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REGIONAL REPORT ON EXISTING REGIONAL INDUSTRIAL EXCELLENCE NODES IN PRECISION

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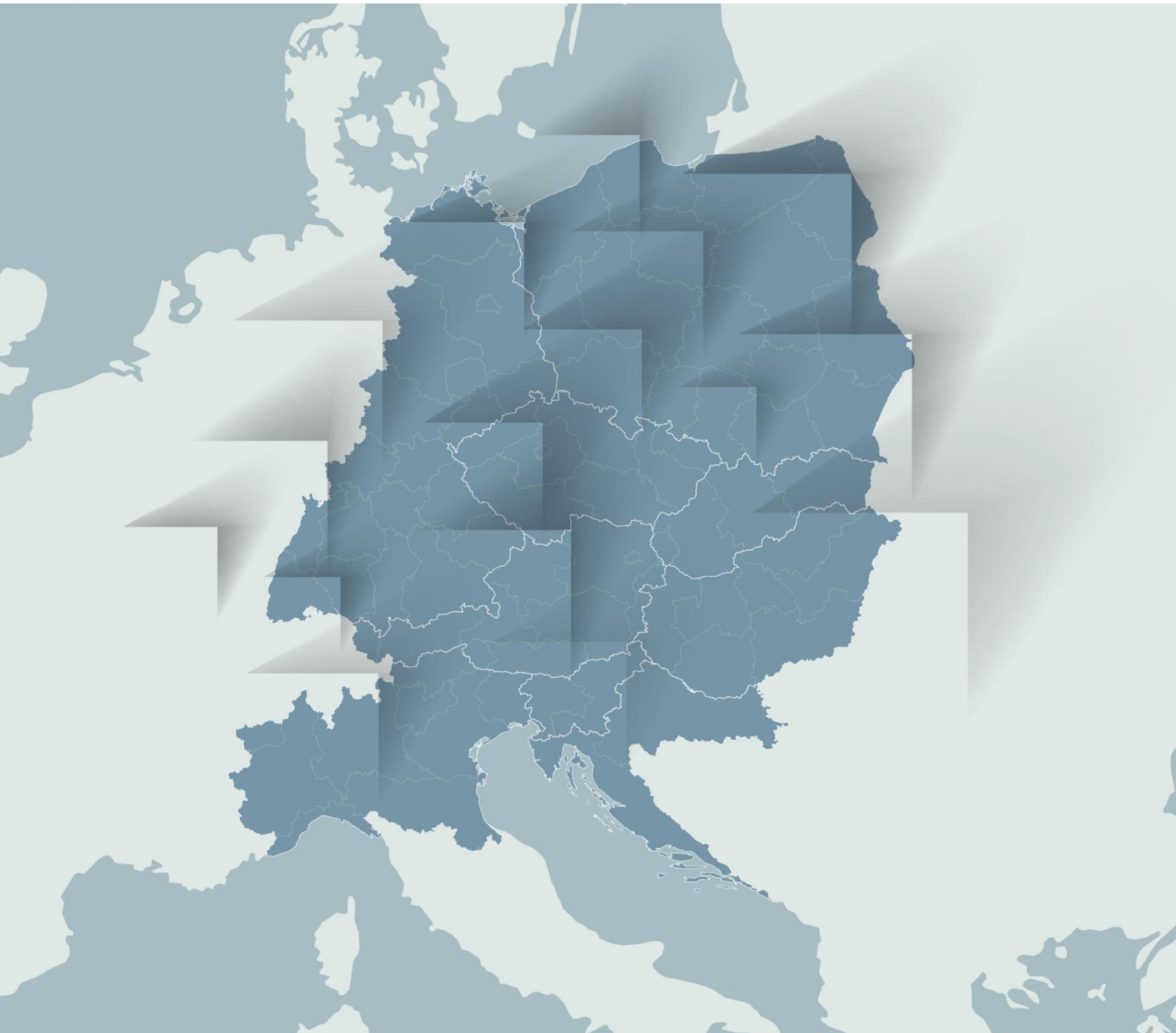

Inhalt

1. Italy[1]

1.1 Overview of regional PA status

National Level Overview

According to Eurostat[2], Italy is today the second major agricultural producer in Europe after France, with a 56,9 billion € total agricultural output produced in 2018. Nevertheless, Italy stays a step behind the European standard for what concerns PA diffusion: indeed, at the moment less than 1% of Italian cultivated soil is managed with PA systems[3]. These numbers suggest that, despite the rich amount of research and the wide offer of PA technologies produced at national level (sensors, GIS, GPS and GSNN, production mapping, automatic guidance systems, etc.), Italian agriculture is still not able to sufficiently exploit PA when it comes to its practical implementation. The main reason for this lays in the nature of Italian agricultural sector: a

