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ALLIANCE FOR INTERNET OF THINGS INNOVATION

Digital Innovation Hubs: democratising digital technologies in agriculture

AIOTI WG06 – Smart Farming and Food Security

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Executive Summary

Working Group 06 (WG06) is one of the vertically-oriented WGs within the Alliance for Internet of Things Innovation (AIOTI). The scope of AIOTI WG06 covers the scenarios and use cases where IoT-based technologies, applications and services provide high added value to the actors within the plant and animal products life cycle, from farm to fork.

The purpose of this document is to provide clarifications and recommendations about the implementation of Agriculture Digital Innovation Hubs (ADIH) in Europe. DIHs are instruments conceived to support businesses, notably SMEs, farmers, agri-cooperatives and non-tech industries, in their digital transformation. DIHs are receiving a strong back from the EC under the Digitising European Industry (DEI) initiative and in particular under the framework of the H2020 2018-2020 programme, which include specific calls for agriculture DIHs such as the DT-RUR-14-2018. ADIHs have the potential to play an important role in the democratisation of IoT and digital technologies in the European agri-food domain, but they will require significant investments from the regions and Member States, and strong coordination efforts to maximise their positive impact.

Section 1 of this document briefly introduces the concept of Digital Innovation Hub and why it is important for the future of agriculture. Section 2 introduces and describes the dimensions which, according to WG06, are essential in agriculture DIHs. Section 3 reflects on key aspects, again according to WG06, that should be taken into account when a pan-European network of agriculture DIHs, as pursued by the H2020 DT-RUR-14-2018 call. Recommendations are provided at the end of each section.

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1 What is a Digital Innovation Hub (DIH) and why it is important to the future of agriculture

As explained by the European Commission when introducing the Digitising European Industry (DEI) strategy,¹ the industrial activity is one of main the pillars of the European economy: the manufacturing sector represents about 15% of the European GDP, with 2 million companies and 33 million jobs. The automotive sector leads the manufacturing production in the period 2008-2016, but other “traditional” sectors such as food production are among the top-5.² All economic sectors worldwide are immerse in a process of digital transformation, which will profoundly change the way goods and services will be produced, sold and consumed. The term “digital transformation” or “digitisation” is widely used because the core of such transformation is indeed in digital technologies. Europe is strong in certain digital sectors with industrial application such as telecom equipment, electronics for automotive, security and energy markets, business software, and sensor technologies. Moreover, Europe hosts leading research and technology institutes with good potential for transferring digital innovations to the industry. However, the worldwide competition in high-tech sectors is fierce, and many traditional sectors, as well as small and medium enterprises (SMEs), are lagging behind in the adoption of digital technologies.³

In this context, the European Commission launched on April 2016 the DEI strategy under the framework of the Digital Single Market package,⁴ which builds on and complements various national initiatives for digitising the industry to “*ensure that any industry in Europe, large or small, wherever situated and in any sector can fully benefit from digital innovations to upgrade its products, improve its processes and adapt its business models to the digital age*” [1]. One of the pillars of the DEI initiative is the development of a pan-European network of **Digital Innovation Hubs (DIH)**. Digital Innovation Hubs are “*one-stop-shops that help companies to become more competitive with regard to their business/production processes, products or services using digital technologies. They are based upon technology infrastructure (competence centres) and provide access to the latest knowledge, expertise and technology to support their customers with piloting, testing and experimenting with digital innovations*”. Thus, DIHs are conceived as means of supporting businesses, and notably SMEs and non-tech industry, in their digital transformation under the Digitising European Industry (DEI) initiative. DIHs should also help in the assessment of digital skills needs and provide access to those skills when needed. Ideally, any business in Europe should have access to a DIH at “*a working distance*” [1].

Helping farmers to meet the wide range of economic, environmental and societal challenges of the 21st century is one of the key challenges for Europe. The Sustainable Development Goals⁵ and other initiatives have set up an ambitious challenge within a reduced time-span to achieve a sustainable food security. Within this context, promoting DIHs in agriculture may enhance the adoption of ICT solutions for more productive and sustainable agriculture systems, thus contributing to achieve those goals. The use of digital technologies in agriculture is expected to bring a number of benefits to farmers, such as increased productivity, increased profitability and reduced environmental footprint, access to new markets without heavy infrastructure, better conditions for farmers and their families etc. 0.

The rise of new innovative ecosystems of competence centres, farming users and suppliers is a very much needed baseline to democratise ICT in agriculture. The common marketplace for the digitisation

¹ <https://ec.europa.eu/digital-single-market/en/policies/digitising-european-industry>

² http://ec.europa.eu/eurostat/statistics-explained/index.php/Industrial_production_statistics

³ <https://ec.europa.eu/growth/tools-databases/dem/monitor/scoreboard>

⁴ https://ec.europa.eu/commission/priorities/digital-single-market_en

⁵ <https://sustainabledevelopment.un.org/>

of agriculture should contribute to accelerate the adoption of research and innovation by practitioners that feed farmers' needs. A new era of improved development of products and services will be possible, as far as SMEs and start-ups will take advantage of innovative technologies and their application to real problems in agriculture. Moreover, traditional barriers such as company size, place of origin or market entry will be reduced thanks to an improved connected society. Overall, DIHs have the potential to foster the conditions for dynamic and innovative farming and food production, enhancing high-quality products and turning high environmental standards into a competitive advantage.

1.1 Existing initiatives in the field of agriculture

Digital Innovation Hubs hold significant potential to support and assist SMEs and start-ups and could become key actors in bringing digitisation within the reach of all industry sectors. The rise of a Digital Innovation Hubs' network is a great opportunity to help EU companies to seize the opportunities of digital transformation, especially for SMEs and industries such as agriculture which today are not making intensive use of digital technologies. The collaboration between the ICT sector and the farming sector can be highly beneficial for both sides and can be tightened through Digital Innovation Hubs, leading to faster adoption of digital innovations and more robust products and services. As of today, DIHs in agriculture are in general incipient initiatives, but things are moving fast and the expectation is that some on-going initiatives will consolidate in the next years, whereas many others will flourish. For the sake of illustration, a few examples of on-going DIH-like initiatives in agriculture are mentioned below.

