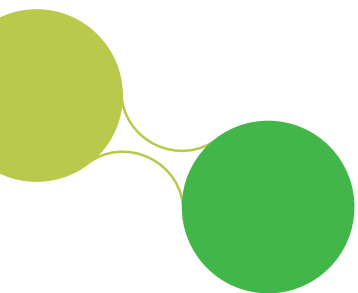




# The Spanish Bioeconomy Strategy **2030 Horizon**



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Humanity is confronting major challenges, made evident with two major international events in 2015. On the one hand, the Milan Universal Expo held from May to October with the theme "Feeding the Planet, Energy for Life" and, on the other, the United Nations' COP 21 climate change summit in Paris in December, at which all the world's countries undertook to cooperate in advancing toward a low-carbon economy.

Both involve challenges that are transcendental for our civilization, related to key questions for survival in the best possible conditions. And given their global nature, all countries must collaborate to implement clearly defined strategies with actions and deadlines that help promote productive models more respectful of the environment.

The Bioeconomy emerges in this context, as a set of economic activities that make use, as fundamental components, of resources of biological origin to produce food, and backup energy for the economic system as a whole, economic activities which, intimately linked to "things green", go hand-in-hand with the development of the rural world.

Spain, with its food and agricultural potential, its proven capacity in the realm of research in this field, and the availability of geographical spaces, is shaping up as a society which can and must make the most of the benefits offered by the Bioeconomy in our particular conditions, fostering them to the maximum.

This is the aim of the Spanish Strategy, Horizon 2030, based on the trilog of science, economy and society, assigning a fundamental role to the food and agriculture and forestry sectors.

The main objective is to establish the Bioeconomy as an essential part of this country's economic activity, featuring the innovation that yields know-how, demanding close public-private collaboration and an enhanced interaction between the Spanish and international science and technology systems.

The Strategy proposes specific measures within a framework of major lines of action and, for its implementation, will draw on technical, financial and organisational resources made available by the institutions promoting it, taking the form of annual action plans, with the impact evaluated by the Spanish Bioeconomy Observatory.

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The Ministry of Agriculture, Food and Environment plays a leading role in the startup and promotion of this Strategy, and must reconcile various areas of action in its area of operation with those of the Autonomous Communities in agricultural, livestock and forestry production, consumables, the environment, biodiversity and climate change.

Here, the Ministry's commitment to innovation is key. In April 2015, we initiated the National Food and Agriculture and Forestry Innovation and Research Programme, to accelerate R+D+i processes in the sector and allow for more efficient and sustainable and so more competitive resource management.

On the other hand, the inauguration is imminent of the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-agri), with the creation of Operational Groups to implement ideas helping to resolve specific problems or deal with an opening for improvement in the food and agriculture and forestry sectors.

It is to be hoped that this support will become one of the main tools in fostering this Strategy, making innovation in food and agriculture and forestry the cornerstone of backup action for the Bioeconomy.

All this as part of a productive model based on the efficient use of existing resources, on a broad and integrated basis, as support for the intelligent economy we are obliged to build, to our own benefit and that of future generations.

**Isabel García Tejerina**

*Minister of Agriculture, Food and Environment*





The world faces a multitude of challenges in the coming years. The population and its needs for food, services and consumer goods are increasing inexorably. Climate change is a reality which must be dealt with seriously, along with the intense use of fossil fuels which continue to be major players in our energy balance, despite the fact that they are finite and pollutant. Our aim with this Bioeconomy Strategy is to help find solutions to these problems, which affect the five continents. Solutions which must involve the generation of scientific know-how and which will imply competitiveness and economic growth for this country.

We are as a society committed to mitigating Climate Change and to the healthy nutrition of all humanity. We must produce more food and at the same time reduce food waste. We must be capable of guaranteeing that future generations will inherit the soil, water, biodiversity, ecosystems and landscape we enjoy today.

Thus it becomes essential to create knowledge, reach a greater and better understanding of our biological systems, their functioning and their interactions. Also to link it with the production and processing of products of biological origin, both in our already established and developed traditional sectors – such as food and agriculture or forestry – and in new ones emerging, to raise alternatives to oil by-products and which allow jobs associated with the new value chain to be created.

Such objectives are attainable only with the collaboration of all those involved – administrations, universities, research centres and companies. Thus the Bioeconomy Strategy has been designed with a clear intention of fostering cooperation in all fields and in a broad frame, making it possible to integrate differing regional and local strategies, facilitating coordination and promoting the development of the bioeconomy from both an economic and social standpoint.

In this context, social dialogue is a basic pillar. As a consequence, account has been taken in drawing up this strategy of the opinion of a large number of experts in the fields of science, management and the private sectors, and representatives of social organisations. Proposals have also been taken from public consultation, all to generate a document based in operational terms on annual action plans, begun even before it was adopted.

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Ultimately, this strategy comes into being with the idea of converting a necessity into an opportunity, with the mission of facilitating the development of the sustainable bioeconomy in Spain during the coming 15 years, to a 2030 horizon, maintaining competitive food production while developing and placing a wide range of high value-added products on the market using raw materials from renewable sources.

**Carmen Vela Olmo**

*Secretary of State for Research, Development and Innovation*



1

# Introduction



Advances taking place in the fields of **agricultural science, food science, biotechnology and chemistry**, and those which will arrive in the coming years, with technological and innovative support from other areas such as **engineering, organisation or logistics**, may enhance the competitive position of our productive sectors. The Spanish **food and agriculture and forestry sector** will be the first beneficiary, both in meeting domestic demand and in advancing in its strategy to export and internationalise. Moreover, the application of this know-how to an **integrated use of resources of biological origin**, and in particular to a reappraisal of food and urban waste and by-products, will allow the development of other economic sectors which may use them as raw material and enabling them, with biological, physical, chemical or thermochemical processes, to place a variety of **biomaterials** (bioplastics, lubricants, etc.) on the market, along with **bioenergy** (advanced biofuels or other energy applications for biomass). The development of the bioeconomy as a whole, as the sum of all these sectors, which take in as much **traditional activities** as others which are **new**, will enhance the efficiency of the use of our resources, ensuring that they are adequately implemented, to optimise their use, and advancing toward a sustainable economy and away from the use of resources of fossil origin.

The Bioeconomy strategy to be developed is designed to encourage economic activity and improve the competitiveness and sustainability of productive sectors linked to the use of resources whose base is biological, promoting the **generation of know-how** and its use in **developing and applying derived technologies**, via **collaboration within the science and technology system and Spanish public and private bodies**. The competitive development of new industrial sectors and new professional skills is also foreseen.

This strategy, designed by a multidisciplinary working group comprising experts from the public and private sectors, has undergone a preliminary phase of contributions in surveys among identified collaborators, along with a subsequent phase of public consultation.

