EDIH DATAlife Project

D6.3. Strategic report on digital & Agri-Sea Food

EDIH-DATAlife Digital Europe Programme (DIGITAL)

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Contents

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CURRENT STATE OF THE SECTOR: LEVEL OF DIGITALISATION, CAPABILITIES AND BARRIERS

The Spanish and, by extension, the Galician agri-food sectors are in a transition phase towards digitalisation, with significant advances, but also with significant challenges. While there is a growing awareness of the need to incorporate digital technologies, the level of adoption varies considerably across sub-sectors and regions.

LEVEL OF DIGITALISATION

According to reports such as [1], [2], [3] and [4]. In general terms, the degree of digitalisation is considered high, both at statal and Galician level. Most businesses are familiar with emerging technologies, although their degree of adoption varies significantly depending on business size, geographic location, and subsector.

Large corporations and some cooperatives have managed to implement technological solutions in a comprehensive way, while SMEs, which make up most of the productive fabric, have a lower level of digitalisation [1, 2, 3]. The agri-food industry shows a greater adoption of digital technologies compared to primary production, although this implementation is conditioned by the economic and human resources available [1, 3].

At a strategic level, 36% of companies in the agri-food industry already have a specific digitalisation plan, and 24% are in the process of developing it [2]. This percentage varies significantly according to the subsector, leading in digital planning egg products (60%), fish (45%) and beverages (44%) [2]. There is also a clear correlation between the economic dimension and the existence of digital strategies. Only 25% of companies with a turnover of less than 2 million euros have a plan, compared to 80% of those with revenues of more than 50 million [1, 2].

Connectivity at the Galician level appears to be a reasonably well-resolved issue, at least in terms of basic access, with 100% coverage across all sectors except for agriculture, which still reaches only 83% [3]. At the state level, the technological coverage available to the agri-food sector is also high [1]. This facilitates the

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implementation of digital tools. However, it is still necessary to expand network infrastructures in areas without access, to prevent them from becoming a barrier. Only 2% of the agents in the value chain do not have an internet connection. The autonomous communities with the greatest difficulties are Castilla y León and Aragon, while, by sectors, livestock farming is the one with the most connectivity problems. 80% of the agri-food industries have fibre optics, compared to 70% in the case of primary production. The use of ADSL is residual, between 1% and 4%. Agricultural production exceeds the 4G connection requirements by 10% compared to industry, which is related to the geographical dispersion of farms. This type of activity demands wireless solutions and has the highest rate of demand for satellite connection (7%) [1].

In terms of the use of electronic devices, 79% use mobile phones, 61% computers that are more than four years old, 36% use newer computers and 31% *use tablets*. Use is similar in primary production and industry, although the renewal rate is higher in the latter. Despite this, 77% of companies still manage their operations on paper, although this figure drops to 49% among 18 to 25 years old [1].

The adoption of management and production support programs is widespread, particularly in the industrial sector. Among companies, 83% use corporate email, 78% office software, 74% antivirus, 50% cloud storage, 40% IoT, 24% massive data analysis, 25% SCADA systems, 20% CAD/CAM and MES and 19% cloud computing. Additionally, around 10% employ advances technologies such as digital twins, *blockchain*, augmented/virtual reality or additive manufacturing [1, 3]. In the agricultural sector, regarding ISOBUS[1] implementation, in the Galician sector only 12% of companies have adopted the system (Controller Area Network, CAN), although all of them owns compatible tools. This contrast with the national level, where penetration is significantly higher, 22% of the companies use ISOBUS along with compatible tools, and an additional 10% use ISOBUS alone.

Automation and sensor technologies are also present in the sector [1, 3]. Around 73% of livestock farms incorporate some automated process. In the industry, 36% operate automated lines, 14% use articulated robotic arms and 10% employ internal transport robots [1]. These figures are higher in large companies [1, 3]. In Galicia,

[1] ISOBUS (Controller Area Network – CAN) is a communication standard used in the agricultural sector that enables interoperability and data exchange between different electronic machines and systems employed in agricultural machinery.

