extended to data, platforms, services, applications, human knowledge, to the point of promoting its implementation by connecting farmers and consultants with ICT and machinery solution providers.

In order to achieve these goals, DEMETER has defined a Reference Architecture (RA) designed to meet the challenges in the agri-food sector. DEMETER's architecture is based on the results of major initiatives that have produced Digital Platforms for the development of complex systems. These include: IoT-A and AIOTI in the area of IoT, BDVA and NIST in the context of Big Data, IDSA and FIWARE in the area of the Interoperability Platform. Finally, the Architecture of DEMETER will certainly take into account the results of the GAIA-X project, which is considered the "next generation" in terms of data infrastructure for Europe.

In order to implement the Reference Architecture several key technologies have to be developed. These include the implementation of an open and interoperable data integration model. This must take into account multi-source and multi-data systems from IoT systems, as well as systems of legacy, from open data, geographic and satellite information.

In addition to our position as technical coordinator, we play a central role in the project in managing a pilot related to the integration of data from different devices in the milk supply chain.
The aim is to develop a blockchain-based information traceability system from the stable to the end user.

3

FIELD OPERATIONS

SMART AGRICULTURE

For some time now, the agricultural world has seen the adoption of automation solutions that generate information that is not always fully usable. In order to promote innovation, it is necessary to leverage not only the potential of new knowledge, but also a substantial part of existing knowledge and its relative supporting information flows, which have yet to be exploited to their full potential.

The approach of Engineering, which is aware of the trend towards consumerisation that is taking the technological world by storm, is to create a platform on which farmers, through a plug and play approach, will be able to simply connect an IoT device to obtain data from all kinds of objects or vehicles, such as weather stations, food production and storage machinery, telecommunications units or agricultural machinery.

In the Field Operations area, our offering is based on the Digital Enabler, our Ecosystem Platform, which makes it possible to aggregate different technological components into an ecosystem that can enable new business models based on the data economy. In this way we aim to enhance the interoperability and openness of the different systems, enabling the integration of new technologies, the sharing of data and the consequent generation of knowledge.

We take advantage of a digital infrastructure in the Cloud, which is able to orchestrate typical processes and provide a semantic representation of data, **including the production, processing and distribution of food products**. In this way, different functions are supported at various stages of the E2E process with traceability information about the product for the end user and for administrative and control bodies, ranging from producer to processor to distributor.

We also support the world of Smart Agriculture with management platforms that integrate administration functions for business management, agronomic functions for monitoring crop production in the fields, scouting or field survey management, processing management and livestock management.

Our expertise in enabling technologies means we are able to incorporate advanced IoT technologies into **solutions that are designed to improve operational efficiency, maximise yields and minimise waste** through the real-time collection of field data and the implementation of control mechanisms. IoT-based applications - such as variable rate dosing, precision agriculture, smart irrigation, and smart greenhouse - transform and enhance processes in addition to increasing the quality and quantity of agricultural products.

Save The Grape: precision farming for Maison Anselmet

CASE STUDY

Maison Anselmet is one of the most prestigious wine producers in the Aosta Valley, and has been challenging the climatic and environmental conditions of the area for generations to ensure the excellence of its products. To support the production of its most valuable vineyard, together with our experts we used the latest Internet of Things and Big Data technologies. This enabled us to analyse the micro-climate and identify environmental factors that can optimise crop development and prevent the spread of plant diseases.

The monitoring and protection of the vineyard is based on constant, real-time data collection to monitor environmental and physiopathological conditions. The micrometeorological values collected take a snapshot of the state of the crop and, once archived, allow analysis over the long term. Sensors constantly measure temperature and relative humidity in the air and soil, as well as data relating to wind, atmospheric pressure, rain, light intensity, dew point, leaf wetness, diametric stem growth, pH value and soil conductivity.

Engineering's flexible and modular application architecture consists of a set of sensors located in the field that send data to a central unit, which transmits them directly to the Engineering data centre. The power supply is modular, either via the mains or via a photovoltaic panel, and data are transmitted via GSM/GPRS/3G/LoraWan/ethernet/wi-fi/wi-max. The data transmitted by the group of sensors to the Engineering Data Centre are collected and protected in a database for processing. The detection, collection and analysis of the data make it possible to dictate intervention times according to disease prediction models and, on the basis of specific signals, to support the work of the winegrower in the decisions to adopt in certain situations.

The solution provides the farmer with:

- **prediction models** related to the phenological stage of the vines for the main diseases (such as downy mildew, botrytis and powdery mildew)
- **models for monitoring microclimatic conditions**, e.g. which allow assessment of frost risk
- functions for **managing irrigation and monitoring soil moisture** at different depths.

Thanks to Save the Grape, we have achieved:

- improved biological product quality
- a reduced environmental impact
- a balanced use of products for viticulture
- a reduction in the number of working hours required
- a 50% reduction in chemical treatments on the plants.

DE4VINES

DE4Vines is the innovative solution dedicated to Precision Farming, developed by Engineering D.HUB, for all winegrowers, consortia of farmers and producers who care about the quality of their production, whatever the size of their company.

DE4Vines combines digital technology with a world made up of traditional manual skills, passion, experience and personal memory, which are key elements for Italian winegrowers and make our country a flagship of excellence in the wine sector.