It includes the motivation, definition, the objectives and above all the tools for promoting the bioeconomy in Spain over the coming years. The result anticipated is for scientific research to be used in developing technologies, and for them to be incorporated into existing companies, to enhance their competitiveness, and into any which may arise, in promoting new economic activities based on those technologies. In short, this Spanish Bioeconomy Strategy is



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presented with the objective by 2030 of more innovative, more competitive and more efficient companies, and a more diversified and environmentally more sustainable economy, advancing in the transition toward a circular economy, launched by the European Commission at the end of 2015.



# 2

## The Rationale



## 2.1. The new context of food and agricultural production and demand

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Spanish food and agricultural activity produces a significant number of end products which reach consumers in the form of food, services and consumer goods. In a context of open, globalised markets, the nutritional and consumer goods requirements of an **increasing** world **population** must be met. At the same time, the percentage of **middle classes** is increasing, particularly in countries with higher growth rates, and concentrated in large **urban conglomerations**, fundamentally in Asia and Africa. This totally conditions the shape of the **demand for food**, orienting it toward secure, high-quality, more manufactured products, with nutritional profiles defined to promote consumer health, and with differentiated added values.

In parallel, a modification is being experienced of the conditions surrounding production and linked to **climate change** (temperatures, rainfall, extreme phenomena, soil quality) and to a society which demands a **correct use of resources** to maintain the capacities and potentialities of productive systems (land, water, emissions, biodiversity, ecosystems). In this context of food production, Spanish companies must continue to hold the **competitive edge** they have attained in recent years and will have to **innovate**, making the most of the scientific know-how available to adjust their food production models (plant varieties and animal genotypes resistant to biotic and abiotic stresses, pest- and disease-control tools, environmentally sustainable productive systems), to enlarge and differentiate the products reaching the market (and oriented toward consumer demand, ecological products, functional foods and ingredients, nutraceuticals, biodegradable materials, food additives, etc.), and incorporating new conservation and transformation systems (longer shelf life, reduced cold chain, new processing technologies), and different organisational and logistic strategies to improve **efficiency and reduce food loss and waste**. It is also important to respond to social demands by making use of innovative business models to promote rural development, bringing producers closer to consumers and helping to encourage other complementary sectors through food and agricultural production.



The change will undoubtedly be led by technologies and innovations in the field of biology, linked to other sciences and the new information and communication technologies, promoting a **simultaneous advance in the intensification of production and the environmental sustainability** of the productive system as a whole. The challenge is to make it possible to produce foods of greater quality at reasonable prices and to adapt to consumer demands, the impact arising from their production both in terms of emissions and of the water footprint or the use of chemical products in the that process, by enhancing efficient use of consumables. This must also all ensure the sustainable use of resources such as soil or water, the conservation of the biodiversity and ecosystems, guaranteeing that they will be maintained for future generations, and the development of sustainable food models. It will also be possible to advance along these lines in rural development as a further element of the bioeconomy.

## 2.2. Forestry and forest-by-product output, and other biomass sources

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Another group of important activities included in this strategy and linked to the agroforestry sector relates to the extraction and **transformation of timber, cork, resin, production of paper** and of other **industrial products**, and extracting **bioenergy and other bioproducts**, uses and services linked to ecosystems, ranging from harvesting activities to tourism and leisure. These productive processes, with great potential for generating employment and added value, involving major amounts of biomass which can be exploited will, like the rest of the activity described, be subject to the influence of climate change and the need to apply criteria of maximum efficiency and sustainability in their management throughout the extraction and transformation process.

On the other hand, strategies are currently being developed for the production of biomass from non-conventional sources, from cultivation of algae and microorganisms, and associated with the possibility for its use as raw material for innovative productive processes. The potential of the marine environment must be emphasised here. The enormous variability of habitats and environmental conditions on the Spanish coast has led to the very greatest genetic diversity. Marine microorganisms may be a most interesting source of a very wide range of compounds and bioproducts (enzymes,



polymers, carbohydrates, pharmaceuticals and other molecules of biological origin and with unique characteristics). Thus the marine environment offers a vast reserve of unexploited natural resources, of very great genetic wealth, which may be used to generate new value chains. Marine biotechnology's potential for delivering solutions to the great challenges of the population (healthcare, food, power supply) is unquestionable.

### 2.3. By-products and waste: raw material for new productive processes based on the generation of knowledge and innovation

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The food and agricultural chain is sometimes not very efficient, generating residues from harvests and a wide range of by-products from the transformation and the commercialisation of foodstuffs. The same thing happens in processes for the exploitation of forestry resources. All are biomass, as is a substantial part of the waste produced by human activity itself, notably the biodegradable fraction of industrial and municipal waste or solid urban waste (biodiesel glycerol, tanning collagen, etc.) and other waste derived from urban activity, such as treatment plant waste and that derived from the breeding of animals for consumption.

The total volume of all these organic remains and other biomasses was quantified for the whole country in the 2011-2020 Renewable Energies Plan and in the PROBIOGAS project (Development of sustainable production systems and use of agro-industrial biogas in Spain, [wwwprobiogas.es](http://wwwprobiogas.es), 2010). On the basis of both, the biomass produced, including that **derived** from agricultural crops, forestry, the food, timber, paper and textile industries, animal waste and the organic fraction of solid urban waste, can be estimated at **159 million tons/annum**.

Until a few decades ago, waste organic matter was used in our society as an energy source when of forestry origin, or as organic improvements for the soil, or it was simply buried. The situation is changing. On the one hand, the advance in **scientific know-how** is allowing for the development of **new technologies** so that this **raw material** can be **used** more **efficiently**. On the other, current waste regulation, both nationally and at the Community level, recommends moving forward in the application of waste management Plans and prevention programmes which must adhere to the following **hierarchy** by order of importance: prevention, reuse, recycling, reappraisal and elimination of waste (*European Parliament and Council Directive 2008/98/EC of 19 November 2008 on waste and repealing some Directives*). Moreover, it is recommended that recovery processes make use of technologies which allow the application of a system in cascade, to obtain a larger number of high value-added products. That all opens the way to their efficient use while also generating a wide range of different products able to reach markets, thereby sustaining productive economic activity.

## 2.4. Bioproducts and bioenergy; the biorefineries

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An important part of the new by-products that can be obtained from organic matter are **oil by-product substitutes**, including new ranges of bioproducts (biolubricants, bioplastics, food additives, cosmetics, varnishes, solvents, etc.), and **bioenergy** (advanced biofuels, thermal or electrical energy, etc.); it is also possible to advance in the development of compound materials, combining organic by-products with others of fossil origin. It is in this context that the **biorefineries** arise, as industrial plants where, making use of biologically-based raw materials, a great diversity of new and recycled compounds is obtained, in addition to energy.

Thus, with the promotion of innovations linked to production and to the use of organic matter, support is given to the traditional agro-industrial and forestry sectors, at the same time facilitating the development of new activities which contribute to the transformation of an economy whose basis is in the employment of fossil fuels to another where renewable resources are used, which must be much more efficient while also economically, socially and environmentally sustainable. This assertion will be particularly true if the activity of these biorefineries is focused on the use of biomass obtained at the local or regional level, thereby ensuring their environmental, economic and social sustainability.