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regarding data capture in agriculture, the traditional analytics remain predominant (71%), while sensor-based soils and fruit monitoring reaches 45%. Drone-based data collection shows no penetration, and the use of climatic stations or satellite image analysis still low to residual. Conversely, in the livestock farming, both in Galicia and Spain as a whole, almost 70% of the farms capture some type of data: 50% use temperature or humidity sensors, 33% employ intelligent scales and 21% have automated feeding stations. GPS neckless are residuals. For digital record-keeping, 80% of agricultural producers in Galicia complete entries manually (70% in digital notebooks and 30% on paper), with only 7% using automated systems – half the rate observed nationally. In livestock farming, manual and automated record-keeping are more evenly distributed, with similar figures between Galicia and Spain. Regarding machinery, only 25% of tractors in agriculture are equipped with GPS, and auto-guidance systems remains residual at both regional and national levels. Irrigation programming is predominantly manual, while soil sensors are present in 28% of cases, though only 17% are used regularly. For pest and disease prediction, digital tool adoption in Galicia is still limited (4%), compared to a slightly higher 8% nationally. In livestock farming, nearly 75% of farms have at least one automated task, and 50% automatically manage feeding or environmental welfare monitoring, in line with national trends.

The use of artificial intelligence is around 50%, although this figure may be overestimated due to the confusion between AI and data analysis or control-monitoring [1, 4]. Approximately, 84% of primary producers collect some type of data on their farms, compared to 51% in the industrial sector [1]. The lack of training limits the implementation of these practices, which are more common in larger companies [1, 4]. In Galicia, the level of implementation is similar to the national average, with image processing standing out with a 19%.

E-commerce is used by 30% of the agents in the sector [1]. In agriculture, 15% of companies obtain more than 25% of their income through this channel, in livestock 9%, and in industry 17%. 58% of primary producers are willing to acquire inputs in this way, with the most demanded products being machinery, spare parts, fertilizers, seeds, feed and data capture devices [1].

The average level of soft digital skills among workers is relatively high, with around 90% demonstrating at least basic competences in problem solving, information management, *software* use and content creation [1]. These skills are higher in

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industry than in the primary sector and tend to increase with company size [1, 2]. However, in the primary sector only 11% of workers consider that they have sufficient knowledge to implement new technologies. ICT specialists are present in just 34% of companies, either in-house or subcontracted. Moreover, 67% of large companies report difficulties in requiting these profiles, likely due to the high degree of specialization required [1, 4]. Overall, there are notable gaps in worker's specific digital skills necessary to achieve a comprehensive digital transformation, with the most significant deficiencies observed in the primary sector and in small to medium-size enterprises.

CAPABILITIES

Companies in the agri-food sector show a proactive approach to digital transformation [1, 3], forecasting short-term annual growth of the sector over 10% and expressing confidence in their ability to meet evolving market demands [1]. This perception is supported at statal level by data from the [5], which indicate a growth of 3.9% in the Gross Value Added (GVA) of the sector, exceeding the national economy as a whole and the decline of 2.7% in the EU-27.

In general, aggrotech companies agree that the development of digital tools should be carried out in collaboration with end users, i.e. professionals in the sector [1]. There is a strong conviction that it will increase reliance on ICT, especially in relation to tools applied to precision agriculture, sustainability, productivity, production optimisation, cost control and improved competitiveness [1, 3].

As reflected in the report [6], this boost is supported by a solid national infrastructure, with the support of bodies such as the Ministry of Science and Innovation, CDTI, ENISA, Red.es and ICEX. In addition, the Spanish aggrotech ecosystem has more than 20 CSIC research centres specialising in agri-food, biotechnology and sustainability, such as CRAG, IBMCP, EEAD, IRTA, NEIKER and SERIDA, among others.

