TRANSFARM 4.0

Deliverable D.C.5.1

Business meeting with EU institutional players & technological platforms

Version 1
06 2021

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1. Executive Summary

The successful development of the European Green Deal, set of policy initiatives by the European Commission with the overarching aim of making Europe climate neutral in 2050, will mark a milestone in the evolution of the new European economy and will affect the global economic trends in the decades to come.

These trends impact the agricultural machinery industry and more in general all the stakeholders involved, as they contribute to create a new framework in which the equipment and related services do not have just to make sure a given operation is carried out efficiently, but must also contribute to the farmer's respect of EU or national laws, including on emissions and environmental impact.

The industry will also need to adhere to and promote consolidated and emerging European values, e.g., privacy safeguards and data ownership. Those values will further shape European data economy technologies, products and practices.

This document is the result of an intense work of coordination between partners and stakeholders. It condenses the efforts of the project partners in the dialogue with different types of stakeholders that represent the agricultural machinery industry, the data industry, the farming industry or the extension services.

The objective was to provide a comprehensive view on the smart farming perspectives in Europe, and to stress the issues that policy makers at regional level should keep in mind, when dealing with innovation in the farming business and with the support to the developers or producers of that innovation.

The document is therefore meant to support the dialogue among European and national policy makers, industry, research, public sector and civil society on the definition of the role of agriculture in the ecological and economic paradigm-shift and to foster a critical analysis on the future of precision agriculture in the new policy context and market trends.

This paper addresses all the above-mentioned actors and considers joint collaboration as the only way forward. It highlights current trends to underline opportunities in Europe for industry, end users (farmers), research and academia and the public sector.

It also identifies and analyses foreseen technical and non-technical challenges (business, organizational, legal compliance and skills-related challenges) as well as specific challenges that need to be tackled in a coordinated manner at both national and regional levels.

The document collects the testimony and insightful observations of five representatives of the agricultural machinery industry, the data industry, the farmers' organisations and the extension services.

Several key issues emerged from the interviews. One regards the increasing political attention towards the biological farming practices which risk cutting down the margins of efficiency of precision agriculture equipment and techniques. The scale of intervention is also cause of concern and, in this respect, new forms of aggregation of farmers, to access innovation at a fair price, are deemed as necessary. The role of the extension services is ultimately acknowledged as vital in the sector, as it works as a pivotal node of a network connecting the different stakeholders at territorial level, facilitating "collective" purchasing of solutions, technologies

or services and making sure that compliance with European or regional regulations is respected.

In conclusion, regional centres for innovation in agriculture are envisioned to make sure that innovative solutions can be easily found, and their adoption managed in real contexts. Acceleration mechanisms are then advocated almost everywhere in the Central Europe region to reduce time and costs involved in the production and deployment of innovation in the field.

2. Introduction

With the new programming period, Europe enters a new phase of development and management of agriculture, also in view of significant changes in the CAP (Common Agricultural Policy). Coherently also with the orientations emerging in the Green Deal, the European Union is promoting more environment friendly policies and is pushing for stricter standards and norms in terms of environmental impact, use of resources, the circular economy and zero or reduced pollution. This trend affects the agricultural machinery industry and more in general all the stakeholders involved, as it contributed to create a new framework in which machinery, implements or related services do not have just to make sure a given operation is carried out efficiently, but must also contribute to the farmer's respect of EU or national laws, including on emissions and environmental impact.

A specific analysis of all norms and provisions goes much beyond the scope of the present document. Coherently with the mission of Transfarm 4.0, which provides support to better Smart Farming policies in the Central Europe region, we have concentrated on the identification of the key drivers, which will shape tomorrow's scenarios for the smart farming industry.

As farming operations are more and more scrutinised from the perspective of their contribution to food security and their respect of environmental regulations. As they become more connected to other segments of the supply chain and as they become more and more data intensive, it is extremely important to keep those drivers in mind, in order to devise efficient strategies, which will help the smart farming industry to thrive in the future.