## 2.5. The Bioeconomy: an opportunity and a necessity

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The economy associated with resources of biological origin is benefiting from continuous **scientific and innovative advances** that are under way, and will continue to do much so much more in the future. The development of the bioeconomy is **an opportunity and a necessity** both for Spanish society as a whole and for its component companies. We need it in order to move in the direction of a society that is less dependent on non-renewable resources of fossil origin, consumption of which is accelerating a process of climate change which will condition our future on the planet. At the same time, for a country like Spain this sector must be a driving force in consolidating the process of economic growth. On the other hand, the new technologies must be the **tools for the differentiation and competitiveness of the companies** already operating on our domestic and international markets. Moreover, this resource is autochthonous, and harder to substitute in global geographical competition.

Economic activity linked to the production and transformation of these resources will evolve constantly. Thus the drafting of the strategy cannot be an end in itself but rather the **initiation of an on-going process** which feeds back and which **accompanies science, technology and companies, encouraging them to interact**, with the assistance of the various administrations, over the coming 15 years of the time horizon for which it has been designed. It must during that time be submitted to assessments and revisions coinciding at least with the preparation of each National Science, Technology and Innovation Programme.

## 2.6. Currently-related economic sectors

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According to official data from the statistics of the Indicators of the Ministry of Agriculture, Food and the Environment (MAGRAMA), in 2013, the **farming sector** in Spain generated Gross Value Added (GVA) of 21.707 billion euros, 2.5% of national GDP, pursuing its activity in 890,000 operations and employing 740,000 people.

The **fisheries sector**, comprising **offshore fishing** and **continental and marine aquaculture**, generated GVA of 1.047 billion euros, with 5,025 operations in all, 9,871 vessels and 64,675 jobs (MARM – Ministry of the Environment and Rural and Marine Affairs – 2011), contributing about 0.2% to national Gross Domestic Product (GDP) (National Statistics Institute – INE – 2011).

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GVA in the **food industry sector** was 28.448 billion euros in 2012, accounting for 2.7% of GDP, with a total of 28,762 companies and providing direct employment to 480,000 people (MAGRAMA, 2014 Economic Report of the Spanish Federation of Food and Drinks Industries – FIAB). Overall, in 2014, the food and agriculture sector represented somewhat more than 17% of all Spanish exports.

The system made up of the **silviculture sector** and **forestry exploitation** plus the **timber, cork and paper industry** generated Gross Value Added (GVA) in 2012 of 5.936 billion euros, 0.56% of national GDP. Of the total, 3.307 billion euros came from the paper industry (2.59% of GVA), 1.867 billion from the timber and cork industry (1.46% of GVA) and 762 million from silviculture and forestry (3.22% of primary sector GVA). (*MAGRAMA Indicators*).

According to 2013 INE data, the **biotechnology sector** is made up of 2,831 companies providing work for 172,939 employees of whom 9,135 are engaged in R+D in biotechnology, and with 5,148 researchers. 530 companies are working on R+D: 196 in animal health and aquaculture; 314 in food; 206 in agriculture and forestry production; 182 in the environment and 159 in industry.

The **sector producing and transforming biomass** for energy generation and creating bioproducts comprises some 170 companies in Spain. According to the Association of Renewable Energy Companies (APPA), the input to GDP from bioenergy, including biomass for the generation of electricity, thermal and biofuels for transport in the period 2007-2014 averaged 3.562 billion euros each year. In that period, an annual average of some 47,880 direct and indirect jobs was generated according to the same sources.

The **companies in the economic sectors** referred to will be able to participate in the creation of **new value chains** where the production and transformation of primary products connects with industrial activity, whether bioproducts, bioenergy or both, to make economic use of all that biomass, not exploited as a whole until now and, at times, with management costs. However, this strategy goes further, in parallel with the very concept of bioeconomy into which **other complementary, dynamic and sustainable areas of activity** are integrated. Thus further sectors, such as chemical, paper, energy, etc., have points of confluence in their activities with the development of the biorefineries referred to, enhancing the emergence on the market of new products and the development of new bioprocesses, promoting specific development in rural settings.



## 2.7. Public resources for research and innovation in this area

Spain has significant capacity to generate know-how in the area of the bioeconomy, in public research bodies and in the universities, along with both public and private Technological Centres, to which must be added the companies working in the field. According to information furnished by the Directorate-General Scientific and Technological Research in the State Secretariat for Research, Development and Innovation (SEIDI) and by the National Agricultural and Food Research and Technology Institute (INIA), in 2015 2,780 projects were active in research in areas related to the bioeconomy, with public funding from both those divisions of the General State Administration. The following was the distribution, by areas of expertise:

| Áreas   | Nº Proyectos |
|---|--------------|
| Food and Agriculture Resources and Technologies | 1,150        |
| Agriculture                                     | 451          |
| Livestock farming                               | 272          |
| Aquaculture                                     | 83           |
| Forestry  | 74           |
| Food  | 270          |
| Fundamental biology                             | 577          |
| Biotechnology                                   | 236          |
| Environmental Sciences and Technologies         | 273          |
| Chemical Sciences and Technologies (Bio)        | 439          |
| Energy (Alt)                                    | 105          |

The data show that there are at present in our research centres at least 2,780 research groups working in different scientific areas associated with the bioeconomy.

**Public investment** here in the field of **research and innovation** is significant, as seen from **Table 1**. In 2013, the different programmes for financing research and innovation as part of the State R+D+I Plan and in the EU's Seventh Framework Programme supported **778 projects** in the bioeconomy field. This meant an overall **subsidy of close to €124,000,000 and investment in excess of €320,000,000**, of which over €130,000,000 was in the form of subsidised credits.

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**Table 1. Annual public investment (€) in R+D+I and induced private investment in the bioeconomy**

*(Includes food and agriculture, forestry and biotechnology and industrial chemistry applied to transformation of biomass)*