Public-private collaboration is a key pillar, articulated through platforms such as BIOVEGEN, Foo for Life Spain, PTEPA and PTVino, which connect companies, technology centres and universities. Initiatives such as Demofarms and Living Labs allow the direct transfer of knowledge between researchers and producers, facilitating the adoption of technologies in the field.

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Spain also has a network of Digital Innovation Hubs (DIHs) specialized in agri-food, such as DIH DATAlife, Andalucía Agrotech DIH, DIGIS3 (Castilla y León), IRIS Navarra, Madrid Food Innovation Hub and DIHbio (Catalonia). These hubs offer diagnostic services, training, technological advice and access to demonstration laboratories, strengthening the innovation capacities of the sector.

In this context, Galicia stands out as a dynamic regional hub within Spain's aggrotech and foodtech landscape. The Galician Foodtech Ecosystem Map 2025 illustrates a well-structured network that integrates startups and scaleups, knowledge centres, ecosystem supporters, funding entities, and incubators. It includes specialized initiatives such as Situm, Néboda, Bima, ODS Protein and 3edata in the startup segment, alongside research institutions like CIAM, CETMAR, CIS and CTC which drive scientific progress in agri-food and marine sectors. Public-private collaboration is reinforced by supporters such as Clusaga and DiHDATAlife itself, while funding mechanisms like Unirisco and accelerators such as ViaGalicia, BFood, and Biocubatech foster entrepreneurship and innovation. This interconnected structure positions Galicia as a key player in promoting technological adoption and sustainable practices in the food industry.

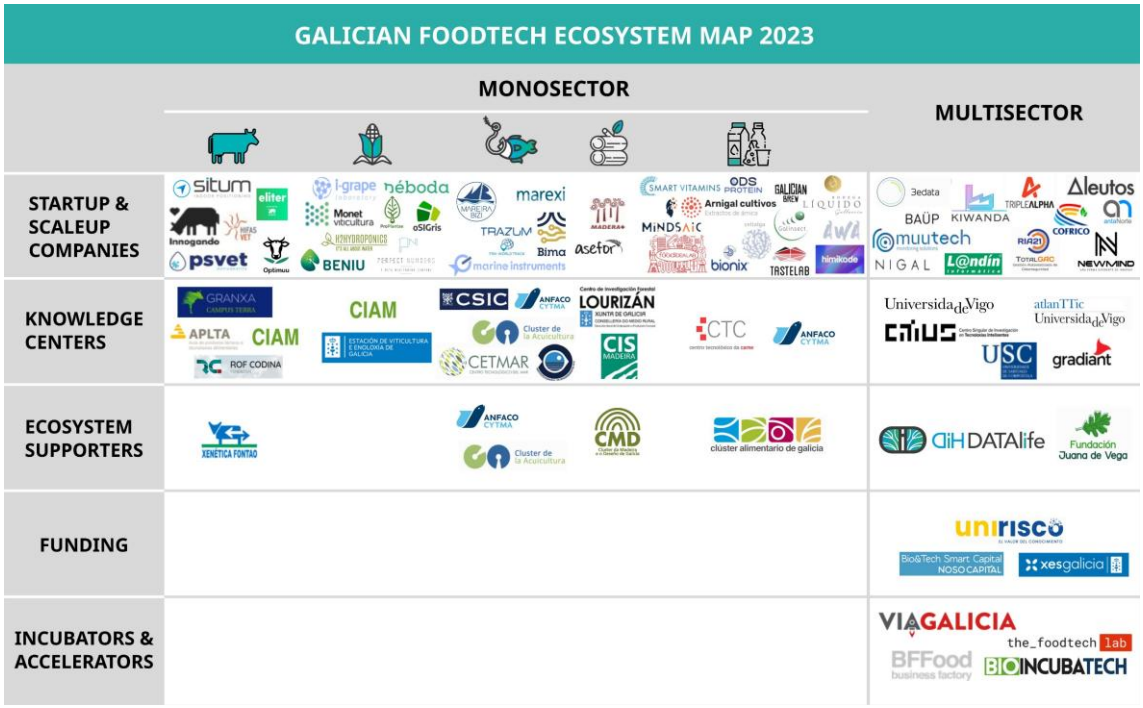

Figure 1. Galician Foodtech Ecosystem Map, 2025. Source: DATAlife

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Although there is a recognised capacity for improvement, there is also a growing interest in expanding expertise, especially in technologies with a high degree of penetration and knowledge, such as automation, energy management and the circular economy. Likewise, interest is detected in lesser-known technologies, but with high potential, such as modelling, simulation and virtualisation of processes, which can contribute significantly to the optimisation of production systems.