3. The Emerging drivers

The following chapters provide a quick recognition of the growing constraints placed on the so-called Precision Agriculture industry.

3.1. Increased traceability of farming operations and data evidence

The European legislation is evolving towards stricter measurements of agricultural activities, be it on output, types of treatments, number of treatments, emissions, etc. Almost every farming operation is becoming subject to monitoring and quantification against legally binding parameters. Machinery (notably, devices and technologies produced within the so-called precision agriculture paradigm) provides a complex, distributed platform on which data are collected, stored, shared and analysed in view of further adjustments to agricultural activities or also in view of monitoring for policy making purposes.

3.2. Europe's growing orientations towards bio

The European Union has been changing its legislation in many agricultural domains, in the direction of more biological farming systems and practices. This means in practice that a lower number of treatments are allowed with pesticides or fertilisers, that products admitted are more severely scrutinised and more in general that the margin of farmers in deciding how to perform those operations is becoming smaller. This represents a critical issue for the smart farming industry, as it reduces the potential for increased efficiency due to the adoption of precision agriculture. In a few words, in a biological supply chain, the scope for smart farming appears more limited than in conventional agriculture.

3.3. Issues of scale

The adoption of smart farming processes requires investment by the farmers (or by a third party). As investments may vary depending on the type of intervention planned, for sure they represent a critical factor, and in many cases a barrier to the deployment of better farming practices. This becomes more serious as the return on investments in some areas may be quite long, extended to several years before the adoption of a new mode of production is paid off. This effect is particularly severe on farms of a smaller size, where scalability is not achieved in an optimal way. European countries show different degrees of "fragmentation" in land ownership, farm management or access to services and innovation. Changing the models by which access to precision agriculture is provided or facilitated for farmers, might represent one of the key issues of which to concentrate in the future.

4. Consultation with the stakeholders

During the work in the production of the deliverable D.C.5.1, partners have discussed on which orientation to take, whether to reflect the institutional positions of the European Union or whether to express a plurality of positions, sometimes from potentially conflicting angles. As the EU's policies and regulations are publicly available, we have concentrated our efforts in the dialogue with non-institutional stakeholders that represent the industry, the data industry, the farming industry or the extension services.

Our main goal was to provide a realistic picture of smart farming perspectives in Europe, and to highlight the issues that policy makers at regional level should keep in mind, when dealing with innovation in the farming business and with the support to the developers or producers of that innovation.

The people we have consulted are included in the following list.

1. Jérôme Bandry, Secretary General of CEMA, the European Confederation of Agricultural Machinery Associations
2. 2. Nuria de Lama, Secretary General of BDVA, the Big Data Value Association, the European Public Private Partnership that engages with the European Union with issues related with data in different types of industry

3. Daniel Azevedo, from COPA COGECA, the European federation of farming associations

4. Daniele Rossi, delegate for research and innovation at Confagricoltura, one of the main Italian farmers' associations, and a Working Party delegate for Research and Innovation at COPA COGECA

5. Patrick Crehan, CEO of CKA and an expert in agricultural innovation and cluster management

4.1. Jérôme Bandry - Secretary General of CEMA

CEMA has been engaging with the European Union on a regular basis in the last years, both on normative ground and on general innovation policies. However, the federation has not yet formalised a position in respect of the new programming period (2021-2027) when it comes to research and innovation. "We have maintained a regular effort in the participation to innovation projects and in the uptake of new technologies - Jérôme Bandry says, Secretary General of the European agricultural machinery industry for three years - with the outline of the new CAP (Common Agricultural Policy), we see a need for the national strategic plans to be sufficiently aligned and to consider farm technologies as a key driver towards sustainability". A vision that has also been made explicit by CEMA's President, Thierry Krier, who has advocated at the April summit of the confederation for public investments in advanced agricultural machinery that should be aligned to the CAP and provide a push for greener and more competitive agriculture in Europe.