[1] provided from: FEDERUNACOMA – Giuseppe Saija (2020); CREA –Researcher Davide Boscaro, Diego Tomasi

[2] https://ec.europa.eu/eurostat/documents/2995521/10217315/5-14112019-BP-EN.pdf/9d55702f-e9f8-dd7e-56c0-50d1b54feb59

[3] https://www.osservatori.net/it_it/osservatori/comunicati-stampa/coltiva-dati-raccogli-valore-la-trasformazione-digitale-della-agroalimentare

fragmented market composed by many small (often family run) farms that lack, in most cases, the onerous capitals and the digital skills needed to adopt PA practices.

Though, agri-food tech is increasing in Italy[4]: 1.890 start-ups over a total of 18.853 considered (10%) operate in the "agri-food tech extended", that is to say, they develop technologies that are virtually applicable to the agri-food sector but have not been applied yet (an example: drones). 617 of them are instead defined as "agri-food tech core", since they produce and already implement techonologies in the agri-food sector.

According to a recent study by Simbiosity, a consulting company in the field of digital innovation, agri-food tech core start-ups increased by 74% in one year: Lombardy (127), Emilia-Romagna (69) and Veneto (54) are the cutting edge regions, bringing together about 50% of the total amount of agri-tech enterprises in Italy developing PA technologies and other agri-food related services. Northern Italy is indeed by far the most innovative area of the country for what concerns Digital Agriculture, with an annual increment in the number of new start-ups of +80%, followed by Central and Southern/Insular Italy at +58% and +78% respectively.

Regional Level Ovierview[5]

Lombardy: Lombardy is the first Italian region for number of smart agri-food start-ups (33%) as well as for received funds: 53% of the total 25,3 million euros granted at a national level[6]. After a socio-economic and environmental analysis of this area, the Ministry of Agriculture aims at financing the promotion of new technologies particularly in the field of bioeconomy. Indeed, Lombardy's farms need to adopt new and innovative technologies and mechanization in order to reduce production costs, optimize production inputs and natural resources, and improve the organization and managing of activities at an economic and environmental level. All this is considered necessary to keep Lombardy's agriculture competitive and profitable. In particular, some of the expected innovations are:

- Facilities ensuring a higher energetic efficiency and lower emission of pollutants in the atmosphere

[4] https://www.ilsole24ore.com/art/start-up-cresce-l-agrifood-tech-AEGTIhjE

[5] Most information reported in this section comes from the paper *Report sullo stato dell'arte dell'Agricoltura di Precisione in Italia (Mipaaf, 2015)*

[6] https://www.ilsole24ore.com/art/droni-sensori-algoritmi-ecco-rivoluzione-dell-agricoltura-italiana-AEaCUzoG

- Structural interventions aimed at rationalizating the use of water and at controlling the distribution of fertilizers
- Facilities ensuring a more effective utilization of phitosanitary products, fertilizers and zootechnic manures

Emilia-Romagna: Emilia-Romagna is one of the first Italian regions for regional budget dedicated to scientific research and technological experimentation, as well as for technical assistance and dissemination. Nevertheless, such effort is not always capable of effectively reaching the production side: a relevant number of local farmers and lands are indeed not properly integrated in the PA network. Hence, for Emilia-Romagna the Ministry of Agriculture aims mainly at:

- Spreading a better knowledge of Digital Agriculture among local farmers
- increasing farmers' participation in PA practices in order to create a network between farmers, research institutes and enterprises

Veneto: Veneto's agricultural sector produces on average 6,1 gross billions per year, namely the 11% of total national production, and generates an added value of 3 billions euro**.** Its growth rate in the last years is around 1,5%, in particular for the agri-food sector showing an increase of more than 3% per year[7]. The Italian Ministry of Agriculture will particularly promote in Veneto the improvement of farms' profitability and the generational turnover in the agricultural sector. A particular effort will be put therefore in:

- Rationalization of water used for irrigation
- Energetic optimization
- Encouraging young people to start new business in the agricultural field

1.2 High-performing OEMs (HW & Equipment), by technology

Components manufacturing definitely represents one of the greatest Italian contributions to Precision Farming. Italian farm equipment manufacturers produce the largest variety of equipment in the world[8] and Northern Italy, in particular Emilia-Romagna with its long-time

[7] *L'agricoltura veneta verso il 2030*, June 2019

tradition in the field of automotive (brands like Ferrari, Lamborghini, Ducati originated here), presents a cluster of firms producing high quality components for agricultural machinery.