- **Digital Innovation Hub for Galician agrifood sector**⁶: A digital innovation hub for Galician agri-food sector, aiming at establishing a dynamic profitable open and responsive collaboration to achieve greater competitiveness for agri-food sector. It is actually a private-public initiative for the capitalization of already existing knowledge in research and innovation centers in Galicia. Among its objectives are to expand business opportunities and export potential for technological providers, by facilitating networking between different types of stakeholders, such as academic institutes, research companies and farmers in order to generate solutions and improvements demanded by the agrifood sector.
- **Netherlands Field Labs**⁷: within its national Smart Industry strategy, Field Labs are practical environments in which companies and knowledge institutions develop, test and implement effective Smart Industry solutions. It aims to facilitate entrepreneurship by providing the necessary resources, such as training materials, workshops, coaching sessions etc. An important aspect is the effort towards linking research with education and policy, therefore providing a framework for the implementation of research outcomes and their commercial exploitation. Field Labs already encompass several initiatives in the digital agriculture domain, including smart farming, dairy, floriculture, fruits.
- **The National Center of Irrigation Technologies for Spanish irrigation sector (CENTER)**⁸: it is the technological instrument of the Directorate-General for Rural Development to address the challenges associated with irrigation planning and integrated water resource management. It promotes and carries out activities of international cooperation for the development in matter of water and irrigation, acts as a center for applied research, development, experimentation, standardization and innovation in cutting-edge technologies for irrigation. In addition, it acts as

⁶ <http://polodeinnovaciondixital.org/en/>

⁷ <https://www.smartindustry.nl/english/>

⁸ <http://www.mapama.gob.es/es/desarrollo-rural/temas/centro-nacional-tecnologia-regadios/>

a body responsible for training, monitoring and transfer of technology and dissemination of knowledge, as national and international point of reference.

- **FINISH**⁹: It is the Future Internet accelerator for food, perishable and logistics based on FIWARE technologies, an innovative, cloud-based infrastructure. Besides mentoring, consulting and networking, it has funded over 30 innovative projects that provide new ways of facilitating seamless business-to-business collaboration in complex supply chains and networks¹⁰. It is a domain-specific accelerator that makes use of the FIspace tools and infrastructure.
- **FIspace**¹¹: a business-to-business (B2B) collaboration platform inspired in professional social networks such as LinkedIn or Facebook. It facilitates access to peers for co-developing useful apps, exchange of data, negotiations related to contracts and other activities related to business collaboration. Examples in the agri-food sector already exist for exchanging valuable data between agriculture practitioners, from farm to fork. Activities take place via the FIspace platform: an extensible SaaS cloud offering that can be extended by adding functionality through apps, defining collaborative processes and integrating data sources of users.
- **EIT Food**¹²: a Knowledge and Innovation Community (KIC) of the European Institute of Innovation and Technology (EIT), which was recently launched. The EIT Food connects partners from universities, research centres, institutes and businesses across 13 countries in Europe, from the whole food value chain, to put Europe at the forefront of food innovation and production. The EIT Food is one of the largest food-related initiatives worldwide. Especially the European network of Co-Location Centers (CLCs) of EIT Food could play the role of a nucleus for a European-wide ADIH network. As an example, the CLC North-East of EIT-Food could be a potential ADIH covering Eastern Europe, with its CLC office in Warsaw and a network of so-called EIT Hubs, dedicated outreach partners in individual countries. CLC North-East offers dedicated projects to increase the innovativeness of primary producers in Eastern Europe (including farmers). It implements a structured approach to developing entrepreneurial talents, and maintains outreach to key stakeholders in Eastern European countries including governments, industry and academia. Support for digitisation of the European food system is one of key strategic objectives of EIT Food. Through its industrial and academic partners, CLC North-East has relevant expertise in using digital technologies for agri-food sector, sensors, beacons, big data and satellite data for precision farming. EIT Food supports start-ups with incubation and acceleration of innovative business ideas, and mobilization of private/VC investments. The same approach is implemented in the other CLCs of EIT Food, namely CLC South (Madrid), CLC West (Leuven), CLC Central (Munich), CLC North West (Reading).
- **Agricultural Engineering Precision Innovation Centre (Agri-EPI Centre)**¹³: This new center has been established by the UK government to help provide engineering and precision agriculture solutions for the Agri-Food industry. By bringing together leading organisations in all sections of the supply chain it will become a world-leading centre for excellence in engineering and precision agriculture to benefit the livestock, arable, aquaculture and horticulture sectors. It delivers research, development, demonstration and training. The Agri-EPI Center is driving growth and supporting innovative ideas to help farmers and business

⁹ <http://www.finish-project.eu/>

¹⁰ <http://www.finish-project.eu/projects-funded-by-finish/>

¹¹ <https://www.fispace.eu/>

¹² <https://www.eitfood.eu/>

¹³ <https://www.agri-epicentre.com>

owners become more profitable and sustainable.

- **Gaiasense:** In Greece, an example of an ADIH is Gaiasense¹⁴. Gaiasense aspires to be a digital collaborative workspace that enables all stakeholders of the agrifood chain to collaborate towards the development and adoption of digital innovations in agriculture. In terms of infrastructure, Gaiasense consists of a network of IoT environmental stations (Gaiatrons) and a cloud infrastructure responsible for the acquisition of data from various sources (e.g. IoT stations & remote sensing sources), the management and sharing of data. Gaiasense provides access to the necessary data and tools, computational infrastructure, scientific models, it offers flexible interoperability options, it engages all players of the agrifood chain (from research to the field) and facilitates access to the market, to support the development of added-value, innovative applications for the agrifood sector and the transfer of innovation to the field. The Greek state recently announced an investment of approx. €7,5M through a project titled “Agro Internet of Things”, which aims to boost the adoption of smart farming in Greece. By extending the existing network of IoT stations to fully cover the Greek cultivated land, and focusing on the combination of data collected with earth observation data such as Copernicus, it will expand the Gaiasense ADIH to a national level.

1.2 The role of the farming community in a Digital Innovation Hub

The farmers remain at the heart of the Digital Innovation Hub. Farmer’s needs are the main driver for setting innovation priorities; it is absolutely necessary to align all the related efforts (e.g. the focus of technology) according to the needs of the farming community, following a bottom-up approach. In the context of an ADIH, farmers (and at some extent the agri-cooperatives) will be able to test and assess the effectiveness of a variety of tools and business models.