The spectrum of technologies and areas of innovation which will shape the future of the machinery industry is broad and varied, with earth-observation-based operations, advanced sensors and growing quantities of data to deal with. "We know where to expect innovation on a

technical level - Bandry says - but on a political level, the main message is coming from the very ambitious targets set by the Green Deal on biodiversity and on the Farm to Fork approach. There is wide consensus on sustainable farming, but we do not see this being based on sufficient evidence in terms of impact assessment. I think one urgent thing is to agree on the impact assessment of the Green Deal goals. At the same time, we need investment on innovation and demonstration. For sure, technology will be fundamental to reduce fertilisers and pesticides".

"In a way - continues Bandry - we all went through a stress test with the Covid period - but interestingly enough, the system demonstrated that it is strong enough to keep stores and shelves full. We are in a phase where we have goals, but we do not know the impact of achieving them. If we, as Europe, do not put efforts into calculating those impacts, we risk of missing important elements to orient our efforts in innovation".

Needless to say, investments will also play a role in how fast industry can contribute to smarter and greener agriculture. "It is clear that with no support for technology, there will be no uptake. Research and innovation are key factors, but in the end we still need to allow farmers to access the innovation they need, which could even just be modernisation of equipment. If farmers are not supported, we do not see how real change can happen. Vouchers schemes, through contractors, could actually be an interesting model". And last, but not least, coordination at European level. "National policies alone will not work. We need the understanding of specificities - concludes Bandry - but within a shared framework. Let's not forget our main strength is the common market."

About Box 1. CEMA in a nutshell

As the European agricultural machinery industry association, CEMA represents over 4,500 manufacturers, both large multinational companies and European small and medium-sized enterprises ("SMEs"), through 11 national member associations.

CEMA members produce more than 450 different machine types and generate an aggregated turnover of more than EUR 28 billion.

135,000 people are directly employed in the sector, with a further 125,000 people working in distribution and maintenance of this equipment without which modern farming would not be possible.

CEMA's position on the Farm to Fork Strategy and the role of precision agriculture[1]

The Farm to Fork Strategy has set specific targets regarding the reduction of inputs used in European farming practices or the promotion of specific farming approaches. Considering the very significant economic impact these unprecedented targets might have on EU farmers, a transition scheme should be carefully designed and financially supported with adequate means. Dedicated measures should also be planned to facilitate the access to agronomic advice services. In this view, CEMA strongly advocates to perform specific and thorough impact assessments to better anticipate environmental, social and economic likely consequences of any potential new environmental target and associated legislation across the

[1] CEMA - European Agricultural Machinery Industry Association, "CEMA contribution to the open Consultation: Farm to Fork Strategy", Brussels, 13th March 2020.

European agri-food sector. CEMA recognizes the relevance of the Farm to Fork Strategy for the agri-food sector in general and for the agricultural equipment industry more particularly, with specific actions to reach the ambitious objectives put forward by the EU Green Deal.

Advanced machinery and solutions are key to support sustainable farming and help farmers from farms of all sizes and all types to reach a high-level of environmental protection and productive agriculture.

CEMA calls on the European Commission to prioritize the uptake of precision agriculture and digital farming technologies as part of the solution to achieve a more sustainable agriculture in Europe. CEMA's position in this regard argues that the European Agricultural Machinery industry meets the most environmental advanced standards, which the EU regulations lay out, and develops precision agriculture technologies that enable farmers to significantly reduce the impact of inputs while optimizing their farming practices.

Concurrently CEMA supports the efforts to enable farmers to access to the necessary investments and professional skills to reach the farm to fork strategy goals through a strong CAP budget.

4.2. Nuria de Lama Sanchez – Vice Secretary General of BDVA (Big Data Value Association)

The Big Data Value Association (BDVA) is an industry-driven international not-for-profit organisation with more than 200 members all over Europe. BDVA is the private counterpart to the EU Commission to implement the Big Data Value Public Private Partnership programme. In 2021, BDVA becomes DAIRO (Data, AI and Robotics).