DE4Vines was created for vineyard monitoring but can be used for various types of crops. DE4Vines is a multi-device platform, with simplified and intuitive access, that supports the organisation and planning of activities. This solution makes it possible to control and monitor crops: the data transmitted by the sensors to the Engineering Data Centre are processed and, when predefined events occur, DE4Vines sends automatic alerts via text message or email.

Crops are also monitored through the processing of statistics and forecasts, thus enabling each worker in the company to carry out his or her activities to the best of his or her ability with views tailored to his or her role.

The advantages of DE4Vines are:

- Reduced cost of crop management processes
- Increased and more uniform soil yields
- Optimisation of product characteristics and increase in quality
- Reduction of environmental impacts of cultivation processes.
- Focus on Field mapping systems

Mapping systems for fields

In recent years, Engineering has been paying close attention to developments in the increasingly widespread use of **Global Positioning Systems (GPS) and Geographic Information Systems (GIS)** in Smart Agriculture. These technologies, together with real-time data collection and accurate position information, allow the efficient manipulation of the analysis of large geo-spatial datasets.

The Global Positioning System is currently used to implement solutions for Precision Agriculture that facilitate **field mapping, agricultural planning, crop scouting, yield mapping and soil sampling**. This technology is also compatible with many GPS-enabled mobile phones. GPS also allows farmers to work well in low-visibility field conditions such as dust, fog, rain and darkness, but sometimes, especially in certain locations, the GPS signal is absent.

This is why only the combination of GPS and GIS technologies is essential in linking crop yields and production techniques with land variability, allowing growers to devise the most appropriate and effective plant or soil treatment strategies to improve crop production. The maps generated can be used for the **precise distribution of water, fertilisers, pesticides and herbicides**, thereby limiting the dispersion of these chemicals, optimising environmental sustainability, reducing production expenses or costs while maximising yields.

Engineering's solutions also take advantage of Earth Observation systems such as the satellite platforms of the Copernicus Programme (European Space Agency) and high-resolution imagery (VHR) to provide photogrammetric and multispectral surveys. From the latter, indices of crop vigour, the degree of greening of vegetation or the water content of surfaces are extracted in order to optimise and improve interventions on the crops being analysed.

Similar information can also be obtained using more innovative technologies, e.g. using a drone fitted with a multispectral camera and a laser scanner. A survey carried out using a **laser scanner** during the dormant period makes it possible to obtain a 3D map of the crop and to generate the hydrographic grid to identify water stagnation. This instrument also supports the planning of any restructuring work on the plot of land.

The IoT is also a technology that enables the management of farm assets in the field and all related activities (e.g. maintenance, performance measurement, quality, etc.).

Using an IoT platform such as DiVE, we enable the connection and interconnection of assets, locating them by integrating their geographical coordinates with GIS systems. This allows for remote and constant monitoring to intercept faults or abnormal trends.

Conditions and information are then available on synoptics and geographical maps, making them easier to consult. The analysis of the acquired data becomes simpler and faster, also making it easier to correlate them with environmental information collected by various IOT sensors.

In addition, with regard to field operations, we aim to provide the customer with the best possible scheduling of activities and resources to increase effectiveness and efficiency.

Thanks to the expertise of OverIT, an Engineering Group company, we are able to offer two specific solutions to meet these objectives:

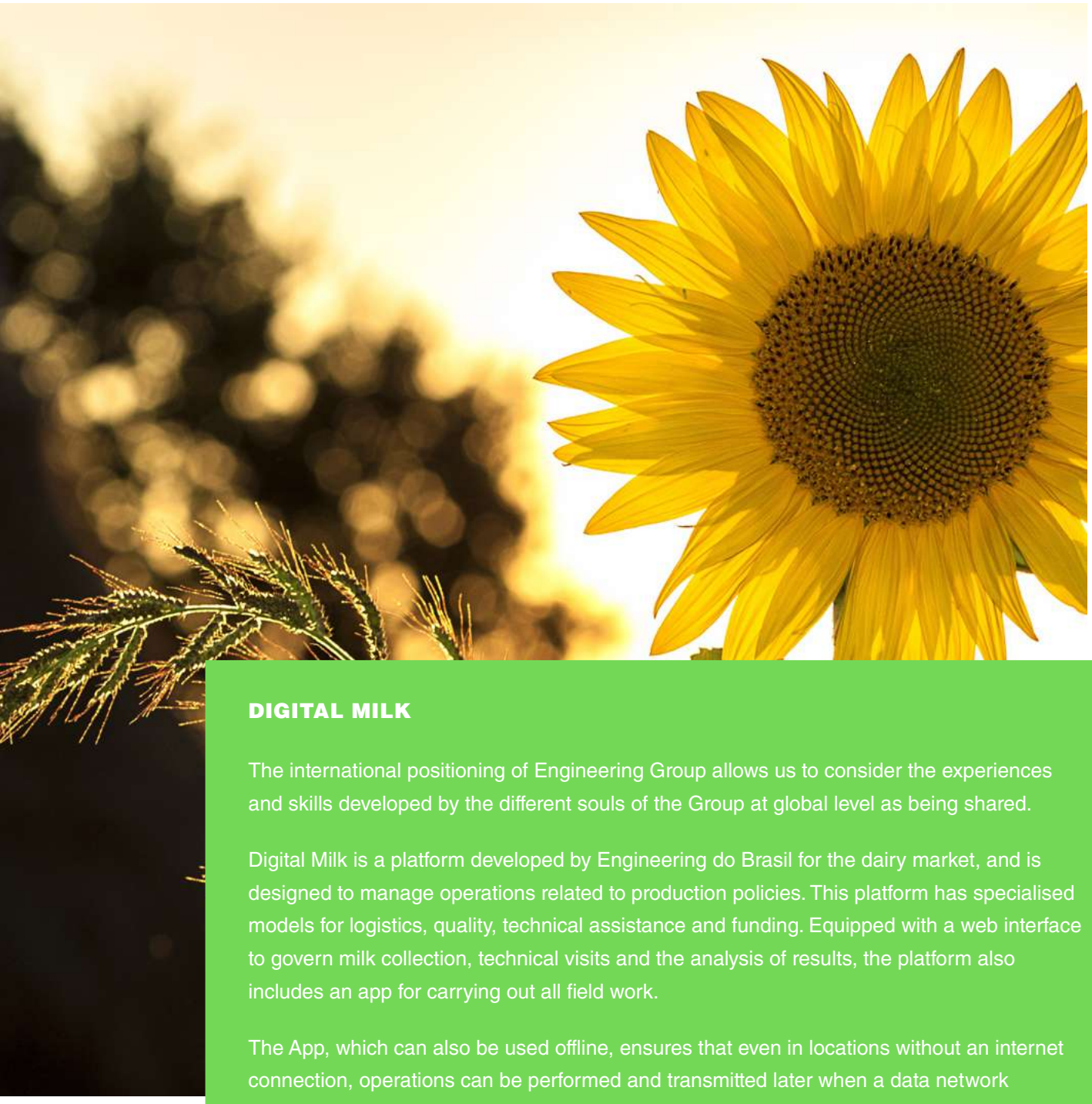
- Geocall is the end-to-end product dedicated to Field Service that supports leading companies in different sectors. In the agricultural supply chain, Geocall has a positive impact on the organisations involved in **production/cultivation** (such as inspections by authorities, product collection services, machinery maintenance services). The solution also plays a central role in all situations where productivity is linked to the effectiveness of emergency response operations. Thanks to its **ability to integrate with IoT technology**, it plays a key role in automatically generating tasks and optimally managing a rapid response.
- With SPACE1 Augmented Collaboration we can also provide technicians with appropriate digital tools and innovative technologies, such as Augmented and Mixed Reality, thereby improving their operations in the field and increasing safety at work.

SMART AGRILAND

Smart Agriland is our proposal designed to develop a solution based on the most innovative digital and geo-spatial technologies to monitor and optimise the production processes of farms, exploiting Internet of Things, Advanced Analytics, GIS and Remote Sensing technologies.

This solution allows the optimisation of fertiliser and irrigation water quantities in crops using indices of vigour and water stress produced by Remote Sensing data. It produces prescription maps for use in field vehicles using VRT (Variable Rate Technology). Smart Agriland is equipped with master sensors connected remotely via a cloud platform, which transmit data via SIM and make it possible to track work in the field and the interaction between vehicles and equipment: seeders, fertiliser spreaders, sprayers, threshers.

It is a very useful tool for monitoring diesel consumption and for applying for the UMA contribution.



DIGITAL MILK

The international positioning of Engineering Group allows us to consider the experiences and skills developed by the different souls of the Group at global level as being shared.

Digital Milk is a platform developed by Engineering do Brasil for the dairy market, and is designed to manage operations related to production policies. This platform has specialised models for logistics, quality, technical assistance and funding. Equipped with a web interface to govern milk collection, technical visits and the analysis of results, the platform also includes an app for carrying out all field work.

The App, which can also be used offline, ensures that even in locations without an internet connection, operations can be performed and transmitted later when a data network becomes available.

Through the App it is possible to record structured and unstructured information, record geo-referenced scouting information for the crop map, information on the use of machines or operations carried out in the field (such as sowing, fertilising, treatments and harvesting).

4

FARM OPERATIONS

SMART AGRICULTURE

Now that Digital Transformation is becoming increasingly widespread and indispensable, more and more players in the agricultural sector are adopting smart technologies with the aim of improving the quality of processes on their own farms, in order to have a positive impact on the quality of their products.

At Engineering, we are also able to support our customers in the management of their operations, from the analysis and processing of raw materials to the management and maintenance of production machinery.

In recent years, there has been a **growing interest in predictive maintenance**, a new approach that aims to exploit the integration with **IoT, Big Data and Analytics**, in order to collect data and monitor parameters of each individual machine, and then translate them into information that can predict failures and anomalies. This approach allows the **development of targeted interventions and specific maintenance programmes**, reducing not only downtime but also the costs of repair and maintenance work.

In this context, we provide solutions for monitoring the technical parameters of machines, which are able to detect any anomalies during work phases, as well as to determine movements and working speed, connecting several machines operating simultaneously in the field. Our experience in the automation and control sector also enables us to offer a **range of solutions and systems for automating production and processing**, which meet the customer's need for flexibility and ensure greater standardisation, cost reduction, increased efficiency and process optimisation.

Some of the solutions we provide in the area of Machinery Predictive Maintenance are:

- DiVE Suite is our platform for asset integration, the connection of business processes and Data Intelligence, which can digitally collect and analyse field data, predict and prevent potential machine and tool malfunctions, and anticipate and prevent quality loss within production processes. This solution integrates easily with multilayer data and Edge, Fog, and Cloud data architectures. It consists of connected modules, which, when used together or individually, make it possible to manage specific communication, supervision, data analysis, information distribution and maintenance planning needs.