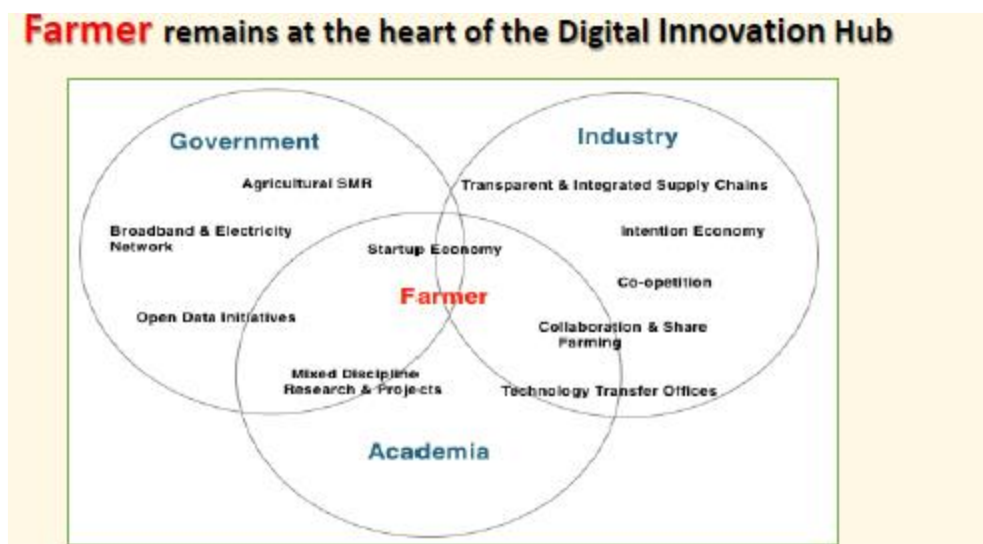


Figure 1: The role of farmers in the Agricultural Digital Innovation Hubs (Source: COPA-COGECA)

In the context of an ADIH, farmers’ representatives (i.e. agri-cooperatives) serve as interface between the Digital Innovation Hubs and the farmers in the field, by selecting the most suitable candidates to test

¹⁴ <http://www.gaiasense.gr/>
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ideas, but also selecting projects and partners among the ICT community and scientists. They are extremely important on raising awareness among farming community for the projects but also facilitating competitions aiming at showcasing technologies and digital tools. On top of that, they are good partners and facilitators. Finally yet importantly, farmers through the agri-cooperatives, help by creating trust & transparency among partners (e.g. elaboration of code of conduct on data sharing) but also by raising profile for the bottlenecks to implement digital farming.

2 Dimensions of an Agriculture Digital Innovation Hub (ADIH)

An Agriculture Digital Innovation Hub (ADIH) is a multi-dimensional entity, as it is expected to provide a wide variety of services to its members, as any typical DIH would do - but in this case focused on agriculture, as described earlier. In short, ADIHs must help the agrifood sector to understand the opportunities brought about by digital technologies to overcome the sectorial challenges, facilitate the adoption of those technologies and make the best from them in their practical application. To achieve these general objectives, the following dimensions (among others) must be addressed:

- Have an overview of the current status of the agrifood ecosystem in terms of actors, like farmers and cooperatives, stakeholders, networks, technological solutions, ongoing research, production chain etc. and take advantage of existing structures;
- Understand the issues faced by its members and the solutions available so to propose the best possible solutions by matching issues with opportunities;
- Analyse and establish networks and create profiles of their members (so to facilitate matchmaking), bringing together farmers, scientists, ICT companies, entrepreneurs in order to create a hub in agri-tech;
- Manage and coordinate the network of ADIH members;
 - develop and maintain a common vision for all ADIH members;
 - define the processes, ensure cooperation and build trust among members, manage issues (e.g. intellectual property, data ownership, transparency and trust on data sharing) etc.;
 - be able to understand the different “language” used by different stakeholder types and “translate” it, facilitating the communication between them;
- Provide the means for business incubation of innovative ideas,
 - identify and refine innovative ideas and facilitate the start-up of operational groups;
 - provide the necessary expertise and infrastructure (premises, hardware, software, consumables etc.);
 - facilitate the identification of the most appropriate funding options;
 - support the creation of an innovative friendly regulatory framework;
 - create conditions for showcase of benefits of new technologies under farm conditions.

As described later on in this document, an ADIH needs to be active at different levels; for example, it aims to establish and maintain a network of partners (hub members), expand the network by establishing collaboration with external entities (both individuals and organizations) and also liaise with other related networks, creating “networks of networks” or “hubs of hubs”.

Each agriculture subsector and each EU region have their own specificities, so probably it does not make sense to provide a standard catalogue of “services” to be provided by and ADIH. Actually, the catalogue must be properly tailored to the real needs and context of each hub. Thus, the subsections below do not pretend in any way to provide an exhaustive/detailed catalogue of ADIH services, but an overview of the most important dimensions which, under our point of view, must be addressed within an ADIH.

2.1 Technology and experimentation

Access to digital technologies for experimentation and validation in the field (experimental/real farms, etc.)

One of the most important aspects of an ADIH is the ability to provide its members with access to innovative digital technologies that may have not been tested yet in the field. Farmers are very unlikely

to introduce in their day-to-day operations any new solution, which has not been properly tested in real conditions, in part because of the risk to disrupt their business due to a malfunctioning of the adopted solution, but also because of the risk to not get a proper return on investment. Thus, by providing the testbed facilities required for the testing and validation of digital technologies under real conditions, an ADIH can play an important role in facilitating the way to commercial exploitation and validation of new applications.

An ADIH needs to understand the exact needs of its members in terms of digital technologies and at the same time have up-to-date knowledge on the existing technological offerings. As a next step, it needs to establish contact (and a form of collaboration) with bodies operating testbed facilities and ensuring that they will be available to its members under clear and non-discriminative conditions. Compared to other industries, the required facilities might demand larger up-front investments, costs of operation and increased management complexity (as they may involve live animals and plants). In this regard, it is advisable to identify existing facilities (either public or privately managed) that can be used for ADIH experimentation purposes. In some cases, this could lead to explore synergies with on-going research and innovation projects at regional, national or European scale, which might have funds allocated for facilitating experimentation in real conditions to external entities. For instance, in the context of Horizon 2020 projects, the IoF2020¹⁵ large-scale pilot in the domain of agriculture is a clear candidate to establish this kind of connection. Cooperation with private agrifood companies should also be explored to figure out possible collaboration models enabling testing of technologies by external parties.

The role of Competence Centers as central actors in ADIHs

Competence Centers may be considered as the forefathers of DIHs, as they existed before the concept of DIHs was defined and they partially served the same role. Competence Centers are collaborative entities which aim to help companies towards their digital transformation, by improving their digital competences and facilitate technology transfer towards them. This is achieved by e.g. providing access to infrastructure, digital tools and services, guidance on the adoption of digital tools (and the digitisation of the companies in general), demonstrate new digital technologies highlighting their potential benefits, provide support for the development of new products etc. The role of Competence Centers is usually served by public and private research and technology organisations (RTOs) and universities, which have direct access to new technologies and the means for facilitating their adoption by those who wish or need to integrate them in their workflows.

Since technology transfer and adoption is one of the core dimensions of an ADIH, Competence Centers play a crucial role in their operation. Through a close collaboration with ADIHs, existing Competence Centers can be integrated in ADIHs as a whole and their work may be integrated as one of the services provided by the Hub. It is important to note that in many cases existing Competence Centers have already well established networks and a significant dimension, so their sustainability and collaboration with ADIHs is of high importance. In this context, different models for collaboration between these two entities should be considered, such as (i) upgrading Competence Centers to Digital Innovation Hubs, so that the former will offer the full set of services available through the latter and (ii) establishing and enhancing networking between Competence Centers and ADIHs, taking advantage of existing networks/structures.