| 2013 Investments   | No. of projects/<br>actions | Public Investment  |                   |                    | Induced Private Investment<br>(*) |
|--|-----------------------------|--------------------|-------------------|--------------------|-----------------------------------|
|  |                             | Direct Subsidy     | Approved Interest | Credit granted     |                                   |
| <b>Derived from the State R+D+I Plan and other plans</b>               |                             |                    |                   |                    |                                   |
| <b>1. Directorate-General of Scientific and Technological Research</b> |                             |                    |                   |                    |                                   |
| Research projects  | 172                         | 22.438.000         |                   |                    |                                   |
| Other instruments  |                             |                    |                   |                    |                                   |
| <b>2. Directorate-General of Innovation and Competitiveness</b>        |                             |                    |                   |                    |                                   |
| Technological Development Projects-RETOS-COLL                          | 48                          | 10.440.805         | 0,506             | 16.360.146         |                                   |
| Other instruments: FORMACIÓN-EMPLEA                                    | 42                          |                    | 0,54              | 3.804.786          |                                   |
| Other instruments: equipment-EQUIPA                                    | 10                          |                    | 0,501             | 1.752.803          | 471.508                           |
| Other instruments: CENER Subsidy                                       | 1                           | 909.563            |                   |                    |                                   |
| <b>3. CDTI (Industrial Technological Development Centre)</b>           |                             |                    |                   |                    |                                   |
| R+D+I Projects   | 270**                       | 33.531.213         | Euribor + 0,1%    | 108.042.715        | 58.741.797                        |
| Other instruments  | 2                           | 16.519             | Euribor + 0,1%    | 313.856            | 110.125                           |
| <b>4. Other institutions: (INIA, MAGRAMA, etc.)</b>                    |                             |                    |                   |                    |                                   |
| Research Projects (INIA)   | 154                         | 16.738.923         |                   |                    |                                   |
| Other instruments (MAGRAMA)  | 24                          | 2.884.474          |                   |                    | 2.884.474                         |
| <b>Derived from the Seventh Framework Programme</b>                    |                             |                    |                   |                    |                                   |
| <b>1. Research (Collaborative Projects)</b>                            |                             |                    |                   |                    |                                   |
| Research Projects (Collaborative Projects)                             | 49                          | 36.028.991         | -                 | -                  | 5.595.179                         |
| <b>2. Coordination and Backup Actions</b>                              |                             |                    |                   |                    |                                   |
| Coordination and Backup Actions  | 6                           |                    | -                 | -                  | 15.996                            |
| <b>TOTALS</b>  | <b>778</b>                  | <b>123.883.085</b> |                   | <b>130.274.307</b> | <b>67.819.079</b>                 |

(\*) Investment collected by participating companies that receive no public or financial or non-refundable support

(\*\*) 402 business participations, thanks to consortium projects

Directorate-General of Innovation and Competitiveness data refer to 2014 calls.

In coming years, these figures **will be increased** with contributions from **ERDF funds** designed to promote innovation, or from **rural development funds**. This fact, linked to the capacity of bioeconomy activities to produce more food, to mitigate and to adapt our society to climate change, seeking to improve efficiency and sustainability in the use of our natural resources, and the creation of new jobs, justifies the drawing up of a specific strategy, promoted by the General State Administration, with the participation of the private business sector and in coordination with all the Public Administrations, while involving all the interested social organisations.

## 2.8. Society's participation in the bioeconomy

Society as a whole must be familiar with the objectives and principles of the economy based on the use of resources of biological origin, combining consolidated technologies with others, recently developed. It must be aware of its favourable impacts on our surroundings, reducing dependence on fossil resources once the technologies have been adequately evaluated, and also of the new product ranges which will gradually appear on our markets and become available to consumers. Development of a **communication strategy** with all our **social and economic players** is an essential element to attaining technological advance and its application to the productive reality.

Society must identify and understand the added value the development of this strategy generates for our economy and our surroundings, with clear commitment to employing our useful agricultural area to provide food for human and animal consumption, complemented with the development of other chains of value based on the use of technologies for transforming organic matter into bioproducts and bioenergy, to ensure that all the biomass generated is comprehensively exploited.

## 2.9. The situation around us

The European Union published its Bioeconomy Strategy in 2012 and it has subsequently been implemented in other Member States such as Germany, the Netherlands, Ireland and some Scandinavian or Eastern European countries. The United States or Russia have also created their own. Spain cannot be left out of the development of this strategic sector.



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The panel of international experts who in 2014 evaluated the Spanish Science and Technology system on the basis of experience in their own countries, recommended that **strategic areas for innovation** be identified and promoted in which to encourage public-private collaboration at the national level, targeting innovation and bringing together public and private sector resources while also involving sector players, along with the Government, participating actively in both the financing and regulatory fields. Here two major aspects can be mentioned: **collaboration and cooperation between Autonomous Communities**, and the **inclusion** of a greater number of entrepreneurial agents in the system, **particularly small and medium-sized enterprises (PYMES) in the innovation process.**





# 3

## The Process of Design of the Strategy





### 3

## The Process of Design of the Strategy

The first step was a political understanding offering cover and a horizon to this initiative, which was very readily formulated and approved between the Ministry of the Economy and Competitiveness and the Ministry of Agriculture, Food and the Environment and, to start to draft the Spanish Bioeconomy Strategy, a working group was initiated, chaired by the Secretary of State for Research, Development and Innovation (SEIDI), to implement the design of this strategy. The Director of the National Agricultural and Food Research and Technology Institute acted as General Coordinator of the initiative.

The group assigned to coordinate the work was made up of experts from the public and private fields, to draft a working document as starting point.

The different phases making up the process as a whole, based on input from collaborators found by survey at an initial stage, along with the subsequent process of public consultation on this Strategy, and its result, are described in detail on the Strategy website (**[www.bioeconomia.agripa.org](http://www.bioeconomia.agripa.org)**)

A summary description follows of each of the landmarks in its preparation:

- ▶ One: the design of the bases for drafting the strategy, taking account of the opinions of experts from the public realm (research and innovation, agriculture and the environment, industry) and from the private field (a representative of the food industry and the business sector, technological platforms and associations).
- ▶ Two: drafting of a preliminary strategy document with the information secured in a survey of 240 selected persons from various institutions in the General State Administration; from all the Autonomous Communities and from the universities; from companies and organisations representing the farming, forestry, fisheries, food, chemical and energy sectors, consumer organisations, trade unions and environmental NGOs.
- ▶ Three: drawing up of the final document following collection of all the proposals received as part of public consultation from 1-25 September 2015, announced in emails and on the social networks.



## Definition and Scope of the Bioeconomy in the Framework of this Strategy





## 4

# Definition and Scope of the Bioeconomy in the Framework of this Strategy

The bioeconomy is, in the framework of this strategy, the **set of economic activities** that obtain products and services, generating economic value, making efficient and sustainable use of **resources of biological origin** as **fundamental elements**. Its objective is to **produce and market food**, along with **forestry products, bioproducts and bioenergy** obtained by physical, chemical, biochemical or biological processing of organic matter not destined for human or animal consumption and involving processes which are respectful of the environment, along with the **development of rural areas**.

The strategy brings together, as essential elements, the **public sector** as the strategy's prime mover, catalyst and coordinator, current and future **productive and technological sectors**, as the main players and stimulators of economic activity, and the whole of the **science and technology system**, at both the Spanish and international levels, as generator of know-how and the driving force for technological development.

The strategy's **target sectors** incorporate **food and agriculture**, comprising *agriculture, livestock farming, fishing, aquaculture and food production and marketing*, the **forestry sector** and the *timber by-product sector*, **industrial bioproducts** obtained with or without the chemical biochemical or biological processing of the organic matter generated by our society and not used for human and animal consumption, and the **bioenergy** obtained from biomass or the services linked to the rural world. All this is done as part of an activity conditioned by growing limitations on the availability of water and the need for sustainable management based on science and technology, and so includes productive sectors that are already consolidated, along with others still emerging and developing, with the resulting creation of the associated jobs, so new professional skills must be fostered.