- Geocall is the end-to-end product developed by OverIT, a company in the Group, dedicated to Field Service, which integrates with diagnostic tools to remotely monitor machine parameters, recognise trends and guarantee that all data is recorded. At the same time, it allows the planning of an intervention, taking into account a multitude of elements, such as skills and qualifications of resources, materials, vehicles and all the elements necessary for its optimal completion.

Given the increasing complexity of the technologies, another aspect that should not be underestimated is the support for technicians, who need all the information they need to complete the tasks in hand.

The integration between mobile tools, wearable devices and the new Augmented, Mixed and Virtual Reality technologies that we are able to provide has revolutionised the concept of maintenance.
SPACE1 Augmented Collaboration is our product that increases the capabilities and autonomy of technicians in the field, bridging any gaps due to inexperience or lack of skills. With our solution, operators access pre-configured solution procedures, view content and digital animations, monitor parameters in real time, and benefit from advanced remote collaboration and knowledge transfer capabilities powered by Artificial Intelligence to share knowledge gained during interventions with all levels of the organisation.

SMART FLOW

Smart Flow is a mobile application, developed by Engineering Do Brasil for Brazilian customers, aimed at linking the different players in the agri-food chain in the milk production sector, in other words large producers and small farmers.

Large agricultural producers can use the APP to request the purchase of working materials from smaller local companies. The latter, at the same time, can consult various indicators including the production records sold to larger players, quality indicators, the status of payments, through to the monitoring of zootechnical control plans and animal inventories.

The use of control systems and digital technologies makes it possible to automate production processes, reducing the need for manual human intervention. By analysing and processing data, it is also possible to plan, organise and control the entire production process, from the field to the final product.

At Engineering we build systems that manage data to and from field systems, controlling and supervising the information. The data acquired are stored in historical archives and correlated with each other so that they can be transformed into useful information for product traceability. Thanks to radio-frequency systems, it is also possible to **trace raw materials**, from the moment they are received in the factory to their use in production. Traceability also concerns the mixtures produced and the batches of ingredients used.

In the field of raw material management especially, the use and consumption of raw materials can be traced through recipes for the production and processing of products. Systems that control the consumption of raw materials are often integrated with management and product definition systems. For each processed and manufactured good, recipes are managed that identify the quality and quantity of raw materials to be used.

By managing product and process information, our solutions make it possible to draw up production plans according to the conditions of the plant, and then generate the production recipe schedule. The consumption of raw materials and production are automatically reported to the ERP systems.

The production process is also controlled by integrating the data provided by the equipment used in production (tanks, filling machines, autoclaves, packaging machines, palletisers, etc.).

Through the collection and processing of data, our systems also allow the analysis **of product and process quality** (in terms of temperature, speed, etc.), and the management and **calculation of performance** (OEE and other KPIs), the calculation of downtime and justification of stops in production. Finally, we implement systems for **labelling pallets of finished products** and for issuing reports on completed orders.

The importance of laboratories in quality analysis

Integrating and automating data, equipment and processes means improving laboratory efficiency and product quality. The **Industries eXcellence Global competence** centre implements solutions for the **management of quality data acquired in processed product analysis laboratories**. In this way, industry players achieve equal product quality standards (e.g. GLP, GMP, ISO, HACCP) across different processing/production facilities.

Designed as flexible tools based on a multi-site, multi-plant, multi-language and multi-time zone approach, our products offer a single, unified overview of all quality measurements.
They also **allow QC/QA operating modes to be integrated into all production operations** and provide the essential proof of quality for regulatory compliance with all industrial and laboratory standards (GLP, GMP, ISO 22000, etc.).

Our solutions also allow you to:

- **historicise all quality** data related to incoming controls of raw materials, process controls (intermediate products) and finished products (test reports)
- **provide full support for complex test plans/methods** definition and execution in different contexts flexibly (e.g. test plan definition for each product family or single product)
- **manage the connection of instruments and equipment** allowing qualification of all analysis results acquired
- **provide immediate feedback** on quality alerts (OCAP - Out of Control Action Plan).
- **produce automatic reports**, allowing the accounting of all SPC activities, when applicable.
- **manage the traceability** of each batch analysed
- **co-ordinate the distribution of analysis activities** by means of a work list.

5

SALES & SUPPLY CHAIN

The development of agriculture has contributed to the creation of companies whose processes and volumes of activity have developed requirements comparable to those of true industrial companies. The processes and activities of these players are undergoing a process of digitisation that can draw on paradigms similar to those of Industry 4.0: from holistic management of machinery to optimisation of the supply chain and production, as well as a more streamlined approach to customer relations.

The increasing use of complex machinery and equipment in the agricultural sector also raises the issue of managing it to ensure productivity, ranging from status monitoring to scheduling preventive maintenance activities.

With Geocall, OverIT's end-to-end Field Service Management product, we integrate IoT solutions into vehicles to monitor their parameters. In this way, the optimal management of machinery and equipment relies on our modules for the automatic generation of maintenance activities, whether due to faults or for preventive activities. Due to increasing automation, **integration with Qlik Sense also enables us to implement reporting systems and dashboards to provide summary data** for monitoring productivity and machinery faults. As mentioned above, however, maintenance activities play a crucial role. Given the complexity and customisation of the machines, it is necessary to provide technicians with innovative tools and technologies that can support them when carrying out their tasks.