The industry is aware that technology adoption not only improves the productivity and quality of products and services, but also makes it possible to maintain competitiveness, ensure sustainability, improve traceability, and adapt the offer to changing consumer demands.

The main concern is focused on the productive activity and on guaranteeing the quality of the final product. In this sense, greater importance is given to the development of new products and knowledge of the market, with the management of existing products and cost control taking a back seat. The technologies most associated with these improvements are big data, advanced automation and simulation.

At the state level, according to the report [1], approximately 70% of primary producers are in favour of implementing new technologies on their farms. 62% believe that they can increase the productivity of their businesses, and 45% believe that they can reduce production costs, a stronger perception in industry than in the primary sector. Water management is one of the main drivers of digitalisation, especially in the agricultural sector, along with the simplification of administrative procedures. On the other hand, the reduction of inputs (fertilizers, phytosanitary products, antimicrobials, energy, etc.) has less weight as a motivation.

In terms of advisory services, 28% of producers use cooperatives or input supply centres, 18% use public institutions and 17% use private technicians [1]. The main motivation of Galician companies, according to the report [3], is to improve the efficiency of their production systems (95%), followed by increasing energy efficiency (50%), improving management systems (40%), increasing profits (30%) and generating new products and business models (20%). Only 5% do not find any motivation to move forward in this line.

In 2021, 45% of companies in Galicia had already initiated actions related to Industry 4.0, 15% discarded it, 20% considered it interesting but had not yet implemented it,

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and the remaining 20% were working on the definition and implementation of roadmaps [3].

The projects linked to Industry 4.0 are developed in collaboration with different knowledge centres, distributed in a balanced way among universities, technology centres and other companies that are part of the Galician industrial ecosystem of the bio-food sector.

BARRIERS

Despite the progress in the digitalisation of the agri-food sector, there are still many barriers that hinder its full implementation, especially among small and medium-sized enterprises. According to reports [1, 2, 5], the main obstacles identified for the Spanish territory, which are also extensible to Galicia, are:

- **The cost of new technologies** (71%), which represents a significant burden for many companies, especially smaller ones.
- **The lack of public funding** (50%), which limits the capacity to invest in innovation.
- **Limited awareness of available technologies and concerns about not recovering the investment** (40%), create uncertainty and significantly hinder adoption.
- **The shortage of trained personnel** (20%).
- **Concerns about data protection** (15%), which affect both the implementation and management of digital solutions.

These barriers have a more pronounced impact on SMEs, while large companies, with greater resources, manage to overcome them more easily. In addition, the fragmentation of the sector, cultural resistance to change and distrust of new technologies by some traditional producers remain major challenges.

The report [5] adds that the low investment in R+D and the lack of generational renewal make it difficult to adopt new technologies. Despite a slight recovery in investment in innovation in 2023, the investment effort of the Spanish agri-food sector is still lower than the European average, standing at 0.55% of value added, compared to 0.80% in the EU-27.

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Insufficient technological infrastructure in certain regions, especially rural regions, aggravates the situation. Communities such as Castilla y León and Aragón have greater connectivity difficulties, and sectors such as livestock suffer more from the lack of access to quality networks.

The report [6] identifies additional structural barriers such as the lack of technological standardization, the poor interoperability between digital solutions and the limited connection between companies and specialized providers, which makes it difficult to implement solutions adapted to the real needs of the sector.

