



**C3-BIOECONOMY**  
Circular and Sustainable Bioeconomy

## **Bioeconomy as a strategic line of the Agri-food Campus of International Excellence, ceiA3**

M. Dolores de Toro-Jordano<sup>1</sup>

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Corresponding Author: gerente@ceia3.es

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### **Abstract:**

Awareness of the importance of the Bioeconomy and the promotion of its transfer to promote progress towards a circular economy in productive systems linked to agri-food calls for the implementation of a series of actions and strategies at the territorial and regional levels, and the involvement of different agents serving as driving forces and energising initiatives, with a bottom-up and multi-actor approach. This is where the Agri-food Campus of International Excellence, ceiA3, through its Bioeconomy strategy, aligned with the Andalusian RIS3, stands as a key instrument for the Andalusian region. The campus promotes scientific dissemination and awareness of the Bioeconomy in society and the productive fabric while favouring the alignment of the institutions that make up the campus with policies in this field, stimulating interaction between universities and research groups, as well their interconnection with the agri-food sector, to respond to its specific Bioeconomy-related demands in relation to education, training and teaching, as well as in R&D and transfer through a quadruple helix open innovation model.

**Keywords:** Bioeconomy, RIS3, Agri-food, Transfer, Dissemination

## **La Bioeconomía como línea estratégica del Campus de Excelencia Internacional Agroalimentario, ceiA3**

M. Dolores de Toro-Jordano<sup>1</sup>

### **Resumen:**

La concienciación sobre la importancia de la Bioeconomía y el fomento de la transferencia para promover avances hacia una economía circular en los sistemas productivos vinculados con la agroalimentación precisa de la implementación de acciones y estrategias, a nivel territorial y regional, y la implicación de diferentes agentes que sirvan de tractor y dinamicen iniciativas con un enfoque botón-up y multi-actor. Aquí es donde el Campus de Excelencia Internacional Agroalimentario, ceiA3, a través de su estrategia bioeconomía, alineada con la RIS3 andaluza, se posiciona como un instrumento clave para la región de Andalucía. El campus promueve la divulgación científica, la concienciación de la sociedad y del tejido productivo en materia de Bioeconomía, asimismo favorece el alineamiento de las instituciones integrantes del campus con las políticas en ese ámbito, dinamizando la interacción entre Universidades y entre grupos de investigación así como su interconexión con el sector agroalimentario para dar respuesta a las demandas específicas del mismo en bioeconomía tanto el formación, capacitación y docencia como en I+D y transferencia a través de un modelo de innovación abierta cuádruple hélice.

**Palabras clave:** Bioeconomía, RIS3, Agroalimentario, Transferencia, Divulgación



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<sup>1</sup> Campus de Excelencia Internacional Agroalimentario (ceiA3), Córdoba (ESPAÑA), correo electrónico: [gerente@ceia3.es](mailto:gerente@ceia3.es)

## 1. CONCEPTUAL AND POLITICAL FRAMEWORK

The Bioeconomy is the production, use and conservation of biological resources, including related knowledge, science, technology and innovation, to provide information, products, processes and services to all economic sectors, with the aim of moving towards a sustainable economy (FAO, 2018).

In Europe, after an initial Bioeconomy Strategy in 2012, in November of 2019 the Council adopted its conclusions on the updated Bioeconomy Strategy entitled "A sustainable Bioeconomy for Europe: strengthening the connection between the economy, society and the environment".

As defined in the European Bioeconomy Strategy "The Bioeconomy encompasses all sectors and systems based on biological resources (animals, plants, microorganisms and derived biomass, including organic waste), their functions and principles. It includes, constituting a nexus between them, terrestrial and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all those economic and industrial sectors employing resources and biological processes to produce food, feed, bioproducts, energy and services. To be successful, the European Bioeconomy must be developed around sustainability and circularity. This will promote the renewal of industries, the modernization of primary production systems, environmental protection, and will also enhance biodiversity (European Commission, 2018).

In line with Europe, at the national level the Spanish Bioeconomy Strategy "Horizon 2030" was revamped in 2016, whose following strategic objectives should be highlighted:

- To improve the competitiveness and internationalization of existing companies.

- New economic activities and jobs with new scientific and technological developments.
- The positioning of the Bioeconomy as a knowledge-based area of strategic innovation.
- Reach development potential in 15 years.

The strategy's scope "incorporates as sectors receiving attention agri-food, made up of agriculture, livestock, fishing, aquaculture and food processing and marketing, as one of those that is functioning as an engine driving our exports; the forestry and wood by-products sector; in addition to industrial bio-products, obtained with or without the biochemical or biological transformation of organic matter generated by our society, and not used in human and animal consumption; as well as bioenergy obtained from biomass, and services associated with rural environments".