The widespread use of wearable devices and the development of innovative technologies such as Augmented, Mixed and Virtual Reality open up new scenarios for our products. Our SPACE1 Augmented Collaboration product is able to streamline operations and gives technicians access to step-by-step operating procedures that guide them through the execution of tasks. In the most complex cases, SPACE1 also makes it possible to request the help of a remote expert who, using the visuals of the resource in the field, is able to support them by sharing technical documents, images, solution procedures and 3D models. Finally, the integration of Virtual Reality increases the effectiveness of staff training activities, thanks to the possibility of artificially recreating multiple immersive scenarios.

SMART AGRICULTURE

The management of the activities of large companies increasingly follows a sustainable approach to business, so much so that it is now a common and compulsory goal. In line with this principle, a new approach has emerged that has revolutionised the classic linear economic model, Take-Make-Waste, by introducing the concept of circularity, in other words the possibility of reusing resources in subsequent production cycles. As well as defining a new model, the circular economy has prompted many organisations to review their processes, rethink their business models and redesign the entire value chain, and it is with this in mind that we apply our end-to-end expertise in Sales & Supply Chain.

To support digitisation of the companies' supply chains, through the expertise of our **competence centre Industries eXcellence Global** we are able to manage the monitoring of machinery and production processes across the board, from the acquisition, creation, management and progress of production orders, to the exploitation of data acquired from the field thanks to IoT technologies. This allows real-time monitoring of production and plant performance, ensuring the integration and management of production assets, to enable predictive and preventive maintenance processes for machinery.

However, the production process of a farm must be properly integrated with those processes that manage the assets underlying production. This is why we also offer a range of skills to ensure the optimisation of the farm's logistics, ranging from the management of incoming and outgoing goods in the warehouse, as well as their positioning, internal warehouse space and inventory, to the monitoring and control of warehouse activities and the more administrative management of these processes, also with a view to enabling the customer to have the management of operational activities within the farm under his control. This is also reflected in the energy intensity of these activities. The skills we bring to the table therefore also concern the monitoring of energy consumption, according to the most commonly used indicators in this sector, including: the comparative analysis of consumption and its correlation with costs, the identification of anomalies, waste and inefficiency and therefore also the planning of energy saving/efficiency measures, up to and including the optimisation of supply on the energy market.

The governance of the materials used in the company's production processes is also a crucial aspect with regard to the management of the waste produced by such processes, in other words, the so-called "waste" materials, whether they are production waste or recovered materials to be reused as inputs for the production process. In fact, agriculture is one of the biggest waste-producing sectors and therefore offers the greatest opportunities for "circularity" and smart agriculture.

Among the circular solutions, **reverse logistics** is certainly one of the most interesting and most widely adopted. According to the European Working Group, it can be defined as "the process of planning, implementing and controlling the flow of raw materials, semi-finished and finished products from production, distribution and the end customer to the recycling point or the collection and distribution point". **As its purpose is to collect and recover materials for reuse, a return logistics system requires first of all the creation of a dedicated collection ecosystem**.

With Geocall, OverIT's end-to-end product for Field Service Management, we are able to meet all these requirements, enabling:

- the subdivision of the territory into sub-areas thanks to the integration with GIS systems
- the association of resources and warehouses to areas and sub-areas
- the effective planning of activities and resources (e.g. human resources, vehicles, and materials)
- optimised planning of movements and routes
- tracking of vehicles, materials, etc.
- optimal management of external companies
- monitoring of activities, providing field resources with tools for reporting them.

FOCUS

From business to consumer

The greatest benefits of digitisation can be achieved if it is applied throughout the entire Smart Agriculture supply chain, facilitating the interaction between the different players that make it up: from suppliers, to producers, to the end customer.

In Brazil, we have worked with CCPR (Central Cooperative of Rural Producers), one of the most important rural cooperatives. It is composed of seven cooperatives and includes more than four thousand milk producers throughout the state of Minas Gerais.
In addition to offering producers services such as Technical Assistance and Milk Collection, CCPR has also created a network of Warehouses to provide all kinds of rural materials.
In this context, the CCPR Armazéns warehouse was created, which represents an important source of income for CCPR.

CCPR Armazéns offers 3 types of sales service:

- Direct sales to large producers (with sales teams going to farms)
- Direct sales to warehouses (producers go to the warehouses in CCPR's network)
- Sales to other warehouses that are not part of the CCPR network.

To specifically serve each sales channel, CCPR sought support from Engineering and implemented Dynamics Sales.

The Dynamics Sales platform has a modern design and scalable architecture, as well as bringing together different sales methods that are fully integrated with ERP.

The platform includes the Sales Force modules (mobile application), the B2B portal (for warehouses in the same network) and the Marketplace (for warehouses in other networks). Thanks to this platform, more than 4,000 products will be offered on the Marketplace, including those manufactured by CCPR and other partners.

The time required to implement the project was 4 months, including integration with SAP in the FI, MM and SD modules.

Another example involves the adoption of virtual reality to accompany the end consumer in discovering the value of getting to know the vineyards, wineries and rituals that accompany wine production. With the **Virtual Taste App**, through a 3D visor - specifically Samsung Gear VR - it is possible to view immersive **360° videos to explore the territories and wineries from which the wine comes**. By wearing smart glasses, it is possible to select different environments and access different videos for each label which, simply by turning and moving your head, offer a 360° discovery of the world around you, combining the sensations of sight with those of taste and smell. In this way, technology enhances sensory knowledge, enriching wine tasting with knowledge and sensations by revealing the history and secrets of its places and people involved.