The strategy considers operation with a **renewable resource**, destined fundamentally to **meet the requirements** of a growing population in the global context, to be an **essential element**, obtained in special circumstances of **climate change**, and where improved **efficiency and sustainability** in production and use, linked to growth in the future demand for bioproducts and bioenergy, are a guarantee of its **environmental sustainability**.

The strategy is **based** on the **science – economy – society triangle**: the knowledge generated in the scientific field must be used to develop a productive activity which will allow us

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to continue to grow in those areas our society accepts and shares, so requiring the direct and indirect involvement of all the players making up that triangle:

- ▶ Society, through consumers, the organisations representing different social, economic and environmental groups, together with the media and of course all the interested administrations, which are assigned a significant role as the Strategy's promoters, facilitators and catalysts.
- ▶ Science, through the scientists and researchers making up the Spanish science and innovation system, and who are working in the Universities, Public Research Bodies, technological centres and companies, and their institutions and associations, and organisational structures at different levels (Campuses of Excellence, etc.).
- ▶ The Economy, through the companies in the productive sectors forming part of the area of activity, whether individually or organised around their associations and representative organisations, including employee representatives, paying particular attention to technological platforms which aim precisely to promote innovation by interaction between the private and public sectors.

The Bioeconomy is able to contribute to **economic development** in many areas of activity, exploiting public-private collaboration to transform knowledge into innovation.

The following is a description of the various fields of interest, by areas and productive chains:

In **food and agriculture**, the advances will be provided by improving the efficiency of the productive, organisational and logistic processes thanks to technologies and innovations in different spheres, necessary to maintain our presence on the markets where demand is greatest.

- ▶ Primary production must remain economically, socially and environmentally sustainable. Thus the rapid development of new varieties, nowadays normal in horticulture, fruit production or in extensive crops under irrigation, will extend to the remaining Mediterranean crops. Various technologies and tools, including ohmic types, will make it possible to adapt to the new agro-ecological conditions, to resist biotic and abiotic stress or incorporate new functionalities. This will, together with efficient use of fertiliser, water and integrated pest- disease- and weed-control systems, as well as precision agriculture, be indispensable. In livestock farming, including aquaculture, integrated production management, dealing jointly with reproductive and feeding efficiency, along with the management and reduction of losses associated with pathogenic organisms, will need these same technologies, where genetics and epigenetics will prove essential. Use of autochthonous varieties and breeds may play an important role in this new context.



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- ▶ The transformation of this primary production will develop increasingly, with the incorporation of new processing, wrapping, packing, conservation and cold chain technologies which preserve longer all the organoleptic and nutritional qualities of our traditional as well as new products, amalgamating convenience and functionality, promoting consumer health and guaranteeing food security at all times. Integral collaboration throughout the supply chain will be intensified, to adapt to the various market niches using specific technologies in addition to those related to information.
- ▶ The system as a whole will improve its efficiency in the use of all types of resources (soil, water, emissions, etc.), improving and adapting cropping systems to limit negative external factors (accelerated erosion, diffuse contamination, reduced biodiversity, etc.). And it will do so without distinction, whatever the means – ecological, agroecological or conventional – used to embark upon sustainable intensification. Advances will continue to be made as part of this process in the indicators for environmental sustainability (resource use, biodiversity, etc.) as well as those for social sustainability (acceptance of systems and technologies, etc.). Undoubtedly, cutting residues and the recovery of all waste and by-products as raw material for other productive processes will improve efficiency. Similarly, technologies facilitating recycling and recuperation of raw materials will receive preferential treatment as well.

There will also be advances in **forestry**, with the inclusion of sustainability in resource management systems, based on the development of models that combine their carbon capture capacity with current use and that of future generations, with an integrating focus to preserve biodiversity and help maintain its inherent balance. At the same time as moving forward in productivity or using plant material as biofactories, with genetics and genomics as technology, there will be an improvement in the duration of wood products in their traditional uses (construction, packaging, furniture, etc.) and combining wood with other types of compounds. As in the previous cases, this sector's contribution to the production of biomass as raw material for the biochemical industry and bioenergy will prove indispensable.

In **fishing, aquaculture and exploitation of marine resources**, fisheries activity will also be conditioned by a better understanding of biology and of marine ecosystems, with the creation of sustainable management strategies adapted to trends in scientific know-how and the integrated use of marine resources to obtain bioproducts and algae, in line with the blue growth proposed by the European Commission.

The **chemical industry** will see an increase in the use of renewable resources not competing with human nutrition, also factoring in waste or by-products or algal biomass as raw material for this activity; the German group of bioeconomy experts attributes to them as much as one third of total industrial production in 2030. Fermentation of the organic matter, from which certain short-chain volatile fatty acids are derived, and processes based on the



use of biocatalysts, will make it possible to extract numerous bio-derivatives such as plastics, fibres, detergents, paint, cosmetics, oils, lubricants, construction materials and basic chemical products which may be ingredients or active compounds such as enzymes or microorganisms for the pharmaceutical or food industries or for animal feed.

An advance is also foreseeable in **bioenergy** in an understanding and the marketing of new ways of synthesising biofuel using thermochemical or biochemical technologies, and with waste, by-products or algal biomass as raw material. These technologies will, together with improvements to gasification or pyrolysis techniques, also make it possible to increase efficiency in the extraction of fuels for transport, electricity or heat.

Efficient and sustainable use of biomass from various sources, whether the food and agriculture and forestry sector or from the field of urban waste to extract a wide range of bioproducts, points in the direction of the **development of biorefineries**, plants which employ diverse and complementary technologies to appraise the different fractions of organic matter (cellulose, hemicellulose, lignin, proteins, etc.) to obtain one or more of the bioproducts listed in the previous paragraphs, in addition to biofuels or energy.

In the **field of water**, adequate water management and reuse is primordial. The efficient and sustainable use of this resource must be explored if the capacities and potentialities of productive systems in a new context of food production and demand are to be maintained. Such efficiency of use must be contextualised not just in food and agriculture sector primary production but also in other target sectors.

It is an essential feature of the activities described that they are pursued in the places where the organic matter is generated: agricultural, livestock and forestry operations, the food and agriculture companies, the coastal surroundings, and waste management centres. The bioeconomy will thus bring with it **new economic activities to drive development in the rural setting**, and an interaction between rural and urban areas. In parallel, companies will emerge to supply new services for these new activities, in both production and commercialisation and in guaranteeing sustainability.

# The Objectives of the Spanish Bioeconomy Strategy



## The Objectives of the Spanish Bioeconomy Strategy

The Strategy defines two types of targets – strategic and operational - described below:

### 5.1. Strategic

1. To enhance the **competitiveness and internationalisation of Spanish companies** operating in the realm of resources of biological origin, and to create **new economic activities** and new jobs **by generating knowledge** and **adapting** it to new **scientific and technological developments**, responding to the demands of the productive sectors and of consumers.
2. To maintain the **Spanish bioeconomy as an essential part of our economic activity**, and position it as **an area of knowledge-based strategic innovation** among the leaders in an international context.
3. To assist in attaining all the **bioeconomy's development potential** to a horizon of the coming 15 years in Spain, based on social and environmental sustainability and on technological, organisational and management innovation as a tool for resolving problems and to make the most of market openings.