At the regional level, in the Circular Bioeconomy Strategy of Andalusia (Junta de Andalucía, 2018), approved in 2018, the strategic objectives set were:

- Improve the sustainability and competitiveness of the agri-food, fisheries, and forestry sectors, promoting the use of innovative practices that favour and develop a Circular Economy
- Promote the competitiveness of industries that work with biological resources, furthering innovation, the generation of knowledge and technology transfer
- Encourage the reuse of resources, water, gases, nutrients and the use of waste and plant waste to obtain other products, uses and energy
- Promote research, innovation and qualification related to the Bioeconomy and
- Strengthen inter-administrative coordination and foster synergies with other plans and work programmes in different areas.



Finally, it is worth underscoring, as key messages of the 2018 World Bioeconomy Summit Communiqué, the urgent call for increased dialogue and collaboration on sustainability in R&D and training: "with a view to the great challenges of society, we call for an urgent increase in multilateral dialogue and collaboration in R&D related to the Bioeconomy; in particular research on sustainability and global change, governance and capacity building" (Global Bioeconomy Summit Communiqué, 2018).

## **2. ceiA3 STRATEGIC ROLE TOWARDS A SUSTAINABLE AGRI-FOOD FABRIC**

### **2.1 Campus of International Excellence Programme**

After this introduction to the conceptual framework of the Bioeconomy and the importance of promoting sustainable production systems, it is necessary to clarify the aim of the Campus of International Excellence, which is an initiative promoted in 2008 by the Government of Spain related to the process by which to modernize the Spanish university and "aimed at the strategic aggregation of universities, institutions related to the Knowledge Triangle, and the productive sector, which, acting in a specialized environment, or campus, seek their reference points and positioning in the international context." Its objectives are the recognition and endorsement of internationally renowned campus projects in teaching, innovation and transfer, research, and the interconnection between the university and the productive sector.

### **2.2. Agri-food Campus of International Excellence**

In 2009, in Andalusia, five Universities - Córdoba, Almería, Cádiz, Huelva and Jaen - backed the joint Campus of International Excellence initiative, the result of the alliance of these five institutions, coordinated by the University of Cordoba and with a specialization in Agri-Food. The ceiA3 International Agri-food Campus of Excellence's purpose is to promote university-business interconnections, train qualified professionals in line with the needs of the sector

and support its transformation towards a sustainable model.

Since its inception, the project has been strengthened with transfer actions, entrepreneurship, the funding of scholarships and grants, the promotion of infrastructures, collaboration with the CSIC and IFAPA as associated centres, and the creation of the ceiA3 consortium as a management body of the campus.

For this reason, ceiA3's main objective and founding principle is to promote the university's link with the Andalusian agri-food sector, and to promote its professionalization through training and capacity-building, and innovation through knowledge transfer.

The conception of the ceiA3 as an aggregator of institutions, with a specialization in Agri-food, means that one of its main challenges is its alignment with both the Andalusian Smart Specialization Strategy (RIS3) and the main strategies and transversal sectoral policies to position itself as a key element shaping their design.

### **2.3 ceiA3's potential in the field of the Bioeconomy**

The universities that make up the ceiA3 teach a regulated Agri-food education curriculum, with a large percentage of this containing and stressing content related to the Bioeconomy; in 24 of the 100 degree programmes, 18 of the 80 Master's, as well as in specialized classes such as the ceiA3 Training Network Courses, in which the Bioeconomy has been prioritized in the last three programmes.

The campus, made up of 5 universities and 2 associated centres, comprise an R&D entity featuring 302 research groups and nearly 4,000 researchers structured into 7 clusters key to the Bioeconomy, such as Agri-Food Technologies, Bioenergies and Sustainable Agriculture. Its research lines range from the improvement and optimisation of resources for production, plant or



animal, to economic and legislative aspects. Due to the breadth of the Bioeconomy, there are multiple areas in which researchers carry out their activity and are key elements for innovation in the field, such as: biodiversity and the environment, bioenergy, food quality, safety, technology, and enhanced production; nutrition and health, and the recovery of by-products. Transfer is one of the key founding principles of the ceiA3. The campus is defined as an element of cohesion between the scientific community, the Government and the sector, promoting the development of multiple joint activities in the Agri-food sphere. It is also worth highlighting its participation in projects and the alignment of research with the topics included under the Bioeconomy concept carried out in recent years, and future prospecting, where it is worth stressing the special experience of GO in innovative projects, both regional and national, whose main purpose is innovation linked to sustainable agri-food systems and the promotion of rural territories through collaboration between sector agents, with their knowledge.