6

REGULATION & FUND MANAGEMENT

SMART AGRICULTURE

Engineering has decades of experience in the field of Regulation and Fund Management, as it supports the Public Administration in the management of funds made available by the **Common Agricultural Policies (CAP)**.

The CAP aim to improve the competitiveness of the agricultural sector, ensure sustainable management of natural resources and promote campaigns for the climate. **The aim is to achieve territorial development that balances economic objectives with the needs of rural communities, including the creation and preservation of jobs**.
Through an ecosystem of services and products and the expertise of Sofiter Tech, a Group company, we provide Regional Authorities with the tools they need to plan, manage and monitor all types of funding tenders, in particular the **European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD)**.

The tools we provide make it possible to manage the Farm Dossier, which is essential for accessing funds, and to manage the entire process of funding applications, from the submission of Applications for Support and Payment, through to settlement.
Following the requirements expressed by the European Community regarding the need to monitor the expenditure of funds and to have territorial governance indicators, we provide a **monitoring system** that enables an overview - which is integrated, intersectoral, interdirectional and updated over time - of the investment policies on the territory and their programming, implementation and evaluation phases. For example, in the Piedmont region, on behalf of the Customer CSI Piemonte, Engineering has recently taken over carrying out projects in the agricultural sector, related to zootechnics, state aid register and monitoring of harmful organisms.

We are also able to provide support with **Remote Sensing** to control the use of subsidies in the area by acquiring data from Sentinel 2 and later generation satellites. By using Apps that exploit Augmented Reality applied to the use of photos and geo-referenced paths, we support the Paying Agencies in verifying the truthfulness of the requests for aid inserted in the administrative process. We also simplify the declaration of agricultural files through a graphical module for the management of area applications.

Below are our agri-business solutions, which accompany the farmer from field operations to the management of national and international funds, by facilitating sales operations, logistics and maintenance of farm assets

Copernicus Monitoring: enables the use of satellite technologies to automate the process of monitoring and controlling requests for support in agriculture: both for checking compliance with the CAP requirements relating to the use of the soil/land cover and for specific uses, by farm within the Rural Development Programme (RDP).

AgriSentinel: when satellite monitoring is not enough, the farmer interacts with the Administration in the control process via a Mobile App. Agrisentinel is a solution for the management of conflicts with the Paying Agencies and for sending evidence of the agronomic practices declared in the aid application.

Terram: is a Web Information System for streamlining administrative tasks between farms and the Public Administration for the collection and management of data relating to registers of treatments using phytosanitary products and the farm logbook.

ARIA SPA - Lombardy Region: Agriculture and information systems towards the cloud

CASE STUDY

In today's socio-cultural context, the Public Administration is transforming to become increasingly digital and to seize any opportunity enabled by new technologies, related to their relationships and those towards citizens and businesses. At Engineering, we have carried out innovative software development and maintenance projects, wholly covering IT systems management and providing assistance to businesses, citizens, trade associations that benefit from the communitarian agricultural aids for Lombardy Region.

We relate to agricultural entrepreneurs, becoming nowadays managers of their companies, to understand the needs of tomorrow and develop strategies to define and control a complete supply chain model. The latter aiming to be increasingly effective and efficient in terms of IT Governance, in line with the new enabling technologies for Agriculture 4.0.

Parallel to this, with the updating of processes and systems required by the 2014-2020 national programs, a path of strong technological and process renewal has begun. IT systems are increasingly operating in Cloud-oriented contexts, supported by native smartphone apps. The process started with the rebuilding of the management system of the hunting sector.

CASE STUDY

Veneto Region: agriculture is digital

The adoption of modern, innovative tools is crucial for making the internal processes of public bodies more efficient. This need is also becoming increasingly important for the **Veneto Agency for Payments in Agriculture (AVEPA)**, driven by the regulatory evolution of the new Common Agricultural Policy 2014-2020.

For the Regional Authorities, we at Engineering have developed a new Information System which, following the paradigms of Agriculture 4.0, enables:

- the complete management and disbursement of Community agricultural funds and other subsidies for the Primary Sector
- the management of the flow of processes starting from the collection of funding applications to their liquidation, from the drafting of tenders to the management of controls.
- the implementation of a monitoring system based on satellite technology to control the cultivation practices declared in aid applications and integrated into the IACS (Integrated Administration and Control System).

Our project has involved more than 150,000 farms, supported the disbursement of more than €1.7 billion in funding and the processing of more than 700,000 files.

CASE STUDY

Emilia-Romagna Region: digital systems for agriculture

The **Sistema Informativo Agricoltura (SIAG)** [Agriculture Information System] is the platform we have developed for the Agenzia Regionale per le Erogazioni in Agricoltura (AGREA) [Regional Agency for Agricultural Grants] of the Emilia-Romagna Region. Using free and open source technologies, our solution provides the Admistrative Authority with an **innovative, modular and scalable system architecture**.
SIAG allows the Regional Authorities to manage the entire administrative process for the granting of Community, national and regional aid in the agricultural sector, from funding applications to the liquidation of funds.