### 5.2. Operational

1. To promote development of the bioeconomy in Spain with permanent **collaboration** between the **Spanish administrations** and the **productive sectors**, and with society's participation.
2. To foster **interaction between the public and private Spanish and international science and technology systems** and the productive sectors and their **companies**, stimulating the creation of **multidisciplinary teams** able to develop technologies that diversify and enhance the **efficiency** of the use of resources of biological origin, consolidating structures already in operation.
3. To facilitate and foment the **creation of scientific know-how** and its **application to the market and to innovation** by creating and consolidating technology-based companies, incorporating them into national and international knowledge networks.

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4. To favour transversal analysis of the problems of all sectors linked to the bioeconomy, to **identify limitations on its expansion**, proposing administrative, regulatory, legislative or other measures when deemed appropriate.
5. **To integrate all the backup tools** for generating knowledge, transforming it into technologies and innovations applicable to productive processes, concentrating them in a coordinated manner in the bioeconomy sector, enhancing the availability of financial resources.
6. **To facilitate the internationalisation** of companies in the sphere of the bioeconomy, not just for the development of technologies but also in market access.
7. To develop and generate **tools for employee education and training**, to move ahead in capacitating them in this sector in the new technologies, and to create new job opportunities while adjust existing professional profiles to the requirements of the companies in the sector.
8. To facilitate **knowledge, dialogue and social awareness of the bioeconomy**, taking in all the **scientific, social, economic and financial players, and society in general**. To show that this is an activity where science and technology complement each other, to produce food and other by-products of biological origin and attain a more environmentally sustainable society while creating economic activity.
9. To promote **rural economic development** and the **diversification of productive activities** via the use of the know-how available, and its application to enhancing the economic, social and environmental **sustainability of traditional activities** and the **generation of new activities** based on the transformation of biological resources generated in that context, and in processes which go some way to mitigating climate change.
10. **Creation of new markets** permitting a **reappraisal and effective use of resources of biological origin**, obtaining new products and services that meet people's needs, taking account of new sources, contributing to greater development of rural areas, and involving processes that are respectful of the environment.

This strategy will be implemented bringing all the related Public Administrations, all companies and economic sectors, the scientists and technologists associated with the bioeconomy and the bodies representing society on board for its development and application, constituting the tool for the integration of the entire system, and in permanent dialogue with the EU.





# 6

## Measures for the Development of the Bioeconomy



## Measures for the Development of the Bioeconomy

Action in **five specific areas** will be taken in pursuit of the operational objectives: in innovation by generating knowledge and its application in a business setting; in interaction between the different players involved in the bioeconomy; in developing the market for existing products or new products arising from the bioprocess context; in demand; and in expanding the bioeconomy via collaboration, cooperation and by publicising successes.

Each of these fields will constitute a strategic working line. The measures proposed from various areas of collaboration are organised according to the framework of those **five major strategic lines**:

- 1. To promote public and private research and company investment in innovation in the area of the bioeconomy.** As part of this strategic line, measures are incorporated directed at encouraging the generation of knowledge through research, and its application to the development of innovation, using all the instruments the public sector makes available to the science and innovation system, and making the private financial sector aware of the bioeconomy's potential. The following measures are included in this line:
  - a.** To put mechanisms in place for participation by researchers and companies, especially multidisciplinary alliances of researchers and companies, guaranteeing research that targets:
    - i.** H2020 Calls
    - ii.** Calls under the State Scientific and Technical Research and Innovation Plan:
      - Cutting-edge research
      - Research addressing the challenges included in the sphere of the bioeconomy and climate change, with multidisciplinary teams
      - Innovation dealing with challenges, with public-private participation
      - Private innovation and internationalisation
      - Internationalisation of research and innovation
    - iii.** Innovation programmes in the context of Rural Development Programmes (PDR)  
Mechanisms:
      - To create a coordinated programme of congresses, forums and meetings targeting researchers, companies, farmers, etc.



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- To set up a trainer training programme designed to foster the creation of support structures for managing research projects and aimed at the professionalisation of the management of research and innovation projects in the bioeconomy field.
  - To encourage participants in European programmes, taking advantage of the H2020 bonus.
  - To establish a network of parties and collaborators interested in the bioeconomy strategy throughout the country, to facilitate public-private collaboration, the relation between the scientific, technological and business fields, and to develop chains of value described in this Strategy.
  - To organise prioritisation mechanisms for access to funds and to propose specific calls in the plans and programmes that allow this.
- b.** To promote the participation of suitable players for the operational groups in the European Innovation Partnership (EIP) in rural development programmes (PDR).
  - c.** To encourage business investment in innovation in the framework of Regional Operating Programmes, where possible fostering the use of the mechanisms contained in point a).
  - d.** To develop models to facilitate the funding of pilot projects and demonstration plants, combining various public and private financial instruments.
  - e.** To analyse successful public-private collaboration models in generating business innovation based on public research (e.g. Bioaster, Novo Nordisk, Wageningen), to encourage their introduction as part of focal points for innovation in the field of the bioeconomy.
  - f.** To hold an annual Conference on the bioeconomy, reporting on the content, adjustment to state and European plans, and the monitoring.
  - g.** To promote knowledge of the bioeconomy among private financial institutions and risk- capital companies to facilitate the provision of specific financial products and their complementarity with public instruments already in place or which may be created.
  - h.** To develop a repository of raw data on Spanish public research projects in the sphere of the bioeconomy that belong to those generating the results but with associated metadata making it possible to learn about the information they incorporate and the conditions in which it was obtained.
  - i.** To strengthen and enhance interaction between the structures and existing operating networks which act as an interface between the area of the research and the markets, paying particular attention to technological platforms or the so-called campuses of excellence. This measure would be linked to the activities considered in the following strategic line.
  - j.** To promote technological disclosure at congresses, forums and meetings.
  - k.** To monitor these activities permanently.