Both at the level of the ceiA3 consortium itself and at that of ceiA3 researchers, they have participated in about 20 projects related to the Bioeconomy, both towards their specific H2020 challenge, as well as in other European programmes, such as LIFE, Coal and Steel, the 7 Framework Programme, and different ERA-NETs.

Among the support actions promoted by the CEI related to entrepreneurship, the A3BT awards are held annually to acknowledge the best corporate ideas and projects.

Finally, both the consortium and the institutions making up the ceiA3 have a recognized Scientific Culture Unit to promote scientific dissemination and support actions aimed at society.

Figure 1. The ceiA3's R&amp;D and transfer potential and policy alignment.



### 3. THE CAMPUS OF EXCELLENCE'S BIOECONOMY STRATEGY

#### 3.1 Rationale for the ceiA3's strategy on the Bioeconomy

After a first approach to the conceptual framework, the different strategies all coincide in recognizing that the challenge is to develop sustainable bio-based production systems based on circularity. Moreover, due to the Agri-food sector's environmental, economic and social importance, special attention is to be paid to it as one of the main production systems to take into account at the European, national and regional levels.

In a context in which research and innovation take on special importance in the implementation of innovative solutions to promote production through sustainable systems stressing the sustainable use and recirculation of biological resources, and the minimization of waste, new value chains are developed based on the production of bioproducts, and their added value is augmented through the use of by-products, universities and innovation centres with proven experience in the development of such lines, playing a strategic role in helping companies in to achieve these objectives, while favouring sustainable innovation in production systems.

Innovation requires combining production systems with specialized



education and training in the field of the Bioeconomy, which is also considered a key need to favour innovation ecosystems and the professionalization of the sector. In this area, support for new companies that foster innovation processes is also considered essential.

All this must be combined with heightened awareness and co-participation in the designing of actions by all the actors in the chain, including consumers and society itself, which are fundamental to guarantee, in the medium and long term, the success of measures implemented through a bottom-up process.

Standing out in the Andalusian Community is its RIS3 smart specialization strategy. And, among the regional advantages of supporting "Research and innovation in agribusiness and healthy eating" is that the region benefits from the ceiA3 as a high-profile asset for the promotion of synergies between actors.

In 2016 the Organization for Economic Cooperation and Development (OECD) produced a thorough report on the political framework of the "knowledge triangle" for the integration of research, education and innovation, analyzing 16 national case studies on higher education ecosystems in the knowledge triangle in Europe. *The Knowledge Triangle: Draft Synthesis Report* (OECD, 2016) cited and analysed the ceiA3 as an important case in Spain, highlighting how it favours the creation of communities oriented towards excellence in different spheres of knowledge, fulfilling specialization objectives and, therefore, the internationalisation of its activities.

### **3.2 Aims of the strategy**

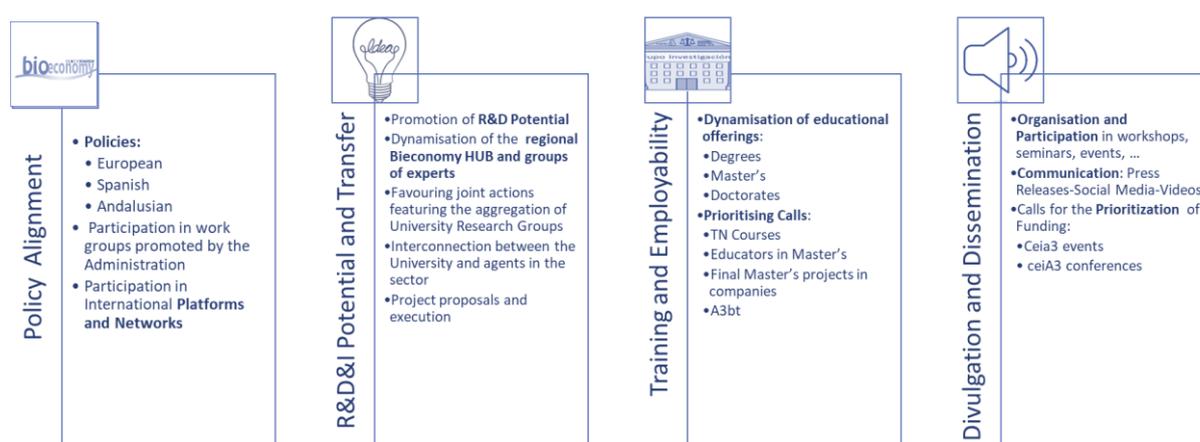
The Bioeconomy, linked to sustainable agri-food production systems, and in the current environmental and political context, should constitute a transversal line of prioritization for the campus whose groups are conducting Bioeconomy research, conferring a greater specialization on the actors, with this matter being tackled in the training and actions of the ceiA3 itself, "transversalizing"

the Bioeconomy, in all its areas, as a top priority.