Thanks to a responsive, secure and accessible user interface, SIAG allows to:

- collect and update the farm dossier of the agricultural enterprise
- collect funding applications and manage the entire preliminary procedure up to liquidation
- check ex-post the Community aids granted and the information contained in the farm file (for example, territorial and zootechnical consistency, production data, etc.)
- monitor the progress of expenditure and its distribution over the territory.

Our project has enabled the management of more than €9 billion in payments since 2007 and the simplification of more than 2 million farm dossiers.

FOCUS

Agricultural policy in Italy

In Italy, the agri-food sector accounts for about 10% of the GDP. It is therefore extremely important to provide farmers with all the tools they need to ensure the optimum yield of their activities, together with the sustainability and survival of the sector.

Over the last few decades, **climate change** has become a major player in global and national challenges for the protection of the environment and human health, putting food production and food safety under severe pressure. This has made it essential to develop efficient adaptation and mitigation strategies at national and local level to build resistance to climate change throughout the food system. Italy is at the forefront in promoting research and developing policies for the conscious management of natural resources such as land, water, biodiversity and plant genetic resources for food and agriculture (PGRFA).

An essential tool to support this sector is the Rural Development Programme 2014-2020 (expected to be extended until 2022, in parallel with the postponement of the CAP reform). This programme provides funding to farmers in different ways depending on the region, and aims to **develop and consolidate the sector and the competitiveness of farms and farmers**. With these funds, many Regions support and promote the use of tools for Smart Agriculture, the modernisation of machinery and equipment and technologies for Precision Farming, including with innovative tools such as Machine Learning, Artificial Intelligence, Blockchain and IoT, so as to effectively and quickly govern the status and development of land, crops and all the macro-systems involved.

The *Guidelines for the development of Precision Agriculture in Italy* aim at increasing the sustainability of the agricultural model through innovation to enable the country to **increase its high-quality agricultural production and at the same time protect the environment**. The precision introduced by the technologies enable the targeted distribution of the main production factors (water, fertilizers, pesticides) only where necessary and in the quantity corresponding to the real needs of the specific crop.

The guidelines highlight the importance of two technologies among those used in precision farming: **semi-automatic guidance and variable dosage**. The installation of semi-automatic guidance systems (via GPS and RTK technology) on tractors allows the vehicles to move with greater precision by eliminating trajectory overlaps, saving seeds, fertilizers and plant protection products. Variable rate dosing allows the amount of product actually needed (water, fertiliser, plant protection products) to be fed to the plants, avoiding uniform distribution throughout the field and instead taking into account the actual needs of each portion of the field. These automations use maps created ad hoc with the aid of tools such as satellites, drones, and proximity sensors.

The *National Strategy for Artificial Intelligence*, (published by the Italian Ministry for Economic Development) identifies a further step towards innovation and sustainability in the agricultural sector. Artificial Intelligence can, in fact, lead to improvements in precision farming, because it supports the safety and optimisation of food production and distribution, helping to reduce waste.

7

WHAT IS THE FUTURE OF SMART AGRICULTURE?

SMART AGRICULTURE

Economic, environmental and social sustainability. It is on these three fronts that Smart Agriculture must develop over the next few years. The rise in the world's population, climate change and the need to ensure productivity in all conditions, and therefore operations in the fields (including emergency phases such as those created by Covid-19), will see new technologies play a leading role in an agriculture based on data, data sharing and traceability.

The future market will demand more and more new technological tools and enabling platforms to help farmers to exploit the benefits of digital transformation through an integrated ecosystem of technologies and data systems, along the entire supply chain, from field to farm and beyond, and to support government organisations in the management of national and international funds, improving the quality of investments and promoting the growth of farms.

Digitalizing agriculture's processess, from the field to production, to public funds.

Also the commitments and rules defined in the new Common Agricultural Policy (income instruments), as well as the guidelines defined in the new European strategy "Green Deal" and "Farm To Fork", will induce Italian and European farmers to adopt new technological tools and enabling platforms to better manage the new challenges concerning environmental protection, the reduction of climate change impacts, the preservation of ecosystems, and the diffusion of more and more capillary and transparent knowledge within the whole agri-food chain.

In the future, this will be determined more and more by the market choices of consumers and citizens who are increasingly attentive and discerning when it comes to consuming healthy food and products, but where new labels such as "Carbon Footprint" and "Water Footprint" will be associated with food products and with the farm itself, also through systems for certifying the sustainability of production processes.

The development and growth of Agriculture 4.0 will therefore have to be based on the market for IoT sensors, Advanced Analytics technologies capable of collecting and analysing Big Data, improved access to the internet (also with the development of 5G) and Cloud-based systems for sharing information. The Digital Transformation of the sector will also have to support the automation of farm machinery operations to make work in the fields less tiring and to enable it to be carried out even when it is impossible to go there personally: added to this is the enabling of real-time monitoring of operations in the field and the adjustment of work plans, when necessary, to achieve greater efficiency. In addition, by becoming increasingly data-driven, Agriculture 4.0 will enable improved cooperation between different players in the food supply chain to ensure F2F product traceability, from Farm to Fork.

Blockchain-based systems for product traceability are likewise increasing their specific weight within Smart Agriculture, to the extent that, in Italy alone (which leads 11% of the international projects launched in Europe in the last three years), solutions linked to this technology have increased by over 110%.

Furthermore, the market will need new tools for the management of pathological attacks on crops, such as Mobile Apps for the automatic recognition of phytosanitary pathologies through cloud-based scouting techniques, or new instruments for the correct management of the storage of livestock manure and digestates and for the spreading of slurry and fertilisers with regard to the administrative obligations laid down by cross-compliance rules.

