



"SUSTAINABILITY IN AGROFOOD IN CASTILLA Y LEÓN AND INDUSTRY 4.0 AS TECHNOLOGICAL DRIVER"

RESUMEN: Vitartis, with funding from the Agricultural Technology Institute of Castilla y León (Itacyl), has launched an initiative to promote the development of R+D+i projects in the agrofood sector that contribute to sustainability in the region, based on industry 4.0 as a technological driver. For this purposes, they have requested Human Tech, to carry out a diagnosis report to qualify the starting point and propose recommendations to promote the implementation of these type of projects and facilitating the achievement of goals with real impact on regional sustainability, for which it is of utmost importance to communicate this initiative to all stakeholders and interest groups. Inthe following, we summarize the fundamental aspects of the study by Human Tech and its conclusions. Figure 1 shows schematically the initiative's approach.

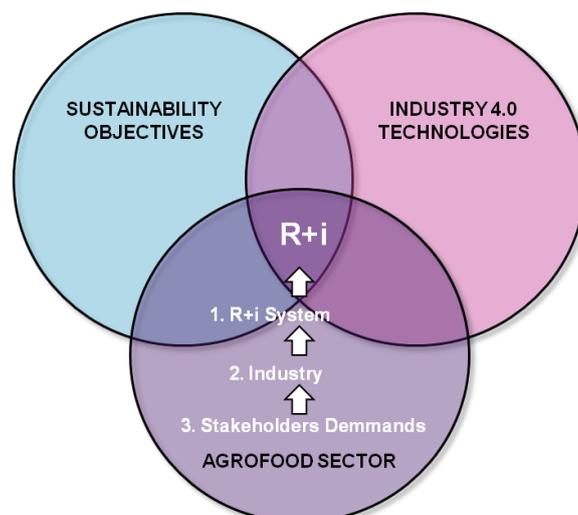


Figura 1: Approach for the Situation Analysis and Recommendations

Sustainable development is a journey, a way to achieve the objective that is Sustainability, and it affects practically all human being activities

The starting point is the concept of Sustainable Development understood as meeting present needs without compromising future generations to meet their own, and under a triple bottom-line approach: **Economic, social, cultural and environmental sustainability**. See figure 2



Figure 2: Sustainability, "Triple Bottom Line, Elkington (2004)

The struggle against climate change and the pursuit of efficiency in the use of raw materials and natural resources are today priority objectives for many countries. Goal #9 of the 2030 Agenda for Sustainable Development of the United Nations supports the construction of resilient infrastructures, the promotion of a sustainable industrialization and fosters innovation. Likewise, the European Union promotes sustainable development through the 7th EAP (General Union Environment Action Programme to 2020), and the Government of Castilla y León, on the other hand, establishes mobility and transport, the use of energy, prevention of waste, the protection of biodiversity and the development of new more sustainable ways of producing and consuming as its main challenges to accelerate the transition towards a sustainable, green, integrating and inclusive economy. Its commitment to environmental sustainability is reflected in the "Regional Environmental Planning" that explicitly addresses the following issues:

- Circular economy
- Water plans
- Environmental education strategy
- Territorial planning
- Sustainable development strategy
- Regional climate change strategy
- Acoustic contamination action plans
- Waste plans
- Natural environment planning

It is important to note that Castilla y León suffers year by year a decline in the population through its rural areas. To prevent the agricultural activity decrease that would occur in the medium term, immigration would be needed, i.e. people coming from harder conditions, willing to work and live far from urban communities. The other alternative, and also the only one that promises long term viability, is **an agricultural industrialization, increasing competitiveness and thus becoming an environment for creating jobs and attracting qualified professionals in search of interesting labor challenges.**

It is expected that through I4.0, companies shall acquire a greater capacity to recognize themselves as part of the ecosystem to which they belong, and address the responsibilities related to the sustainable development thereof.

Europe's competitive position in the global environment, in terms of products and services with high added value, has been put at risk due to the lack of investments in the modernization of industries during the recent crisis. We now need to make investments that allow us to generate products and services with more efficient processes, i.e. less materials, less energy and less waste. This is the main reason why European Union authorities promote Industry 4.0, as a concept of organizational digitalization through the internet of things and the cyberphysical spaces providing integration and awareness to its processes and actions. It is a concept aimed at the company level but, because of its very nature of connection and integration, it transcends beyond the company, enabling it to act better in and with its environment. It is expected that through smart technologies, companies will acquire a greater capacity to recognize themselves as part of the ecosystem to which they belong, and to address their responsibilities towards sustainable development. The research literature confirms that, both from a macro and micro perspective of Industry 4.0, it is a relevant factor for improving the sustainability of business activities under the triple bottom line approach

The agrofood sector maintains a unique relationship with the environment, on which it depends to have in a continuous and adequate manner, high quality, safe raw materials to produce food that enjoys markets recognition".