The BDVA traditionally engages with the European Commission in the definition of research priorities in the field of data science and related technologies, including for instance data use, re-use and the use of AI (Artificial Intelligence). Through its SRA (Strategic Research Agenda), the BDVA contributes to shaping the European data policies, in particular within data intensive industry domains. The work and positions of BDVA have become extremely relevant to the agricultural machinery sector, as this becomes more data intensive and thus demands a more refined data management framework. In the last two years, BDVA has provided advice to the Commission on all digital areas of the new research framework programme (Horizon Europe). Though work of the BDVA has concentrated mainly on clusters 2 and 3, which deal with digital technologies and cybersecurity, relevant indications have also been provided to Cluster 4 (that covers manufacturing) and to Cluster 6 (on Farm to Fork and more generally on food industry themes).

"One of the main issues, when it comes to agricultural production – says Nuria de Lama Sanchez, Vice Secretary General of the BDVA – is data ownership, something we have addressed through the involvement of some of our members in the DEMETER project and in other research initiatives. We want different stakeholders to understand the value of data, to promote the use of own data and its sharing, for instance within concepts like data sharing in a trusted environment. Data sovereignty is an area where we are very active, and which I believe will gain further importance in the future. The new programme is also talking a lot about "data spaces". Together with the Digital Europe initiative, the Horizon Europe programme will provide a very interesting arena for testing and experimentation. The idea of data spaces – de Lama says – is that stakeholders, be it institutions, companies or individuals, can decide what data to share, how and with whom, in a secure manner, within a trusted environment. The principle we are trying to advocate is that of a proportionate manner and a fair access to data, so that not only big companies, but also smaller player can benefit from a data sharing ecosystem. In this sense, experimenting ways of involving small farmers is fundamental to make sure that we will generate a system that all actors can trust. We need to have technologies developed for those environments, in which data sharing can be enhanced, while preserving data privacy".

Managing and respecting data ownership

The realisation of a mixed data sharing space will only materialise if data producers are guaranteed to retain their rights as the original owners. However, data marketplaces rely on a form of ownership that is transferable, making the legal concept of data ownership difficult to define. To safely and fairly support this concept technically, different ownership models or suitable data rights management frameworks need to be explored.[2]

[2] Big Data Value Association, "Towards a European Data Sharing Space: Enabling Data Exchange and Unlocking AI Potential", BDVA Position Paper April 2019.

High on the European data research agenda is also the so-called "transcontinuum initiative", that is the principle that there should be continuity in the use of different computing technologies.

"This is a very important issue - insists de Lama - and we have been contributing to framing the question. The cloud requires a lot of latency and is not totally efficient. We need to shift part of the analytics on the edge and we need to see the right combination of cloud and edge. This is something that might specially be relevant for the agricultural machinery, as many operations take place in areas with poor connectivity".

The edge is probably a challenge where Europe has potential, but still not the same offering as the US. The European Commission has recently promoted the creation of the Gaia X initiative, which should fill the gap for appropriate data research infrastructure, exactly in the direction of generating data trusted environments. BDVA has signed a collaboration framework with Gaia X. "One of our priorities - says de Lama - is to help combine resources from different vendors. Ideally, whatever resource is available in Europe, should be easy to find and use. This entails efforts on creating interoperability, value, standards and sovereignty".

The Project DEMETER

DEMETER is a project funded by H2020 under the Digital Platforms area (therefore, part of the implementation of the so-called Digitizing European Industry policy or DEI). As a project, its focus is on large-scale deployments of farmer-driven, interoperable smart farming-IoT (Internet of Things) based platforms, delivered through a series of 20 pilots across 18 countries (15 EU countries). Involving 60 partners, DEMETER adopts a multi-actor approach across the value chain (demand and supply), with 25 deployment sites, 6,000 farmers and over 38,000 devices and sensors being deployed.