An example in this case is CENTER¹⁶, which has an important testbed for testing materials and irrigation

¹⁵ <https://www.iof2020.eu/>

¹⁶ <http://www.mapama.gob.es/es/desarrollo-rural/temas/centro-nacional-tecnologia-regadios/>

equipment. It was formed by the Spanish Ministry of Agriculture with the objective of submitting tests to the irrigation equipment, according to national and international regulations. This allows an objective comparison of materials with the same utility, providing greater transparency to the sector, credibility to the material itself and confidence to the end user.

The work in the Laboratory is developed according to the guidelines of a quality system based on the UNE-EN ISO / IEC 17025 "General requirements for the competence of testing and calibration laboratories", which is ensured through a competent management and with the technical capacity of its facilities.

Recommendations

1. Elaborate a catalogue of existing testbed and experimentation facilities that could be integrated in ADIHs and define models of cooperation for their use by the ADIH members,
2. Define specific cooperation agreements with public and private RTOs to 1) open their experimentation facilities; 2) provide ICT technology for demonstration/testing purposes.
3. Explore the possibility of integrating testbed and experimentation facilities, currently provided by on-going publicly-funded projects, in ADIHs as a way to ensure long-term continuity of their services. Competence Centers are, at the moment, especially networks of laboratories and researchers not always connected to real needs. The active role of farmers and co-operatives in these projects must be ensured for the subsequent involvement in ADIH.
4. Farmers' representatives (i.e. agri-cooperatives) serve as the interface between the Digital Innovation Hubs and the farmers in the field, by selecting the most suitable candidates to test ideas, but also selecting projects and partners among the ICT community and scientists. They are extremely important on raising awareness among farming community for the projects but also facilitating competitions that aim to showcase technologies and digital tools.

2.2 Brokerage and innovation

One of the most important missions of an ADIH is to stimulate interactive innovation between the different actors of the ADIH, especially between the ICT providers (supply side) and the farming community (demand side). It is important for the hub's members to be able to access the latest advances from the research and technology sector, so that they have the opportunity to explore ways of adopting them and applying them in their business cases. Sometimes this is not possible, due to the lack of the necessary knowledge to understand the potential of new solutions, the capacity (technical, financial) to use them and the channels to reach out to these innovation entities. This situation reflects quite well the reality of farmers, specially the small ones, who traditionally have not been close to digital technologies and have difficulty in being away from their daily responsibilities in the farm. Moreover, their capacity for doing risky investments in technologies with unclear ROI is in general quite limited. At the same time, it is important that all farmers can access the latest technology, in order to improve their competitiveness in dynamic markets.

In this context, the role of the ADIH is really important, as they operate as the "glue" connecting different actors of the ecosystem. For this to happen, ADIHs will need to have a deep understanding of

the needs of farmers and an always up-to-date knowledge of the existing technologies / solutions, so that they can always propose the best possible technological solutions to their expected end users. This will help technology providers in ADIH to focus their efforts on the actual needs of the end users. In the context of a constant and self-feeding process, ADIHs will be able to learn from the successful matches of technological solutions to farmers' needs (best practices) and address any issues identified.

There are different levels where brokerage can take place; as described earlier, there is the brokerage among hub's members, at another level with external entities that are at reach / close to the ADIH, and also in the case of individual hubs (so that a network of related hubs is created).

The innovation broker as a key figure in the future of agriculture

An innovation broker is an entity (organization or individual) which operates in the context of a network and facilitates the innovation of other organizations without getting involved in the organization nor in the implementation of the innovation. Agricultural innovation brokers need to combine a diverse set of skills and expertise: ideally, a background in agricultural sciences with good knowledge in entrepreneurship, marketing and last but not least the ability to form and manage innovation networks. They need to have:

- **analytic skills**, for understanding challenges and opportunities;
- **multi-dimensional knowledge and experience**, in fields like the agrifood sector, technology, entrepreneurship, finance etc.;
- **good knowledge of the ecosystem**, referring to understanding the attributes of stakeholders and having the ability to correlate the needs of the one with the offerings of another (matchmaking);
- **networking and communication skills**, such as building new networks and strengthening existing ones, acting as the intermediate between different stakeholders from different contexts using different "language"
- **management and organizational capabilities**, for the management and coordination of different organizations that participate in the hub, building an environment of trust and coordinating the hub's activities.

The role of innovation broker can be undertaken by a variety of actors, such as individuals (e.g. extension officers), advisory centers and services (both public and private), business incubation centers, research centers and cooperatives, as well as NGOs.

An example in this case is CENTER¹⁷; one of its activities is the transfer of technology through training programs. These programs have been carried out since its creation with the intention of being the perfect link between Research Centers and Companies, between specialist technicians and end users. The aim of the programmes is to keep up-to-date technical knowledge and propose new solutions with the latest technologies. From this point of view, the Irrigation Communities are a priority objective, given the importance they have in Spain in the management and use of irrigation water.

¹⁷ <http://www.mapama.gob.es/es/desarrollo-rural/temas/centro-nacional-tecnologia-regadios/>
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Recommendations

1. Identify existing candidates (both entities and individuals) for innovation brokers.
2. Promote the role of innovation brokers in the innovation ecosystem of the ADIHs. Consider incentives such as training courses for brokers.
3. In case of lack of innovation brokers, the possibility that ADIH will manage the official list of these practitioners should be considered.

2.3 Access to public and private funding

Access to public funding

There is a number of funding options available through public sources, which can facilitate the implementation of large-scale investments needed in ADIHs. These options include various national, regional or even local funding programmes that are usually targeted at innovative solutions that address food security, improve production in terms of quantity and quality, mitigate environmental issues due to agricultural practices, etc. An ADIH's role would be to identify public funding opportunities for its members and work on the most appropriate ones in each case, involving all the necessary stakeholders.

The European Commission (EC) actively supports research and innovation in the agrifood sector, through significant funding channelled mainly through **Horizon 2020** and the **Rural development policy**. Through its seven-year research programme, EU Horizon 2020 aims to support the development of ICT-innovation for agriculture and the food sector; it also *“fosters the broad commercialisation of innovation in the EU by means of public procurement for innovation, design for innovation, demand-side policies for innovation, public sector innovation and social innovation”* (Source: STOA Report 0).