1.2.1 Steering Systems

Concerning Steering Systems, the biggest share of the Italian market, in particular in terms of quantity produced, belongs to two multinational companies: Topcon and Trimble.

Topcon: Topcon Corporation is a Japanese multinational operating in different industries (mainly medical equipment and engineering). The engineering branch, Topcon Positioning Systems Inc., created in 2016 Topcon Agriculture Group with main seat in Turin (Piedmont), focused on Geopositioning, BIM and Precision Agriculture. Topcon provides a wide range of auto-steering systems like the AGI-4, a modular GNSS receiver and steering controller and X14, X25 or X35 consoles, to be used in combination.

Trimble: Trimble Inc. is a California-based software as a service (SaaS) technology company. Trimble operates in Geospatial, Building & Construction, Agriculture and others. The Italian headquarters are in Vimercate, near Milan (Lombardy). It produces the Trimble® Autopilot™ automated steering system.

Other smaller but important high-performing OEMs grouped by region are:

Emilia-Romagna

AMA: settled in Reggio Emilia, AMA is a leading company in the supply of components and equipment for outfitting and maintaining Off-Highway Vehicles, agricultural and gardening machines. Its 6 product areas are: solutions for cabins, seats and steering wheels, solutions for hydraulic, point linkage and PTO shafts, soil working, solutions for garden. They produce several steering components (steering units, steering colomns, steering wheels, etc.)

[8] https://www.machinesitalia.org/sectors/agriculture-and-farm-machinery

ARAG: Established in 1976 in Reggio Emilia, ARAG is a main reference point in the spraying accessories field and in the precision farming area at a national and international level. For what concerns precision farming technologies, the company produces multifunction joysticks, TTC BLC, GPS Navigators and Rate Controllers, accessories for navigators and computers, monitors, computers for auxiliary circuits, electronic control units, GPS receivers. For what concerns automatic steering systems in particular, it produces Polaris, ECU-S1 Control Unit and Automatic steering system MDU-4.

COMER: Settled in Reggiolo (near Reggio Emilia), COMER operates both in Agriculture (Engineering system for agricultural machinery) and Industry (Integrated solutions for construction equipment, marine industry and airport equipment, components and systems for the renewable energy sector). Main agricultural applications are: land preparation machines, soil tillage machines, crop treatment machines, forage and hay machines, biogas systems, corn and grain headers, combine and forage harvesters, forage mixing and distribution machines, tractors.

Considering that three over three Emilia-Romagna based relevant companies are not only in the same region but also in the same district (Reggio Emilia), this may be reasonably considered as a potential excellence node for the supply of agricultural machinery components.

Lombardy

Bondioli e Pavesi: Founded in 1950 in Suzzara (near Mantua), Bondioli & Pavesi is an industry leader in the power transmission sector thanks to a Group of eleven manufacturing companies in Italy and around the world. They created the HUB system, a range of intelligent components integrated into a power transmission system to provide unique control and data capabilities. In such system, the integration of electronics makes the component fully compatible with remote links: data can be sent and received for application of IoT techniques and control via mobile devices. Bondioli & Pavesi produces power transmissions and control tools (drive shafts, gearboxes, servocontrols, electronic control units).

COBO Group: Settled in Leno, Brescia, COBO is composed by several companies, mainly located around Brescia and Reggio Emilia. The group produces electrical and electronic components, seats, steering wheels and completely assembled column kits for manufacturer

of industrial vehicles, agricultural machines, earth moving machines and lift trucks, as well as custom-built cars and motorcycles.

SAME (Società Accomandita Motori Endotermici): SAME is a historical firm funded in Treviglio in 1942. Now it's part of the multinational SAME Deutz-Fahr (SDF). It produces mainly tractors and relative components, among which SDF Guidance, monitors and Isobus systems.