- 2. To reinforce the social, political and administrative context of the bioeconomy.** It is wished as part of this strategic line to organise the structure for the support, promotion and cooperation necessary to develop the Spanish Bioeconomy Strategy both in the realm of the central and regional administrations and its relation to the different players in science, the economy and in society as a whole. The following measures are set out there:
- a.** To create a **Spanish bioeconomy observatory** with two components:
    - i.** A monitoring group for the Spanish Bioeconomy Strategy, created on the initiative of the Interministerial Council for Scientific, Technological and Innovation Policy, with representatives of the Ministries and Autonomous Communities participating in it. Its mission will be to track the strategy, coordinating the introduction of new measures in the field and promoting cooperation between the different administrations.
    - ii.** A Spanish Bioeconomy Strategy Management Committee, whose objective will be to foster implementation of the measures established as part of this strategy and the annual action plans, and which will be made up of representatives of each of the following groups:
      - A Spanish Bioeconomy Strategy monitoring group assigned to promote the strategy from the sphere of the Public Administration.
      - A Spanish Bioeconomy Strategy technical scientific support group, with the participation of the scientific and business worlds, to take a multidisciplinary and international approach in analysing the fields where knowledge applied to innovation can be generated.
      - A technological networks group involving technological platforms and focal points, to engage in on-going analysis of markets and of the potentialities for the bioeconomy and for public-private collaboration in innovation.
      - Organisations representing civil society and workers with an interest in the development of this strategy.
  - b.** Design of a **programme for social divulgation and dialogue on the bioeconomy**, fostered by the management council in the previous point, with three fundamental elements:
    - i.** Exchange of opinions with representatives of the productive sectors, consumers, opinion-makers, trade unions, NGOs, etc. associated with the bioeconomy's objectives, opportunities and challenges.
    - ii.** For observatory members to spread the knowledge by participating in meetings, presentations, etc.
    - iii.** To design a communication strategy targeting the whole of society, using social networks to make known successful cases and the opportunities the bioeconomy offers, with the active participation of organisations with the capacity, for example:

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- The Spanish Science and Technology Foundation (FECYT), to ascertain society's current perception of the bioeconomy, as the basis for identifying exactly the fundamental elements which the Communication Plans must include.
  - The National Rural Network, incorporating the bioeconomy into its seminars.
  - iv. To share the communication strategy with that implemented in the European Commission context and with those responsible for implementing bioeconomy strategy in other European countries and those in policy development groups (the Informal Bioeconomy Policy Group), making the Spanish Bioeconomy Strategy strategy known throughout Europe.
  - c. To generate a broad **group of parties interested in bioeconomy matters** in Spain, with as many subgroups as considered necessary and with the participation of scientists, companies, technological platforms, innovation agents, and various organisations and associations. Their working tool must be based on using existing on-line platforms, with the aim of promoting the following:
    - i. Exchange of information: identification of individuals and legal entities, research groups, research projects and participating companies, from a variety of levels.
    - ii. The creation of clusters and interest groups between companies, cooperatives, communities and research groups, by specific areas.
    - iii. Multidisciplinary collaboration in the search for innovative solutions.
    - iv. Contribution and gathering of suggestions from any citizens, to be evaluated and, if appropriate, incorporated into the system.The technological platforms (e.g. Vet+i) and those promoted by institutions (IDI+A, Agripa) are cited as examples.
  - d. **International cooperation and exchange** by the monitoring group, the management committee or their members, paying particular attention to EU Member States and Latin American countries.
  - e. To promote **training in the bioeconomy field** at universities, inside and outside the formal education system, adjusted to market needs, preparing material which is available to users.
    - i. To define those who are our ultimate targets: trainers (at university, in Professional Training, in secondary and primary school).
    - ii. To develop tools and materials for self-training and professional recycling through "on line" platforms allowing access to study in the various fields of the bioeconomy.
3. **To promote the competitiveness and development of the market associated with the bioeconomy.** This strategic line will focus on defining the



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context in which the market must be developed for bioeconomy products, taking account of all those elements that both supply and demand will have to specify, along with the regulatory demands linked to this new market, taking into consideration the following measures in this sphere:

- a.** To develop the concept of social and environmental sustainability, based on the application of any European or national legislation, or on developing indicators agreed on at the European or national levels, so that sustainability can be included in the productivity and efficiency processes which technological development is leading us toward. It will be necessary to move forward in the following:
  - i.** Calculating the different environmental footprints (carbon footprint, water footprint, life cycle) of farming, livestock, forestry, aquaculture and food products, along with bioindustry by-products, to learn about how impacts evolve as new technologies are incorporated.
  - ii.** Development of new procedures to evaluate the sustainability of production models using objective, comparable indicators which might provide the basis for the establishment of management plans.
- b.** To establish a procedure to identify legal, administrative or other limitations preventing new products from being placed on the market, and develop a specific working plan to help overcome them.
- c.** To promote exports and internationalisation in the field of new bioproducts, particularly where there is no current strategy, making use of the policies and measures of Ministries, ICEX (Export and Investment Spain) and the CDTI (Industrial Technological Development Centre).
- d.** In those areas of the bioeconomy where there is no economic activity, measures must be put in place to promote the development of chains of value intended to reappraise resources for which the current market is reduced or non-existent, using actions such as:
  - i.** Drafting or updating waste and biomass maps, dynamic in time, using all available resources from research projects, etc.
  - ii.** To draw up maps of transformation and reappraisal facilities, and to keep them updated.
  - iii.** To design maps of companies interested in participating in public-private collaboration in the bioeconomy field.
  - iv.** Organising inter-sectorial meetings, by geographical area, to bring supply and demand together, once maps of resources and market needs are in place.
  - v.** To promote sustainable use of biomass resources produced in traditional industrial sectors (agroindustry, food) leading to the creation of new business areas in the rural sector.
- e.** To analyse the standardisation and certification processes where applicable for products from biological sources which are being perfected around us, to facilitate

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commercialisation which is differentiated according to origin, the production process and the above indicators.

- f. To seek alternatives to current productive and organisational models, to facilitate the development of new productive systems making it possible to generate products and services linked to certain market niches, with actions to move forward in:
  - i. Integrated economic development Models – protection of the environment – food production – consumer diet and health.
  - ii. Strategies designed to develop the circular economy in some chains of value.
  - iii. Exploring the possibilities for new crops and new ways of organising productive processes.

**4. To develop demand for new products.** The bioeconomy will bring with it the appearance of new processes or products. Their entry into the market is often conditional upon consumers being aware of them and evaluating them from an economic and environmental point of view. On occasions too, such products will not target the end consumer but will rather act as intermediaries for other productive activities. With no defined market, it will be hard for private investment to commit to innovation in some areas, unless the creation of demand is facilitated with measures considered as part of this strategic line, such as:

- a. The identification of products obtainable through the bioeconomy, and the limitations on technology, on finance or in demand which prevent private initiative from marketing them.
- b. Innovative public procurement as a tool to generate innovation applied to the chains of value which require a strategic focus.
- c. Development of a labelling system for bioproducts as part of EU policy, to facilitate their identification and provide consumers with guarantees as to the source and the processes used to obtain them.

**5. Plan to expand and promote the bioeconomy.** There is always a degree of uncertainty in embarking on pioneering economic activities. If emerging technologies are also in play, the difficulties in making a decision to move forward and secure financial resources to implement investment projects are increased. In many cases, unfamiliarity with the application of the technologies in different fields is sufficient to block a project startup. Thus it is felt to be of enormous interest to learn of experiences in different places. The measures considered as part of this strategic line address that objective:

- a. To compile and explain successes demonstrates the bioeconomy's possibilities. Permanently updating them can provide an incentive for innovators and entrepreneurs. This must of course not involve disclosure of the technology, which is protected by

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various elements of intellectual property. The idea is to show the effect of the technology in reducing impact and improving productivity and job-creation. The first successes are detailed on the strategy website ([www.bioeconomy.agripa.org](http://www.bioeconomy.agripa.org)), to illustrate how these experiences could be described.