Other EU programmes for helping in the uptake and adoption of digital innovative tools, complementing H2020, are the following:¹⁸

- Interreg (<https://www.interregeurope.eu/>);
- the ENI CBC Med Programme (<http://www.enpicbmed.eu/>);
- the EU Regional Policy through the European Regional Development Fund (ERDF; http://ec.europa.eu/regional_policy/en/funding/erdf/);
- the European Social Fund (<http://ec.europa.eu/esf/home.jsp>);
- the SME support programme COSME (https://ec.europa.eu/growth/smes/cosme_en) and
- EU's Education Policy (http://ec.europa.eu/education/policy/strategic-framework_en)

All these funding opportunities can provide the necessary funding for the implementation of an innovative idea (which may have been incubated in a DIH) and bring in contact all the stakeholders that can contribute to this purpose. For example, agriculture is one of the thematic areas that are of interest to the Horizon 2020 Programme and other programmes as well, with focus being on research & innovation for addressing food security at a global level with the involvement of a wide variety of stakeholders, such as researchers, practitioners, businesses, farmers' organizations etc. In this context, an ADIH should be in position to propose the most appropriate programme calls for a specific case (e.g. an idea or a project incubated in the ADIH) as well as to facilitate the process of writing and submitting

¹⁸ <https://ec.europa.eu/eip/agriculture/node/161>

the proposal (e.g. by involving experienced partners accessible through the hub).

The Agricultural European Innovation Partnership (EIP-AGRI)¹⁹ is an EU initiative that aims (among other objectives) to speed up innovation development and uptake through an interactive approach. The EIP-AGRI contributes to integrating the aforementioned different funding options, so that they contribute together to a same goal, avoiding duplication of effort and results. At the same time, the EIP-AGRI facilitates the formation of specific instrument "operational groups", which aim at bringing together various types of stakeholders (such as farmers, researchers, advisors, businesses, environmental groups, consumer interest groups or other NGOs) in order to promote innovation in the agricultural sector.

The national and regional dimension cannot be overlooked. Besides the EU programmes, regions and Member States often count on specific public programmes (sometimes supported on European EARDF or ERDF funds) for promoting innovation in agriculture, or more general programmes for digital innovation that can be focused on agriculture use cases. These programmes have the advantage that they can be much better adapted to the particular innovation needs of the regions, so they can be an excellent complement to support the services of the ADIHs.

Facilitate access to private investment

Apart from the public funding sources, there are also funding mechanisms deriving from the private sector, although they are primarily focused on close-to-market innovations. The role of an ADIH is to find ways to connect its members to existing private funding instruments that are appropriate for them. Various private funding schemes are available, including but not limited to the following:

1. **Investments from private companies** that have interest in the development of specific ideas into products. For example, the envisaged product of a startup may save the company related costs and time needed by their R&D departments for a similar product. Indeed, more and more big companies are progressively reducing (even "outsourcing") their R&D&i departments in favour of creating their own incubators, aimed at identifying and getting fast to the market the most promising innovations for their business. An example is investments by cooperatives of farmers' associations. For example, GAIA EPICHEREIN in Greece is co-owned by farmers' cooperatives, and helps smallholder farmers to access technology and funds.
2. **Investments from individual investors (business angels - BAs) or Venture Capitals (VCs)**, who provide the required funds to ambitious start-ups, usually in exchange for ownership equity. Most BAs and VCs are generalistic, but a significant number of them focused on agri-food have started to arise during the last years. For instance the Rabobank Food & Agri Investment Fund in the Netherlands²⁰, Copia in Israel²¹, S2G Ventures²², or Agrostart in Latin America, just to name a few²³.
3. **Crowdfunding:** through the use of numerous online platforms built for this purpose, start-ups can share their innovative ideas, present a prototype (if available) and then invite individuals (but not necessarily investors) to invest in the development of the idea by pre-paying it and have it delivered to them as soon as it becomes available. Crowdfunding in agriculture is an emerging

¹⁹ <https://ec.europa.eu/eip/agriculture>

²⁰ <https://rfaiif.com/>

²¹ <http://copia-agro.com/>

²² <http://www.s2gventures.com/>

²³ <http://www.agrostart.basf.com/en/index.shtml>

avenue that fits well in the ADIH philosophy and should be further explored, not only for close-to-market innovations but also for technologies/ideas in earlier stages of development.

Recommendations

1. Each ADIH should clearly identify the funding and financing instruments available for its members and make this information easily accessible to them.
2. Public authorities from regions and Member States involved in ADIHs must design public funding programmes complementing the existing ones, aligned with the needs of their ADIHs.
3. Private funding agents must be strongly involved in ADIHs from the very beginning.
4. Each ADIH must clearly identify the benefits of digitisation both on the side of farmers and cooperatives and on the industry and services side, in order to clearly define the economic benefits (cost-benefits) of each actor.

2.4 Support entrepreneurship

Incubation of an innovative idea is often the first step towards its transformation into a commercial product. ADIHs can act as (or promote) **agri-food business incubators** to facilitate the setup and growth of startups and spin-offs by providing them with necessary support, such as training, services (e.g. financial and technical) as well as the infrastructure (offices, facilities etc.). An important part of business incubation is mentoring and coaching, referring to providing start-ups with advice on how to identify opportunities, overcome challenges and develop a sustainable business plan, among others. Coaching is actually a quick transfer of past experiences so that start-ups will know how to handle success and learn from mistakes and failures. At the same time, through the incubation process, the ADIH should also provide the necessary networking opportunities between the start-ups and various types of actors that may be of interest for the evolution of the start-up.

Business incubation opportunities are available through private companies or public organizations (e.g. research institutes and universities). The advantage of startup incubation by an ADIH is the involvement of different types of stakeholders that can contribute to the process, bringing different experiences and expertise on board.

Incubation of start-ups can also be facilitated by EU-backed business incubator programmes like FIWARE (<https://www.fiware.org>), which provide the necessary tools, methodology and framework for the development of innovative technology solutions in the agrifood sector. Another example is the Open Data Incubator for Europe (ODINE; <https://opendataincubator.eu>); an incubator for open data entrepreneurs across Europe, funded from the H2020 programme. ODINE aims to support the next generation of digital businesses and support them to fast-track the development of their products. Both incubators are generic ones; however, theme-specific incubators may be available. An example of a theme specific incubator dedicated to agri-food sector is the EIT Food Start-up Club, “RisingFoodStars”²⁴ and the EIT Food Accelerator.²⁵ Both offer support for the most important needs

²⁴ <https://www.eitfood.eu/start-ups/>

²⁵ <https://eit.europa.eu/eit-community/eit-food>

of startups, access to customers and access to investors. In this context, ADIHs should ensure direct communication and networking with such initiatives, so that incubation of start-ups may be undertaken jointly by the ADIH and the initiatives or by the initiatives alone (freeing up resources from the ADIH) while the ADIH should always be aware of incubation opportunities for its members.

In any case, a startup may require support, e.g. for getting access to private investors (establishing contact) or to understand the obligations (usually shared in legal terms) of a private funding option. An ADIH can identify the best available private funding opportunities for a given case, establish the connection with funders and involve the stakeholders needed (e.g. a legal advisor, an economist etc.). In the context of an international ADIH network, a regional ADIH can facilitate access to international Venture Capitals.