DEMETER is one of the flagship projects in DG CONNECT to maximize and understand the usage of datasets in agriculture.

On farming technologies, de Lama acknowledges that there is still work to do, and probably an area where "we need more tools for policies to be enforced". A BDVA paper was published in 2019, "Towards a European Data Sharing Space: Enabling data exchange and unlocking AI potential".

Edge computing and smart agriculture services

A rural-digital divide exists in the case of internet and broadband access. Pragmatically, there will always be a differential in Quality of Service (QoS) between urban and rural areas. Nonetheless, bridging this gap and minimizing the divide is essential from a social and economic perspective. The value proposition of Edge models is that of pushing computation, networking, and storage to the edge of the network to enable a sufficient QoS for computationally-intensive, latency-sensitive and bandwidth-demanding services. Edge Computing offers intriguing possibilities for smart agriculture[3]. Edge computing offers a solution to the latency problem by relocating crucial data processing to the edge of the network. Rather than constantly delivering data back to a central server, edge enabled devices can process data in real time, allowing them to respond faster and more effectively.

[3] M.J.O'Gradya, D.Langtonb, G.M.P.O'Harea, "Edge computing: A tractable model for smart agriculture?". Artificial Intelligence in Agriculture, Available online 8 January 2021; https://doi.org/10.1016/j.aiia.2019.12.001.

4.3. Daniel Azevedo – Copa Cogeca

Copa Cogeca is Europe's largest farmers' organisation, representive about 11 milion farmers and 22.000 cooperatives. Headquartered in Brussels, Copa Cogeca is one of the key stakeholders in the dialogue with the European Commission and other institutions, when it comes to contributing to shape agriculture and farmers' related policies at European level. Copa Cogeca is also one of the main organisations represented within the European Technology Platform "Farmes for the Future".

Copa Cogeca is among other things contributing to the ETP's SRA (Strategic Reseaerch Agenda) on issues related to smart or precision agriculture. Daniel Azevedo is Director in the Commodities and Trade team.

"Digital is probably the key issue – he says – In particular, aspects related to the digital infrastructure that farmers will be able to access, and the data governance framework will be some of the fundamental factors that will influence the way we bring innovation into farming practices in the next years. We have already addressed the data sharing, by concluding a code of conduct with CEMA (the European) agricultural machinery association), the main principle of which is that farmers keep ownership of data related to agricultural production, whereas machinery producers maintain ownership of data on machines' operation. All approaches must nevertheless recognise the right of the farmer to benefit from and be compensated for the use of data produced on the farm or during farming operations, and the need to grant the farmer a leading role in controlling the access to and use of data from his/her farm. Data is however becoming a more complex issue, as the data farmers may need or have access to or generate increase and as technologies for their management become more sophisticated. However, data are one aspect, although extremely important, of a wider picture. And we should not forget infrastructure. Without a properly functioning infrastructure, there is very little data can do. Let's take for instance, blockchain. Everyone seems to agree that blockchain has potential to make supply chains more efficient, but technology needs to intervene on an infrastructural basis. It is difficult to see how blockchain can help improve logistics, if logistics are absent or poorly developed".

Also, farmers' access to technologies and in particular to experimental facilities where they can test what technologies mean in their business, are equally important. "We should bear in mind – says Azevedo – that change will happen as innovation is brought into the farming business at a sufficient scale. This means that we not only need technologies, but cost-effective technologies, that is tools and systems that farmers will want to use because they contribute to make their business more economically sustainable. In this respect, organising a regular access to tests of technologies may prove very useful. But this needs efficient models, where for instance intermediate organisations like advisory services can play a role. Farmers need to get together. Cooperatives and extension services are usually good models to stimulate a widespread access to know-how and access to testing".