- b.** To promote potential R+D+i programmes related to the bioeconomy, at the national, regional and international levels, with particular interest in developing specific strategies in the Autonomous Communities and locally, based on inter-Community cooperation and coordination, so that integrated criteria are applied.
- c.** Linking Spanish successes to similar measures articulated in other European bioeconomy strategies or those in another international sphere.



7

# The Technical, Economic and Organisational Resources for the Strategy's Startup



## 7

## The Technical, Economic and Organisational Resources for the Strategy's Startup

The Spanish Bioeconomy Strategy comes into being as a working programme agreed on among administrations and economic sectors, aimed at promoting innovation in the area where it operates. The institutions that have promoted it are committed to continuing to back it with their organisational structures and budgets.

To promote the generation of know-how applied and which is able to be converted into innovation through research and innovation projects, the entire Spanish science and technology system will be made available, including companies.

We will also have the technological platforms, which have taken on an active role in the design of this strategy and which have, as an initial collaboration, provided the strategy with information on research centres, research groups and the sphere of activity of the groups, with each of which it collaborates permanently. The information furnished has been incorporated into the website destined for the Spanish Bioeconomy Strategy ([www.bioeconomy.agri-pa.org](http://www.bioeconomy.agri-pa.org)).

On the other hand, **Table 2** contains a summary, by way of description, of the possibilities for the financing of research and innovation projects in this area in the coming years.



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**Table 2. Estimate of the possibilities for the financing of the bioeconomy in the period 2016-2020 (000s €)**

H2020 funds have been agreed until 2018, the rest are the same figures, maintained until the end of the period. It is estimated that 10% might be taken by Spanish proposals, except for JTI BBIs, estimated at 6%. Spanish aid funds are estimated based on real 2013 data, with a 3% annual increase estimated from 2016. Those for the Industrial Technological Development Centre (CDTI) are expected to remain stable from 2017. ERDF funds are calculated on the basis of a linear annual distribution, 10% being for bioeconomy companies).

|   | 2016           |         | 2017           |         | 2018           |         | 2019           |         | 2020           |         | TOTAL            |                |
|---|----------------|---------|----------------|---------|----------------|---------|----------------|---------|----------------|---------|------------------|----------------|
|   | Sub.           | Credit  | Sub.           | Credit  | Sub.           | Credit  | Sub.           | Credit  | Sub.           | Credit  | Sub.             | Credit         |
| <b>H2020 (10% total)</b>  |                |         |                |         |                |         |                |         |                |         |                  |                |
| Challenge 2   | 18,900         |         | 37,900         |         | 32,900         |         | 32,900         |         | 32,900         |         | 155,500          |                |
| Biobased industries   | 12,000         |         | 9,600          |         | 9,600          |         | 9,600          |         | 9,600          |         | 50,400           |                |
| <b>State R+D+i Plan</b>   |                |         |                |         |                |         |                |         |                |         |                  |                |
| MINECO DGIT (Directorate General of Research and Technology)        | 23,000         |         | 23,690         |         | 24,401         |         | 25,133         |         | 25,887         |         | 122,111          |                |
| MINECO INIA   | 18,000         |         | 18,540         |         | 19,096         |         | 19,669         |         | 20,259         |         | 95,564           |                |
| MINECO DGIC (Directorate General of Innovation and Competitiveness) | 11,500         | 21,000  | 11,845         | 21,630  | 12,200         | 22,279  | 12,566         | 22,497  | 12,943         | 23,636  | 61,054           | 111,492        |
| MINECO CDTI (Industrial Technological Development Centre)           | 33,500         | 110,000 | 33,500         | 110,000 | 34,505         | 113,300 | 34,505         | 113,300 | 34,505         | 113,000 | 170,515          | 559,600        |
| <b>PDR and OTHERS</b>   |                |         |                |         |                |         |                |         |                |         |                  |                |
| MAGRAMA PNDR (National Rural Development Programme) EIP             | 4,000          |         | 10,000         |         | 7,500          |         | 7,500          |         | 7,500          |         | 36,500           |                |
| MAGRAMA   | 2,850          |         | 600            |         | 600            |         |                |         |                |         | 4,050            |                |
| <b>RIS 3 and CCAA</b>   |                |         |                |         |                |         |                |         |                |         |                  |                |
| Estimación ERDF Estimate (10%PO)                                    | 83,000         |         | 83,000         |         | 83,000         |         | 83,000         |         | 83,000         |         | 415,000          |                |
| <b>TOTAL</b>  | <b>206,750</b> |         | <b>228,675</b> |         | <b>223,802</b> |         | <b>224,873</b> |         | <b>226,594</b> |         | <b>1,110,694</b> | <b>671,092</b> |



# Implementation of the Spanish Bioeconomy Strategy



## Implementation of the Spanish Bioeconomy Strategy

The Spanish Bioeconomy Strategy will be developed in **Annual Action Plans**.

These Plans are to be promoted by the Spanish Bioeconomy Observatory following analysis of the general framework and the possibilities for financing and implementing each measure, for each of which the specific activities to be carried out in the year immediately following will be programmed. This programming will include the institution, body or group responsible for putting it into practice, the forecast schedule, and the funding.

Each Annual Spanish Bioeconomy Strategy Plan will be made public, at the latest in January each financial year, and will detail the activities to be pursued during that year.

The Spanish Bioeconomy Strategy may undergo periodic review when deemed convenient, recommended for four years following its adoption and implementation.



An Evaluation of the Impact



The Spanish Bioeconomy Strategy will be assessed and monitored by the Spanish Bioeconomy Observatory, with the participation of the organisations making it up. New indicators, both statistical and on sustainability, may be incorporated.

Two types of evaluation index will be kept in mind:

- ▶ Commitment and activity, measuring the related public and private investment and the number of activities, and which will be associated with the activities.
- ▶ Results: this will arise from an evaluation of the economic importance of the sectors linked to biomass-use, and improvements to the effectiveness of biological resource-use:

|  | Final Production | Added Value | Employee numbers | Exports |
|--|------------------|-------------|------------------|---------|
| Agriculture                                |                  |             |                  |         |
| Food Industry                              |                  |             |                  |         |
| Forestry Products                          |                  |             |                  |         |
| Industrial Chemicals                       |                  |             |                  |         |
| Pharmaceutical and nutritional by-products |                  |             |                  |         |
| Biofuels                                   |                  |             |                  |         |
| Renewable energy of biological origin      |                  |             |                  |         |
| Other rural area services                  |                  |             |                  |         |
| Metric tons of processed waste %           |                  |             |                  |         |
| Sustainability indicators                  |                  |             |                  |         |