Initiatives like growITup²⁶ take the private investment aspect into consideration and require startups that join their programme (incorporated and/or operated mainly from Italy) to have already raised funds about \$50K-\$100K (Seed Stage) and looking at investments above \$500K. In case they successfully meet such criteria, selected startups “unlock” entrepreneurship-boosting services like mentoring, networking, are entitled to physical workspace etc. that aim to help them increase their opportunities for investments, partnerships and acquisitions. The initiative covers a set of seven different themes, including food and agriculture and by providing a complete set of resources it aims to provide one-stop-shop for supporting entrepreneurship.

Recommendations

1. ADIHs should identify the existing business incubation opportunities available and making them accessible to their members.
2. ADIHs should assess whether the existing incubators fulfil the needs of the local/regional agrifood sector.
3. Promote the creation of specific agri-food incubators, involving skilled innovation brokers and recognised experts in the field.

2.5 Training

In the era of digital farming and related data-powered services and applications, the delivery of training on digital skills to farmers and expanding digital skills (along with other types of skills) to agrifood startups is one of the most essential services offered by an ADIH. According to a report by CTA 0, the agricultural sector has not yet fully integrated ICT technology but the impact of innovative ICTs is becoming catalytic.

The role of a DIH in the case of training is dual; a DIH may already offer in-house trainings through one of its members or it may have established connection with external entities offering training courses, so that related training activities are channelled through them. Through a collaboration with a training / capacity building body, DIHs need to define the level of skills of the intended audience so that training programmes based on their needs will be developed and delivered. Such trainings may take place either

²⁶ <http://www.growitup.it>

in-house (at the premises of the DIH) or at the premises of the facilitator.

There are various reasons why such trainings do not take place outside (or better, individually) a DIH: First, the intended audience needs focused training on specific topics so existing generic curricula are not applicable; topics of interest are either part of a larger training or not available at all. Second, trainings offered by training bodies (both public and private) are often not flexible in terms of schedules. Last but not least, by being involved in the trainings a DIH can ensure that the skills are the ones needed by their members and can perform the necessary revisions, if needed. This allows a high level of flexibility and reduces the time needed for the completion of the training courses.

Training in digital technologies for the farmers

The digitisation of farming, which is reflected on the wide adoption of approaches like smart farming and mandated in the recent revisions of the Common Agricultural Policy, requires farmers to possess a set of basic digital skills so that they can fully exploit new digital technologies that are integrated in the agricultural systems. In addition, before farmers and farmers' groups are able to make use of the digital technologies offered through a DIH, they need to have the digital skills required for understanding them and using them in practice. However, a recent study of the European Parliament's Scientific and Technological Options Assessment (STOA) committee²⁷ highlighted the current lack of and therefore the need for focused training so that farmers can obtain high-tech skills. In this sense, an ADIH needs to provide access to training opportunities (such as courses) for farmers, tailored to their needs, ranging from the use of Internet to the use of spreadsheets and software used for farm management (i.e. used for recording farm inputs and outputs). Farmers may also be trained on the use of smartphones for making observations in the field, since such data can be useful for various farm activities.

At the same time, farmers operate more and more as business owners (and not as simple food producers), having to cope with the management of their farms, which become complex organizations, and meeting EU directives regarding the environmental impact of their farming practices. In this sense, farmers need to be trained on concepts like farm management (which is now based on digital tools and web apps) and obtain environmental skills so that they become better informed of the environmental impact of their practices - an aspect that can be at least partially addressed through the adoption of environmentally-friendly (and data-based) farming approaches like smart farming.

Training for agrifood startups

Agrifood startups have different needs in terms of training, as they usually have sufficient digital skills, and they may require training on different topics, such as management, marketing and branding, compared to farmers (always keeping in mind that many agri-cooperatives already deal with such aspects). At the same time, innovative digital products are usually data-powered, so topics such as intellectual property rights and data management (referring to aspects from data acquisition to data sharing, ownership etc.) should also be covered by trainings.

The training needs of startups are partially addressed through coaching sessions which aim at knowledge transfer, as described earlier, while typical training courses on e.g. the use of specific digital tools can be delivered as part of a training programme.

Learning from best practices (real use cases)

²⁷ [http://www.europarl.europa.eu/RegData/etudes/STUD/2016/581892/EPRS_STU\(2016\)581892_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2016/581892/EPRS_STU(2016)581892_EN.pdf)
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Best practices, without forgetting to explore the worst practices, can be used for training (and learning) purposes by a DIH, especially as the DIH grows and collects a sufficient number of best practices from its experience. On top of that, best practices shared by other DIHs, along with ones coming from other sources may also be used as good examples, so that given approaches, workflows and tools can be adopted and reused in similar cases. An example of a source of such good practices is the FIWARE Success Stories in the agrifood sector²⁸.

Learning from best practices can help start-ups save time and effort by adopting validated approaches, so that they can move faster towards the implementation of their plan. At the same time, failures can also be used for the same purpose, guiding start-ups on how to avoid making the same mistakes than others in the past. In this way, start-ups can save time and effort - as well as frustration - from repeating mistakes from the past.

Recommendations

1. ADIHs should look at the existing training offerings available, and complement it with programmes filling the gaps relevant for their innovation ecosystem. The focus must not necessarily be put on formal training, but probably on “soft” training (e.g. for farmers in the use of digital technologies).
2. ADIHs should explore liaisons with formal educational programs for filling the existing gap in undergraduate and graduate courses, which are not addressing yet the necessary mix between life sciences and ICT technologies. Social funds are set by national priorities, but usually do not match with the agricultural priorities. ADIH should contribute to the key priorities on training on topics of interest for farmers and technology, such as smart farming.
3. ADIHs should focus on techniques and methodologies to facilitate the digital transition from the sociological, anthropological, cultural and imaginary point of view.

²⁸ https://www.fiware.org/success_stories?s=agrifood

3 Towards a successful network of Agriculture Digital Innovation Hubs in Europe

The implementation of ADIHs by the different MS can play a determinant role in the effective rollout of digital agriculture in Europe. The different initiatives already launched or yet to be launched, by MS and regions alone can greatly contribute to the future development of the agrifood sector in Europe, but there is further, huge potential in interlinking those initiatives to each other in a pan-European network of interconnected ADIHs. Creating such a network would contribute to providing equal opportunities to agrifood businesses regardless their country of operation.

This section reflects on several aspects that must be taken into account when considering the implementation of an ADIH network in Europe.