1.2.2 Tillage/Soil Cultivation and Seeding Equipment

Relevant companies grouped by region are:

Piedmont

ROJ: develops and produces mechatronic solutions for customer-unique industrial and vehicle applications, in medium-sized volumes. In the field of seeding equipment, PCS 200 is the ROJ pneumatic precision planter control system, allowing to replace the mechanical transmission of seeding discs with an electric motor to achieve greater machine flexibility and provide new functions which are not possible with the mechanical transmission. ROJ also produces the PCS FS, a new pneumatic and mechanical seed drill control system based on the rugged Agri-Motion DMD 0 motor, controlled by the PCS 100 ECU.

Veneto

Sfoggia: in the district of Treviso, Sfoggia is a historical firm founded in 1956. It produces a range of precision seeding drills, strip trillers and cultivators. For what concerns Precision Farming, it produces Elektra Drive and Isobus, a completely automatic electronic system for seeding drills.

MC Elettronica: settled in Rovigo, offers a wide range of electronic equipment for sowing spraying and harvesting machinery. They offer customized agricultural technologies for OEM customers and standard products for retailers and private customers. They produce innovative soil tillage monitors and Isobus planter monitors compatible with third party electronic devices including then main GPS navigators on the market.

Maschio Gaspardo: settled in Campodarsego (Padua), Maschio Gaspardo is an international Group leader in the production of agricultural equipment for tillage, seeding, planting and fertilization, crop care and haymaking. The Group produces a wide range of rotary tillers, power harrows, mulchers, precision planters, cereal seed drills, combination cultivator-drills, flail-mowers, ploughs, minimum tillage, spraying and hay making equipment. For what concerns in particular PA technologies, they produce seeding monitors, sprayers and mist-blower control groups, Isotronics and Isobus terminals.

To be noticed, that Maschio Gaspardo's tractor *Crono* was prized during the event *Machine of the Year* (a contest for the most innovative agricultural machines) at 2019 Sima event in Paris as best precision seeding drill of the year.

For what concerns tillage and seeding equipment, the area of Veneto is apparently one of the most advanced in Northern Italy. This is coherent with the particularly consistent agricultural production of this area, both today and in the past.

1.2.3 Plant Breeding & Research

Some of the most relevant universities and research institutes devoted to plant breeding:

Emilia Romagna:

KWS: KWS is a German seeds producer founded in 1856 in Klein Wanzleben. The main Italian branch is in Forlì and works on corn, soy, beets, rapeseed. They also make research in plant breeding, particularly on corn, and offer consulting services to farmers.

Friuli Venezia Giulia

Udine University: Genomics and Genetics Department is currently focusing on genome analysis in plants, including genome sequencing and resequencing, epigenomic analysis, genome evolution studies, and on sequence diversity analysis and association mapping. Here scholars contribute to sequence grapevine, peach, citrus, barley genomes and are currently sequencing the olive tree. A major research activity is related to resequencing using NGS

technologies (Illumina) in order to detect sequence, structural and epigenetic variants and in developing the genomics and bioinformatics technologies needed for this.

Vivai Cooperativi Rauscedo: a grapevine nursery business with a yearly production of more than 60 million grafted vine plants. Beside production, Vivai Cooperativi Rauscedo perform high-quality research ranging from micro-propagation to green-grafting, health checks through Elisa test and PCR, from cloning with weak selective pressure to the characterization of the clones through the evaluation of fine parameters.

Lombardy

Insubria University: University of Insubria (Varese, Lombardy) operates in the field of Plant Breeding and research through its Applied Botanics Laboratory, the Padiglione Spallanzani. Some research areas comprehend for example the identification of molecular factors controlling root system development and morphological analysis of root systems in agronomics plant grown under compost and biochar applications.

Trentino Alto-Adige

Edmund Mach Fundation: a high-tech research institute located in S. Michele all'Adige (Trento) carrying out interdisciplinary research and innovations in the fields of modern and sustainable agriculture, food and nutrition, environment and health. They operate in genomics, computational biology and and biology of fruit crops, with the aim of spreading further genetic improvement of crops and/or to develop new varieties of commercial interest.

Veneto

Padua Univeristy: within the Department of Agronomy, in DAFNAE Laboratory, the main research fields are agronomy and field crops, fruit tree crops, vegetable and flower crops, agriculture genetics, agriculture and microbiology.

1.2.4 Animal Monitoring

Liguria

Cynomis: Cynomis srl is an innovative start-up settled in Genua and operating in the IoT sector. They develop solutions aimed at increasing farm animals' welfare. Their main solution is Plinio, a stable kit making it is possible to accurately monitor environmental parameters in the housings and take prompt action before situations dangerous for the animals and the workers could occur.