As a relevant industrial sector, agrofood value chain must adopt critical concepts of environmental protection, such as waste and effluents prevention, minimization, recovery and recycling. Securing an environmentally sustainable activity not only helps protecting and preserving limited natural resources, but it also ensures the long-term competitiveness and prosperity of the sector. In addition, it seems clear that society demands sustainable products and services. Consumers want to buy from organizations that are doing what they consider to be right, giving their confidence to those who bet on something more than just profit. Last but not least, agriculture and livestock are the main assurance for management of many natural spaces, so the economic sustainability of the agrofood industry ensures the preservation of the rural environment, acting as a retainer of the rural population and also protecting the cultural assets of rural areas.

Agrofood's value chain regional character, determined by the convenience of proximity to raw materials, transformers, suppliers, distributors and clients, implies a direct impact on the sustainability of the environments in which it resides on the three (3) pillars of the sustainability bottom line. **Its companies and their activity have a relevant impact on their local economies, employment and therefore population retention, as well as on the environment, from both the correct exploitation of resources and the preservation of the natural environment.** At this point, it is important to consider that innovations and investments made by agrofood companies in terms of sustainability may have direct benefits for the regions where they are acting, and consequently, beforehand, regional governmental support and funding to R+D+i projects in sustainability, as well as other investments with impact on sustainability, may be more clearly justified for this reason.

Proximity to material resources and a better control of them is critical in agrofood. This has led many companies to upstream integration, either through ownership or total or partial management. **It is therefore clear the need to establish collaborations in innovation among landowners, farmers and the industries to address important issues such as monitoring (field and farms), improving accuracy when providing additives and animal feeding, water management, production prediction, and matching production (supply) with the demand.**

"The greatest environmental impacts in the agrofood value chain occur "upstream" and "downstream" the transformation stages, so it is necessary to create shared value among its actors, establishing innovation collaborations to address these issues."

The most relevant agrofood environmental impact generating aspects are:

- i. Energy consumption
- ii. Greenhouse effect gas emissions
- iii. Resources and Waste Management
- iv. Water
- v. Wastewater management
- vi. Packing and Packaging

Agrofood sector is aware of society demanding the sector's implication in enhancing environmental sustainability which has resulted in initiatives from both governmental and industry associations.

Our research for relevant projects and cases of use in sustainability based on enabling technologies of Industry 4.0 in agrofood, does not yield relevant results, and the sources consulted confirm that the situation of the activity is still in its beginnings, with projects set in motion mainly by research and technological centers. Likewise, there is not an extended model of Industry 4.0 specific to the agrofood sector, although sectorial differential aspects to be considered for such a model have been pointed out in the study such as:

1. Critical access to raw materials and suppliers
2. Transports and Infrastructures costs impact
3. Requirement of proximity to demand

However, we clearly see that research and innovation in sustainability with I4.0 as a technological driver is aligned with the new Research and Innovation model for the agrofood sector of Castilla y León, which itself is aligned with the regional RIS3.

""Of the 92 objectives or research and innovation programs defined by the Community of Castilla y León in its R & i Model, a 45 have an impact on Sustainability, and we identify the enabling technologies of Industry 4.0 as potential sources or factors for practical innovations"

We identify Sensors, the Internet of Things (IoT or IIoT), Augmented Reality, Manufacturing Execution System (MES), Big Data, Cloud Computing and Artificial Intelligence as the enabling technologies that are mostly applicable in these programs or goals.



There are a good number of actors, agents and relevant initiatives in Industry 4.0 with impact on sustainability, at regional, national and European levels, working on this subject that will allow us to make inquiries, learn about good practices and success stories as well as the possibility of making proposals for collaborations in R+D+i projects for the agricultural and agrofood sector. It is necessary to advance in this line, generating the dissemination of the project and establishing collaborative networking channels.

Likewise, it is necessary to bring up and attract the interest and action of the companies in the sector, as well as the other actors in the R & I system, putting in place dynamics to promote the connection, and demand the attention of everyone on the space of opportunity of R+D+i in sustainability through Industry 4.0 as a development driver for Castilla y León.

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