Thus, taking into account the aforementioned, and the principles of the CEI itself, the ceiA3's Bioeconomy strategy was designed as a transversal line of specialization towards the making of special efforts, with its main objectives being:

- To favour the alignment of all the different areas and actions of the members of the CEI with regional, national and European policies and strategies in the Bioeconomy area.
- To promote and strengthen joint actions in R&D and knowledge transfer whose purposes are aligned with sustainable agri-food production.
- To reinforce and promote education and training, the professionalization of the sector, and the employability of graduates of ceiA3 Universities in the Bioeconomy.
- To publicise and position the research and innovation of excellence carried out at the ceiA3's universities and associated centres, promoting their dissemination and social awareness of them.

Figure 2. Summary of the ceiA3's objectives



### 3.3 Lines of action and case studies in the Bioeconomy sphere

In line with the principles of the aggregation and specialization of institutions, it



is proposed to carry out a series of actions that will be undertaken in a transversal way by the different areas of the campus and that, ultimately, will help to achieve the strategy's objectives.

Key examples of actions to be taken in each of the blocks proposed are highlighted:

With regard to reinforcing the alignment of ceiA3 with regional, national and international policies, initiatives and strategies in the field of Bioeconomy, standing out as a success story is the active participation by both ceiA3 researchers and the campus itself in the corresponding national and regional strategies, through their participation in the Spanish Bioeconomy Observatory and in the design of the Andalusian Circular Bioeconomy Strategy, bringing together and representing the interests of its member institutions and contributing its experience in the field.

Also standing out in this block, due to its importance to the Agri-food sector, is the alignment of the ceiA3 with the European eip-Agri initiative, materialized through participation in events and activities related to the Bioeconomy, like focus groups, the launching of Operational Groups, and the execution of innovative projects, all linked to sustainable production, as well as the Green Deal and Horizon Europe commitment: to promote participation in consortium projects aligned with this subject.

In order to promote a ceiA3 curriculum in the field of the Bioeconomy, of special note is the reinforcement of the implementation of educational content on the subject, publicising Master's and PhD programs, promoting specialised training in the Bioeconomy, such as the Training Network Courses; and prioritising assistance lines in this strategic area.

The vitalisation of the R&D&I potential of the research groups attached to the ceiA3 in the field of Bioeconomy is a key action that will be undertaken through the revamping and vitalisation of capacities as regards groups' research and innovation in the area of the Bioeconomy, the categorization of potential, the digitization of information through a platform that facilitates

searches for capacities, and the constitution of Bioeconomy Expert Groups.

In line with the previous objective, but oriented towards the promotion of transfers and links with the sector, the organization of meetings, workshops and projects in this area will be promoted, along with the identification of synergies and the pursuit of innovative solutions to sector problems, furthered through a multi-stakeholder approach, a bottom-up design, and a search for possible sources of public and private financing. All this will culminate in the carrying out of innovative projects, such as those organised by the eip-Agri's operating groups, and transfer and innovation projects financed with European funds. Of special note is the PAIDI regional project for Agroindustry 4.0 and Bioeconomy transfer, which has provided financial support for the development of the strategy.

Finally, within the block of actions aimed at publicity and information dissemination, this will be done through the ceiA3's Scientific Culture Unit and the generation of instructive content, news and videos. In this block, the actions carried out within the framework of Europe's H2020 BLOOM project stand out, whose aim is to raise social awareness of the importance of the Bioeconomy, with the ceiA3 taking responsibility for the development of the project's Web platform and coordinating to bolster the Spanish Hub. Within the framework of the Spanish Bioeconomy Hub, specialising in Agri-food, and promoted by the ceiA3, after a mapping of relevant actors in the region, experts from universities, agents in the productive sector and the territory, and the administrations themselves, got involved. The HUB is constituted as a multi-stakeholder group, and its main task has been the joint designing, through a methodology of co-creation, of different "outreach" activities to promote social awareness, with special attention to the productive sector and groups of schoolchildren. The main actions taken have been the creation of materials for faculty, participation in events like a "researchers' night", demonstrative innovation routes for companies exhibiting an acute awareness of the Bioeconomy, and the development of ancillary contents and audio-visual material.



Finally, of note was reflection on the importance of disseminating the innovative scientific knowledge that led to the launch of the C3 Bioeconomy Scientific-Technical Journal, to promote the diffusion - both scientific and technical - of innovations, experiences and achievements by the agri-food fabric of knowledge and production as relates to the Bioeconomy.

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