Delving deeper into the **Galician context**, even though 90% of companies consider that Industry 4.0 has or will have an impact on their activity, according to the report [3], only 55% have received specific training. In addition, the dependence on outsourcing for the design of new industrialization lines is high, because only 50% have an ICT department, 30% with their own engineering and 40% with internal R+D.

The most relevant barriers to the implementation of digital technologies are:

- The lack of trained internal resources (45%).
- Insufficient financing and uncertainty about the return on investment (35%).
- Lack of knowledge of technologies (25%).
- Limitations in the ICT infrastructure of companies (20%).
- The lack of technological standardization and adequate contact with specialized suppliers (20%).
- The lack of knowledge of the impact of Industry 4.0 by management (10%).
- The shortage of suitable suppliers (5%).

To overcome these barriers, companies identify the following as priority needs:

- Diagnostic services and strategic consulting.
- Aid for investments in infrastructure and ICT solutions.
- Training in ICT and Industry 4.0 (45%).
- Technology consultancy services and innovation support measures (20%).

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In relation to the digital transformation of personnel, both the report [1] and the report [4] agree that the low level of training of technicians in the value chain represents a significant barrier, a problem that affects both Galicia and at the national territory. Although 70% of companies have considered taking measures to solve it, only 37% have implemented concrete actions.

In respect of training preferences:

- 50% opt for online courses of up to 15 hours.
- 30% prefer demonstration days or mixed courses (face-to-face and virtual).

The most demanded topics in the field of digitalization are:

- In agriculture: precision agriculture (64%) and sustainable soil management with new technologies (61%).
- In livestock: digital management of the agricultural and livestock company (60%) and introduction to precision livestock farming (58%).
- In the agri-food industry: digital management of the company (65%), intelligent control in the agri-food chain (64%) and Industry 4.0 (63%).

Regarding public funding, although 50% of companies identify it as a barrier, only 41% have requested aid to digitise their activity. The main reasons for not doing so are ignorance of the available aid and its lack of suitability to the needs of the business (44%).

18% of companies have applied for the Digital Kit, placing it ahead of other aid such as those for precision agriculture within the framework of the RTRP or the Renewal Plan, ACTIVA Industry 4.0 and ACTIVA Growth. This lack of knowledge is more pronounced in smaller companies in the primary sector. However, 78% of those who are aware of these subsidies consider them to be useful.

Digital Innovation Hubs (DIHs) such as DATAlife play a key role in overcoming these barriers, offering advice, training, access to laboratories and connection to European networks. In this sense, the project DiHDATAlife has carried out a gap analysis revealing significant gaps in areas such as: (i) basic understanding of digital technologies and Industry 4.0 concepts; (ii) practical knowledge of IoT, data integration, and artificial vision applications for quality control; (iii) skills for implementing digital tools in production processes and resource management.

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To overcome these gaps, DiHDATAlife has developed a range of training materials and introductory courses, covering topics such as artificial vision, big data, IA, IoT for agriculture and aquaculture, and digital field notebooks, among others. These resources aim to provide both theoretical foundations and practical case studies to accelerate digital adoption in the agri-food sector, they can be found in DiHDATAlife-GapSectorAlimentario.

KEY TECHNOLOGIES IN THE SECTOR

Both the Spanish and Galician agri-food sector are immersed in a process of digital transformation, driven by the need to improve its efficiency, sustainability and competitiveness. Studies such as the [2], [6] and [3] show a growing interest in advanced digital technologies, although with regional differences in their degree of implementation.

In Galicia, the food subsector is characterised by a low technological component, although it shows significant progress in the creation of new products, the improvement of production processes aimed at sustainability, especially in the reduction of water and energy consumption, and in the reuse of raw materials through the recovery of by-products and waste.

The subsequent subsections outline the current state of the new technology adoption in the industry, both in Galicia and across Spain.