And where does precision agriculture fit in all of this? "Precision agriculture technologies have a very important role to play for instance in decreasing the quantities of fertilisers and pesticides to be used, which translates in environmental benefits and cost gains. This can be better enhanced also through investments, for instance linked to measures in the CAP, or by regional incentives. Regional policies can prove a very effective instrument to help channel efforts in

the right direction. If the regional framework is in place, farmers can see the benefit more immediately. Think for instance of regions where the usage of satellite generated data has helped farmers process their claims after their parcels had been hit by bad weather. There is no doubt that farmers will adopt technologies, if they see the benefit".

4.4. Daniele Rossi – Confagricoltura

Confagricoltura is the main Italian farmers' association (as it covers 60% of the total turnovera and 70% of the Italian agricultural surface). With a strong background in European policies and a regular involvement in European Technology Platforms, and chairman of the research & Innovation WP in Copa Cogeca, Daniele Rossi is Confagricoltura's delegate councillor for research and innovation.

"One of the main bottlenecks – he says – to the deployment of precision agriculture, is that its investment costs are rather high, if compared to other measures, and the return on investment can be quite long (10 – 15 years). There are other technologies, like breeding/genetics, for instance, that enable a faster scale leap. Seeds technologies, or the improvement of the soil microbiota are proving very efficient, with a 20 - 30% growth rate. Of course, these technologies determine a situation of dependence/services on those who have generated them, but that is quite the same situation with other types of technologies, including smart farming".

So, does it mean it is the end of a paradigm? "I think – Rossi continues – that we are facing a very critical phase and the precision agriculture industry should be aware of it. Traditionally, precision agriculture has enabled gains on conventional practices on large farms. As a farmer uses fertilisers or pesticides, any technique that will optimise that usage, reducing quantities and costs, will bring a benefit. But as the real farming operation becomes more precise, thanks to smart farming instruments, the case for further optimisation becomes weaker. In a way, there is a limit to how more precise you can be. The other element that should be taken into account is that as part of the overall Green Deal policy, the European Union is adopting an almost full biological approach, with significant reductions in fertilisers, pesticides, number of treatments allowed. All of this may reduce the scope of precision agriculture as we know it today. But it does not mean it is the end of it. I think we will still need technologies, but we'll probably ask them to do different things, like for instance helping in the management of the soil microbiota, or working on the bioactive components. We'll probably need to have a closer collaboration between the world of scientific research and that of technologies, to align those to the real needs emerging in farming".

And, needless to say, scale is still an issue. In countries like Italy, where land ownership is often very fragmented, policies that favour land takeovers might bear some impact. "It is hard to imagine how a drone could optimise operations – concludes Rossi – if it has only five hectares to fly upon".

4.5. Patrick Crehan - CKA

Patrick Crehan is the Director of Crehan, Kusano & Associates (CKA), expert in cluster management and specialised in the management of research and innovation in agriculture.

CKA is a Brussels-based management consulting company specialised in the management of research, innovation, education and training. It has deep experience in the agri-food sector, especially in the application of Foresight to technology strategy, sectoral strategy, organisational and institutional development as well as regional development. It has extensive experience in the development of roadmaps, governance systems and indicators for the management of national and regional systems for Research, Innovation, Economic Development, Higher Education, Vocational Education and Training as well as Quality Assurance.

As Precision Agriculture comprises a set of technologies that combines sensors, information systems, enhanced machinery, and informed management to optimize production by accounting for variability and uncertainties within agricultural systems, it is important to emphasize that smart agriculture evolves in a context of extreme technological complexity which involves a spectrum of technologies that must be harnessed according to need and context. These various technologies involved have to deal with significant data volumes which may be quickly generated from satellite, UAV, and in-situ sources.

Against this backdrop, Patrick Crehan argues for the need to strategically think about the ways to address the challenges posed by the data revolution in agriculture.