3.1 The regional and national dimension in ADIHs: one size does not fit all

Creating a network of ADIHs in Europe does not mean designing one model of ADIH and replicating that model across Europe. On the contrary, ADIHs need to be deeply rooted in their regions and strongly aligned with their regional/national needs and context. Regional and national authorities must play an essential role in shaping and defining ADIHs in close collaboration with the agrifood sector and all the actors of the innovation ecosystem (see below, Section 3.4). The latter must provide the necessary feedback, in a bottom-up manner, about the real situation of the sector and their needs, whereas the public authorities must provide the necessary alignment with regional/national strategies (e.g. the S3 Smart Specialisation Strategy in Agri-Food 0) and supporting programmes.

Often, this alignment with regional and national strategies will need coordination among several governmental departments in charge of different public policies and supporting instruments (e.g. digital infrastructures, digital skills, R&D projects, rural development programmes, etc). This brings additional complexity to the implementation of DIHs over other public innovation programmes. Involving the multiple dimensions and actors of an ADIH requires an increased level of coordination and “common vision”. For these reasons, it is clear that public authorities should not be seen as mere funders of the ADIHs, but they must play a role of “catalysers” and cohesive actors of the ecosystem (both with public and private actors). An ADIH must be an instrument (coordinated with other measures) supporting the digitisation strategy of a region, rather than a purpose in itself.

The collaboration between the public authorities and the other ADIH actors must lead to the definition of a **prioritised catalogue of services** with a strong and relevant value proposition well adapted to the reality of the agrifood sector of each region/MS, taking into account for instance the disparity of digital adoption across different EU MS and regions 0. Other aspects that must be taken into account are the following.

- **Specialisation** of regional/national ADIHs: agriculture activities are deeply rooted in the territory, thus each region has a high degree of specialisation in a few agriculture domains, which usually have a strong impact on its economy. This specialisation includes as well the focus on specific parts of the value chain (i.e. not only primary production). The design of the ADIH must account for this specialisation, as well as for the disparity in digital adoption across different agriculture domains.
- **TRL and technology focus.** ADIHs are by definition innovation-oriented. However, not every ADIH needs to be focused on the highest TRLs (6-9). Some can be focused on earlier stages of technology (e.g. 3-6) to accelerate the process of maturing technology in early development

stages. In general, the TRL focus of an ADIH must be commensurate with the maturity level of the local ecosystem. Likewise, the technologies addressed by the ADIH must be in good alignment with the particular regional/national needs of the agrifood sector: sensing devices, IoT platforms, robotics, decision-support software applications etc.

- **Governance and organisational model.** There is no unique answer when it comes to defining organisational and governance models for DIHs in general. ADIHs, as any other DIH, may adopt multiple forms: private organisations (e.g. foundations), public-private partnerships, or networked organisations without formal entity, to name a few possibilities. The most appropriate model will depend on multiple factors such as the digital maturity of the corresponding industrial sector, the degree of public support, the existence of driving organisations (e.g. competence centers), etc.
- **Funding/business model.** As the governance model, the funding and business models of the DIHs are still open issues (especially in the long term), and each ADIH must design its own tailored approach. More on this below (see Section 3.3).

3.2 Interconnecting regional and national ADIHs

The push that Europe is giving to ADIHs as essential instruments for digitising the agrifood sector will hopefully spur the launch and consolidation of different initiatives in European regions and MS. Each ADIH will have its own and tailored strategy, always ensuring that farmers' needs are met, with defined:

- Specialisation domain(s)
- TRL and technology focus
- Service(s) offered to its beneficiaries
- Governance and business models

A large part of the benefit that Europe can get from the creation of such a varied ADIH network relies on the effective interconnection and cooperation between ADIHs, even from the early stages of development of the network. A few examples of such cooperation are provided below.

Best practice exchange

ADIHs can be excellent instruments to accelerate the pace of successful innovation by helping regions to learn from each other. In particular, consolidated ADIHs can help starting ADIHs to grow and consolidate faster, sharing good practices and real case examples regarding strategic aspects such as the definition and implementation of governance and business models, and more operational aspects such as the process of building the ADIH, engaging the different actors of the innovation ecosystem, etc. Taking into account the specialisation of regional ADIHs, certain aspects can be replicated from one region to other(s) that share similarities.

Cross-MS (Member States) experiments and validation

One of the goals of ADIHs is accelerating the adoption of new digital technology in real applications. Indeed, ADIHs can provide means to facilitate the testing and validation of prototypes with local customers, in particular farmers and agri-cooperatives. The ADIHs network represents a great opportunity to scale up such testing and validation at EU level in field labs and testbeds distributed across the network (e.g. through open calls).

However, the opportunity for EU-wide testing and validation should not be taken only in terms of technology. An interconnected ADIH network can be helpful to validate business models, market

assumptions, move towards interoperability, standardization, data portability, etc. at a wide scale, helping to enlarge the “EU internal market”.

Training

Complementary to the best practice exchange actions, cross-regional training programs can be devised to train ADIH managers (national authorities, competence centers...), or agricultural advisers in transversal aspects of ADIHs. Likewise, it can be of interest that certain training programs (e.g. on digital skills) aimed at agrifood SMEs are shared among different ADIHs.

Recommendations

1. Coordination actions among ADIHs require both certain degree of coordination (defined through some appropriate governance model) and defining a sustainability model (especially if those cooperations are intended to remain in the long term). In this regard, each ADIH should secure some resources to establish links with other ADIHs.
2. From a European perspective, appropriate instruments should be put in place to foster the linking and cooperation of ADIHs, addressing (possibly among others) the different cooperation opportunities: training, testing/validation, sharing of best practices... The Smart Specialisation Platform could be an adequate instrument (but not the only one) to implement cooperation. Keeping an updated map of ADIHs and their main characteristics can also be helpful to promote mutual knowledge and cooperation.
3. Align actions under the Digital Single Market strategy to facilitate the testing and validation of technology/solutions included interoperability, standardization and data portability, in the context of an ADIH network.

3.3 Making ADIHs sustainable

The objectives and potential impact of ADIHs in the future of the agrifood sector are clear, however their business model and long-term sustainability are still open questions. ADIHs involve multiple dimensions and services to be implemented, each with certain associated costs of operation: training, prototyping, brokerage, access to testing facilities and others. Each ADIH must devise its own funding and business models, in line with the services to be offered to its beneficiaries. Such models must evolve over time and be adapted to the development stage of the ADIH:

- In the **preparation stage**, ADIH’s promoters must take care of awareness creation, feasibility studies, definition of service catalogues, long-term business plan... As these tasks are not recurrent, they will not impact the long-term sustainability, but a proper work during this first stage is determinant to the future success of the hub.
- The **start-up phase** of an ADIH: a significant amount of resources must be devoted to creating awareness and building the regional ecosystems, as well as start deploying the first services.
- After the start-up phase, ADIHs must look for **growth and consolidation** through enlarging its customer base and proving its positive impact in the innovation ecosystem.