Veneto

Technos: in Chioggia (district of Venice), Technos offers high-quality monitoring and control in the aquaculture**.** Among its products: oxymeters, oxywifi2, oxygen probes. They also produce breeding facilities for shellfishes.

Animal monitoring is not a particularly developed sector in Italian PA. In most cases, animal monitoring solutions are sold within big firms producing agricultural equipment (for example: D&G Equipment, a multinational in the field of agricultural tools, or CIMA, producing animal feed in Reggio Emilia)

1.3 High-performing service providers, by service

Emilia-Romagna

IBF Servizi S.p.A: BF (Bonifiche Ferraresi) is a 7.000 Ha farm operating also in the field of Precision Farming consultancy through its consulting branch IBF Servizi S.p.A., the first Italian HUB for agriculture. IBF promotes the development of precision agriculture in Italy, supporting farms to adopt and implement innovative technological solutions: optimization of production processes, reduction of production costs, improvement of environmental sustainability and quality.

Lombardy

Vantage Italia (former Spektra Agri): a service company offering technical assistance on a variety of PA practices and tools: collection and analysis of data, mapping and guidance systems, tools maintenance.

Arvatec: Arvatec produces, sells and spreads innovative technologies in agriculture: data managing, production mapping, seeding systems, automatic guidance, levelling.

Veneto

Veneto Agricoltura: an instrumental body of the Region of Veneto which carries out support activities for the Regional Council in the field of agricultural sector policies, agribusiness, forestry and fisheries. It deals with applied research and experimentation aimed at testing and disseminating technological and organizational innovations in order to improve the competitiveness of businesses and supply chains production as well as environmental sustainability in the agricultural, agri-food, forestry and fisheries sectors.

1.4 High-performing research bodies, by typology

1.4.1 Universities

Emilia-Romagna

Modena and Reggio Emilia University: within this University, the laboratory BIOGEST-SITEIA is a research institute for the optimization and valorisation of biological and agri-food. It offers technical consulting for the agri-food production chain mainly in the sector of vegetable production.

Bologna University: The DEI (Ingegneria dell'energia elettrica e dell'informazione Guglielmo Marconi) within the university of Bologna operates in precision agriculture with a remarkable specialization in drone technology, both flying and on the ground. They work moreover on Intelligent Sensor Systems, Field Control Systems, Radio Frequency energy harvesting radiating systems.

Parma University: The Department of Life Science and Environmental Sustainability has been selected by the Italian Ministry of Education, University and Research as a "Department of Excellence" (they are 180 across Italy) and has been awarded with a special ministerial fund (9 million euros) for the five-year period 2018-2022. Parma University also participates a Precision Agriculture project funded by AGER with the collaboration of Padua, Florence and Teramo Universities. The focus of the project is on the optimization of wheat manuring.

Friuli Venezia Giulia

The already mentioned **University of Udine**[9]

Lombardy

Milan University: the public university of Milan recently launched its first course in Precision Agriculture for the academic year 2019/2020. The main subjects are agricultural machinery and mechanization and plant pathology. Students will learn how to apply methods and sensors to monitor the phytosanitary status of crops and to apply plant pathology and crop protection basic principles to process site-specific data for prescribing maps of agrochemical distribution. They will moreover acquire the ability to manage, interface and program the precision farming systems on operating machines for crop management.

Polytechnic of Milan: The DEIB Department (Dipartimento di Elettronica, Informazione e Bioingegneria) is a scientific institution committed to forefront research, education, and technology transfer in computer science and engineering, electronics, systems and control, telecommunications, and bioengineering. They operate in Precision Agriculture also and recently participated GRAPE (Ground Robot for vineyArd monitoring and ProtEction) project, whose focus is developing the tools required to execute (semi) autonomous vineyard monitoring and farming tasks with Unmanned Ground Vehicles (UGVs) and, therefore, reducing the environmental impact with respect to traditional chemical control.

Insubria University[10]

[9] See section 1.2.3 Plant Breeding & Research
[10] See section 1.2.3 Plant Breeding & Research

Piedmont

Polytechnic of Turin: Polytechnic of Turin is one of the most renowned scientific universities in Italy and has a department specialized in sensors. iXem Labs are a component of the LACE (Laboratorio di Antenne a Compatibilità Elettromagnetica) of the Electronic and Telecommunications Department of Politecnico di Torino: the field of activity is mainly related to the assembling of wireless transmission systems and the realisation and management of wireless networks. In PA field, iXem Labs developed iXem Wine, a project consisting in a free platform for the monitoring of vineyards through a network of sensors which collects and analyses data.