"Farming is no longer just about producing food", Crehan says. "A farmer provides many other services beyond the production of food and feed, and generally the farmer is not really compensated for the provisions of these services. However, due to the increasing pressure on the food systems, these services are going to be more critical not only for the work of the farmer but for the life on the planet".

"I think we are moving into an area where the farmer has to be better compensated for the provision of what you might call ecological services. All of this is going to rely on the use of data, whose recent intensification is the biggest change in agriculture nowadays. This is going to be a huge challenge not only for farmers but also for those who are involved in the technology transfer", Crehan points out.

"One of the problems working with data is that most farmers have no formal training, so most of them only have a vague idea of what data is, why it is useful for them and who's the owner".

This growing complexity implies the need to master an unprecedented amount of innovative cutting-edge technologies, tools, devices, and there is a real risk for the farmer to get lost. In this context, the role of the extension services is commonly considered as essential to lead farmers towards innovation pathways.

“There is a share of farmers who are very sophisticated and know a lot about these tools and especially the youngest generations, but they are a minority of farmers - Crehan says. The vast majority knows that a huge change is coming but do not know how to handle. The same actually goes for the extension service officers as they find themselves in the same situation. They all have their areas of expertise but all of them really understand the implications of this data revolution, especially in terms of data ownership”.

A data policy at regional or at least cluster level is therefore needed, according to Crehan, to avoid situation where data becomes siloed and it is unavailable to those who need it.

“One way to do it - Crehan says - would be to set up a strategic foresight initiative and work through scenarios to how data is generated, stored, processed and how this interacts with the business needs of the farmer. It’s worth doing it at regional level as a lot depend on the specifies of the business cases”.

The importance of the regional dimension has also to be framed in the process of CAP reform, as “the European Union has delegated aspects of the Common Agricultural Policy to the member states - Crehan argues - and it is not entirely clear how this will filter down to regional level.”

Regions are extremely different in terms of type, size, production of the farms, and other aspects. This is the dimension where cluster managers can play a role in driving innovation forward.

5. Conclusions

The dialogue with stakeholders at European level, including also representatives from farmers associations, highlights several points of attention, which the industry of precision agriculture should pay attention to. One key issue is that with growing attention at political level, towards biological cultivation and farming practices, the margins of efficiency of smart farming risk of being further reduced. However, even such a shift to "bio" would need to be backed up by technological solutions, aiming for instance at facilitating the management of bioactive components. This requires a tighter collaboration between industry and scientific institutions, and possibly further integration with work being done on data and communication technologies of machinery.

The scale of intervention proves once again critical and, in this respect, new forms of aggregation of farmers or cooperatives, to access innovation at a fair price, are needed. Extension services, recognised as key players in the sector, could play an important role in connecting the different stakeholders at territorial level, facilitating "collective" purchasing of solutions, technologies or services and making sure that compliance with European or regional regulations is respected. As most farmers lack time and resources to perform a continuous technology watch, this could be more efficiently demanded to extension services or to similar organisations active at local level, which could in turn organise the involvement of farmers in testing and demonstration activities. The emergence of testing or demo facilities in regions might accelerate the pace of innovation on farming practices, while also enhancing the dialogue between industry and users. With local specificities to be considered, the scope for low-cost innovation that is well adapted to users' needs would appear more evident. From this perspective, some of the work undertaken by the Transfarm 4.0 could pave the way for efficient models to be rooted in territories.

In addition, regional policies can significantly contribute, by integrating the strategies and overall vision expressed by the CAP or by national guidelines. Regional centres for innovation in agriculture, irrespective of the form or business model they adopt, appear as key elements in the picture, to make sure that innovative solutions can be easily found, and their adoption managed in real contexts. Whereas most regions have clear targets in terms of "greening the agriculture", many are still far from designing efficient models to achieve the leap forward in terms of productivity and sustainability. Acceleration mechanisms are needed almost everywhere in the Central Europe region to reduce time and costs involved in the production and deployment of innovation in the field.

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