In general, ADIHs (as any other DIHs) must consider a proper combination of public and private funds. Public support is probably determinant for the success of the preparation and start-up phases. Funding

of the infrastructure for testing and experimentation is a major concern, as it usually requires large up-front investments, which are not likely to be covered by the private sector. Moreover, such infrastructures need to be maintained and eventually renewed. Regional funds and EU Structural and Investment Funds (ESIF), in alignment with the regional Agri-Food Smart Specialisation Strategy, can be of help in providing infrastructure funding. The European Investment Bank (EIB) is also a possible source for financing large-scale infrastructures without being subject to regional specialisation strategies. Pan-EU networking activities can resort to EU innovation programmes (H2020, Interreg and others) to partially fund their costs.

In a long-term sustainability strategy, it seems reasonable that public funding should be decreasing over time in favour of private funding. This is why, as highlighted, it is so important to define the catalogue of services in close collaboration with the agrifood sector and the beneficiaries of the ADIH. In the case of new ADIHs, the rollout of services should be gradually done, focusing on the highest priority services during the start-up phase in order to generate success stories from the very beginning.

Private funding may come from a number of sources. For instance:

- **In-kind contribution** from the ADIH members. It is expected that ADIH's beneficiaries actively contribute to awareness creation, definition of services catalogue and business plans. Brokerage and incubation activities can also be subject to in-kind contribution specially by larger companies that might defer their benefit in a longer term period.
- **Fees for commercial services:** activities such as testing and prototyping can be subject to fees, agreed a-priori or in a case-by-case basis. Moreover, during the start-up phase such fees might be partially covered by public entities.
- **Membership fees** can help to maintain a reduced yet necessary structure devoted to maintaining certain services, as well as a coordination/secretariat service of the ADIH.

Another aspect that must be taken into account is how the existence of an ADIH network can contribute to long-term sustainability of the individual ADIHs. For instance, opening the customer base of the ADIHs to other EU regions.

Recommendations

1. Build ADIHs on the strong actors of each region. For instance, competence centers which are already well established in their regions, potentially have pivotal roles in the future ADIHs. Thus, it seems reasonable that the funding and business plans of new ADIHs build to a significant extent over those of such competence centers, but only in case these centers can demonstrate a real involvement of farmers and cooperatives.
2. Often, public programmes supporting separated services (entrepreneurship, training, etc.) already exist. Thus, the role of public authorities in many cases should focus on seeking alignment (or intensification in agrifood) of the already existing funding sources, instead of designing new schemes from scratch.
3. New models of public-private cooperation must be explored to guarantee long-term provision of certain services.

4. Explore the possibilities that a network of ADIHs brings to increase the individual sustainability of the ADIHs, e.g. through cooperative models.

3.4 Actors to be involved

By definition, ADIHs are built on the collaboration of multiple actors of the innovation ecosystem. The six main actors or “building blocks”⁰ have been recently introduced by the EIP AGRI, and they have been addressed in this document in Section 2 and Section 3.

1. **Farming community:** the main beneficiaries of ADIHs, at the core of the innovation ecosystem, including agricultural families and rural communities.
2. **Competence centers:** RTOs, universities, public research centers, private research centers, Vocational and training Centers, etc. They include not only agrifood centers, but also ICT centers experts in enabling and applied digital technologies. They have deep knowledge of new technologies and solutions for farming applications, and as explained in Section 2, their main role is as technology providers. They can play also other roles: training, facilitating access to public funds, etc.
3. **ICT community.** They are the technology providers in a ADIH. These providers may refer to companies providing generic digital technologies, that can be adapted to meet the needs of the agrifood sector, or companies providing technological offerings specifically for agriculture.
4. **Innovation brokers.** They have strong knowledge of the innovation ecosystem, as well as of the farming sector needs. Their main role is connecting the different actors of the ecosystem and advising them. They are mainly “facilitators” of innovation rather than “providers” of innovation.
5. **Regional/national authorities.** As explained above, their participation is fundamental not only from a funding perspective, but also with the role of aligning regional/national needs and strategies.
6. **Private investors.** They have the economic resources to fund the development and growth of disruptive or promising ideas and technologies.
7. **Start-ups, entrepreneurs and SMEs.** See Section 3.5 below.

In addition, the role of the following actors must be emphasized:

- **Agrifood cooperatives and farmers’ associations.** Cooperatives and farmers’ associations will surely play a determinant role in the awareness and adoption of digital technologies by the small businesses in the agrifood sector. Moreover, they are the right instrument to raise the voice of small producers during the definition and prioritisation of the ADIH services.
- **Rural development groups.** They are strongly connected to public authorities and their role can be twofold: 1) providing feedback in the design of ADIHs; 2) managing public funding sources to implement certain ADIH services.
- **Industrial clusters.** These can belong to the farming community, but also to the ICT sector that pretends to be provider of the agrifood businesses. They are authorised voices representing the perspective of the regional/national industry that should be beneficiary of the ADIH.

3.5 Focus on SMEs and start-ups

Agrifood SMEs are the main target that should benefit from ADIHs' services. Indeed, they account for the vast majority of the industrial agrifood sector in Europe 0. According to the latest Digital Transformation Scoreboard 0, the degree of adoption of digital technologies (those enabling the digital transformation of industries) in Europe decreases significantly with the size of the companies, putting SMEs (in particular, micro businesses) in serious risk of lagging behind in terms of competitiveness. This situation can be attributed to a number of reasons, among them the lack of staff expert in digital technologies and digital transformation, and the lack of resources to accomplish risky technology investments. As explained above, **agrifood cooperatives** and **farmers associations** have the potential to become the “**digital allies**” of the SMEs and small producers, so it is essential to involve cooperatives and farmers associations in the ADIHs from the very beginning.

One of the fundamental dimensions of ADIHs is to help entrepreneurs, start-ups and spin-offs to grow their ideas and increasing their chances to successfully arrive to the market. Digital agriculture is still in its infancy, so European ADIHs have the opportunity to become the incubators of tomorrow's digital global champions in the agrifood sector. As already introduced in Section 2, ADIHs must help them access funds and private investment for developing their ideas, access meaningful facilities for testing technology prototypes, interaction with real farmers to validate the solutions... in particular taking advantage of the networked structure of ADIHs in Europe, to provide those opportunities at a EU scale (rather than at local or regional scale).

4 Resources

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- [4] EC Digital Single Market: Pan-European network of Digital Innovation Hubs (DIHs) <https://ec.europa.eu/digital-single-market/en/digital-innovation-hubs>
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- [6] I4MS - Digital Innovation Hubs <http://dih.i4ms.eu/>
- [7] Precision agriculture and the future of farming in Europe: Scientific Foresight Study [http://www.europarl.europa.eu/RegData/etudes/STUD/2016/581892/EPRS_STU\(2016\)581892_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2016/581892/EPRS_STU(2016)581892_EN.pdf)
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