Veneto

University of Padua: University of Padua offers a master in Precision Agriculture in collaboration with the Universities of Florence, Teramo and Viterbo, and a master degree course in Sustainable Agriculture. Moreover, the department of land, environment, agriculture and forestry (TESAF) is an important research centre participating at the moment in several EU projects in agricultural sector: Horizon2020, Life, Interreg, PSR (Programma di Sviluppo Rurale).

Research Institutes

CREA: CREA is the leading Italian research organization dedicated to the agri-food supply chains. It operates as a legal entity under public law, and is supervised by the Ministry of Agricultural, Food, Forestry and Tourism Policies (Mipaaft). Scientific activity covers agricultural crops, livestock, fishery, forestry, agro-industry, food science – and socio-economics. CREA was established in 2015, from the merging of CRA (Council for Agricultural Research) and INEA (National Institute of Agricultural Economics).

Headquarters of CREA are in Rome, but in northern Italy two important seats are in Conegliano (Treviso, Veneto) and Bologna (Emilia-Romagna).

FIAT Research Centre: the research centre of FIAT, with offices in Mirafiori (Piedmont), Trento and Bologna, develops innovative power units, vehicle systems, materials, methods and processes to improve the competitiveness of FCA products. FIAT operates in the agricultural sector through CNH (Case New Holland).

Liguria

IIT (Istituto Italiano Tecnologia): the Italian Institute of Technology is a scientific research centre based in Genoa. Its main goal is the advancement of science, in Italy and worldwide, through projects and discoveries oriented to applications and technology. It participates SMASH project (Smart Machine for Agricultural Solutions Hughtech) for the development of agricultural robots.

Trentino Alto Adige

Bruno Kessler Fundation: Top Research Institute in Italy (Trento), ranked at the 1st place for scientific excellence within 3 different subject areas (ICT, History and Sociology. Specialized in ICT and AI, It works on PA too: it recently developed a special photocamera able to take multi-spectral images of a field by flying on a drone, in order to evaluate different soil types.

Fondazione Edmund Mach[11]

1.5 Overview of existing networks

Federunacoma: The Italian Agricultural Machinery Manufacturers Federation, formed in 2012 to replace Unacoma (the Italian Farm Machinery Manufacturers Association set up in 1945), brings together, and represents in Italy and abroad, the associations of Italian manufacturers of implements (Assomao), self-propelled machines (Assomase), tractors (Assotrattori), components (Comacomp) and gardening machinery (Comagarden).

Assotrattori: the main activities of Assotrattori are:

- reporting data for compiling statistics and information
- the organization of specific events such as seminars in the framework of trade fairs

[11] See section 1.2.3 Plant Breeding & Research

- providing incentives for research projects which foster cooperation between member companies and research institutes; providing assistance and consultations in technical and regulatory fields.

Comacomp: an association of components manufacturers in Federunacoma. The production of components represented by the association for machinery for agriculture, earthmoving and gardening, OEM and spare parts, can be divided into macro areas:

- mechanical components (drive shafts for power trains, speed reducers and increasers, gearboxes, free wheels, clutches, axles, etc.)
- hydraulic components (cylinders, pumps, motors, valves, etc.)
- electric-electronic components (electric plant, cable harnesses, electronic regulation and control devices, GPS systems, onboard computers and instruments, etc.)
- various components (belts, cabs, seats, brake systems, frames, three-point hitches, etc.)
- irrigation components (hoses, couplings, filters, pumps, sprayers, accessories, etc.)
- sprayer components (bars, pumps, fans, filters, ECDs, nozzles, etc.)

IDEAgri: IDEAgri is a company network set up to develop common activities within the frame of ISOBUS standard and more generally of Digital Electronics for agricultural machinery. All the 8 founder companies are under the leadership of Reggio Emilia Innovazione (REI) and have joined their specific skills. The 8 companies are AMA, Arag, COBO, COMER, Agro Tractors, Salvarani, Walvoil and ReLab.

CL.A.N.: The National Technology Agrifood Cluster is a multi-stakeholder network of the key Italian players of the entire agrifood chain - a partnership of companies, research centres and institutions set up to promote sustainable economic growth, based on research and innovation in the industry and acting as partner for Italian and European Institutions.