In this framework, Engineering is ready to offer solutions based on the most innovative digital and geospatial technologies to monitor and improve the production processes of farms by exploiting the Internet of Things, Advanced Analytics, GIS and Remote Sensing technologies. Our aim is to enable all players in the sector, including small and medium-sized farms, to optimise the amount of fertiliser and irrigation water in crops using indices of vigour and water stress produced by Remote Sensing data (Copernicus Open Data), and to produce prescription maps for use on board field vehicles using VRT (Variable Rate Technology) and remotely estimate future production yields using real DSS.

Crop Monitoring solutions will be used as Precision Farming tools, consisting of the integration of both on-site and remote sensors and AI and Advanced Analytics systems for the complete management of field decisions and farm logistics, both in arable crops and in wine and fruit growing.

Agro-meteorological information will become more and more essential in forecasting and managing the production activities of farms, as it will allow them to better manage pathogens, phytopathological attacks, irrigation systems, fertilisation, phytosanitary treatments, so as to reduce the impact on the environment and cope with the consequences of climate change. Therefore, new solutions will be developed for the management of damages caused by bad weather and climate change, reducing the costs related to field inspections of insurance groups by exploiting remote sensing technologies and new communication tools between farmers and insurance companies, such as mobile apps to facilitate dialogue and the computerised management of evidence between farmers and external parties.

The use of new technologies will enable the whole sector to make conscious use of data from the fields, machines and the environment, and to create models that allow different subjects and objects to be interconnected. Data processed in this way will become the first pillar of an ecosystem underpinned by a sustainable vision of agriculture. This will have a positive impact on the environment, whose resources and potential can be used (without depleting them), for the profitability of companies, thanks also to an increase in the efficiency of the entire supply chain, and also for society, guaranteeing the end customer products whose origin and quality can be guaranteed.

ENGINEERING

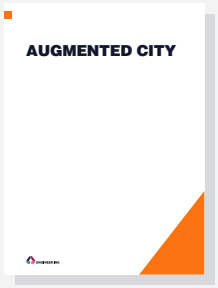
For more than 40 years Engineering has been one of the main actors in the digital transformation of both public and private companies and organisations, with an innovative range of services for the main market segments.

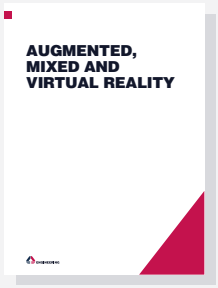
With approximately 12,000 professionals in 40+ locations (in Italy, Belgium, Germany, Mexico, Norway, Serbia, Spain, Switzerland, Sweden, Argentina, Brazil, and the USA), the Engineering Group designs, develops, and manages innovative solutions for the areas of business where digitalisation generates major change, such as digital finance, smart government & e-health, augmented cities, digital industry, smart energy & utilities, and digital media & communication. In the course of 2020, Engineering has supported its partners in the continuation and protection of their businesses and key processes, assisting in the design of their 'new normal' and the mapping of new digital ecosystems. With its activities and projects, the Group is helping to modernise the world in which we live and work, combining specialist skills in the final frontier of technologies, technological infrastructures organised in a unique hybrid multi-cloud model, and the ability to interpret new business models. With important investments in R&D, Engineering plays a leading role in research, coordinating national and international projects with a team of 450 researchers and data scientists and a network of scientific and academic partners throughout Europe. One of the Group's strategic assets is the expertise of its employees, whose development is promoted by a dedicated multi-disciplinary training school that provided more than 19,000 training days over the last year.

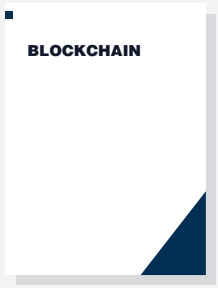
www.eng.it/en

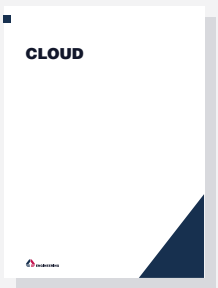
Our point of view on

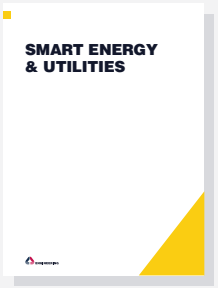
Coming Soon

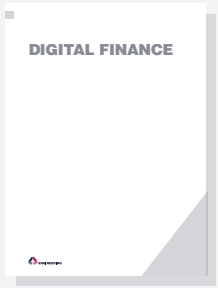


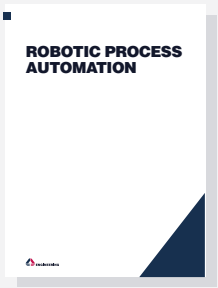


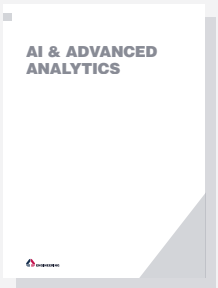


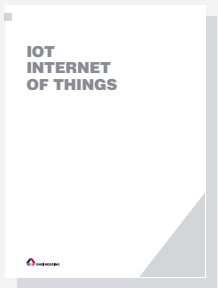












ENGINEERING

www.eng.it

@EngineeringSpa

Engineering Ingegneria Informatica Spa