MOST WIDELY DEPLOYED TECHNOLOGIES

The most deployed technologies in the industry include:

- **Cybersecurity** (55%).
- **Artificial intelligence (AI)** (50%): applied to resource planning, product traceability, and predictive analytics to improve operational efficiency.
- **Energy management** (40%).
- **Circular economy** (35%).
- **Automation and advanced robotics** (25%), has a high penetration in larger companies, standing out in serial manufacturing processes and packaging tasks using robotic arms. Sensor monitoring systems are integrated to

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guarantee food safety, quality and traceability. With application in crop water management.

- **IoT** (40% national territory, 16% in Galicia).
- **Big Data** and **Cloud Computing** (20%).
- **CAD/CAM and MES** (20%), in industrial processes.

EMERGING TECHNOLOGIES WITH HIGH POTENTIAL

Among the emerging technologies (slightly over 10%) with high potential are:

- **Process modelling and simulation**: used to optimise industrial *layouts* and improve energy efficiency.
- ***Blockchain***: key to guaranteeing food traceability and security in data handling.
- **Advanced Photonics (HSI):** Enables non-destructive inspections and accurate physicochemical analysis. It is useful in food sorting applications, physical contaminant detection, and food fraud prevention.
- **Smart materials**: such as active and smart packaging that extends the shelf life of products.

TECHNOLOGIES WITH LOW IMPLEMENTATION

Despite their potential, some technologies have a low adoption in the sector:

- **Additive manufacturing** (10%): although its use in line maintenance through *on-site manufacture* of spare parts is explored.
- **Advanced logistics** (5%): with little implementation due to outsourcing of the service.
- **Human-machine interaction** (5%): despite its potential, it has not yet been widely integrated into production processes.

Lesser-known technologies tend to have an unfavourable cost-benefit ratio or do not fit their operational needs. In the logistics field, interest is low due to the automation of internal flows and the outsourcing of external ones. In addition, the limited deployment of the 5G network conditions the adoption of technologies that depend on advanced connectivity.

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TEN KEY RECOMMENDATIONS FOR PUBLIC ADMINISTRATION

1. **Promoting specialised training**
   Promote training programmes in digital technologies for all agents in the sector, from farmers to entrepreneurs, including updating university and vocational training syllabuses in accordance with the real needs of the industry.

2. **Facilitating generational renewal**
   Encourage the incorporation of young people into the sector through specific incentives and adapted training, especially in rural areas at risk of depopulation.

3. **Support investment in R+D and technologies**
   Increase public investment efforts to close the gap with the European average and promote innovation throughout the value chain, prioritising projects with concrete, measurable results and with a direct impact on productivity and sustainability.

4. **Establish tax and financial incentives**
   To design mechanisms that favour innovation and the adoption of disruptive technologies, promoting the creation of internal R+D departments and strengthening the innovative business ecosystem.

5. **Promoting public-private collaboration**
   Support pilot and demonstration projects through the creation of laboratories, technology demonstrators and regional innovation ecosystems. To facilitate spaces for experimentation (test-before-invest) and knowledge transfer between companies, technology centres and universities. In addition, to promote the creation of federated and secure data spaces, as well as strategic consulting services for technological implementation.

6. **Simplify and adapt administrative procedures**

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Adapt public aid to the real needs of the sector and speed up the obtention of technological authorisations, such as those related to the use of drones or smart sensors.

7. **Promoting technological standardization and interoperability**
   Promote common standards that facilitate the integration of digital solutions throughout the agri-food chain, ensuring compatibility between systems and suppliers.

8. **Boosting rural connectivity and ICT infrastructure**
   Guarantee access to high-speed networks in rural areas as a basic condition for technological adoption, reducing the territorial digital divide.

9. **Incentivising sustainable digitalisation**
   Prioritise technologies that contribute to energy efficiency, sustainable water management and the protection of biodiversity. To promote multidisciplinary research that integrates technical, social and economic knowledge for an inclusive digital transformation.

10. **Improve communication and technological dissemination**
    Develop information campaigns on the benefits of digitalisation and the resources available to companies. Establish support programmes for digital transformation, especially in SMEs and family farms.

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