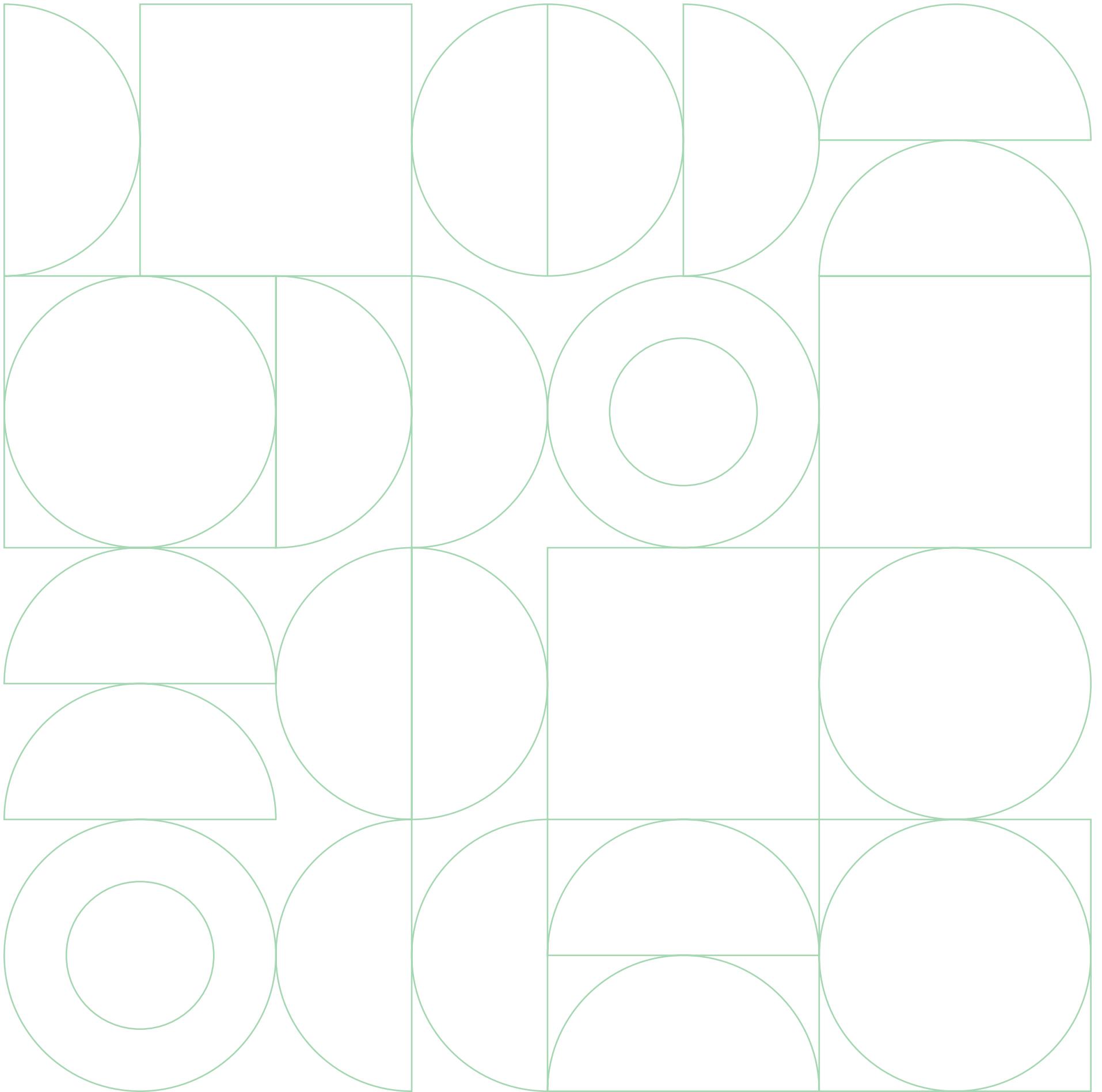




# **Bio-based Industries Joint Undertaking**

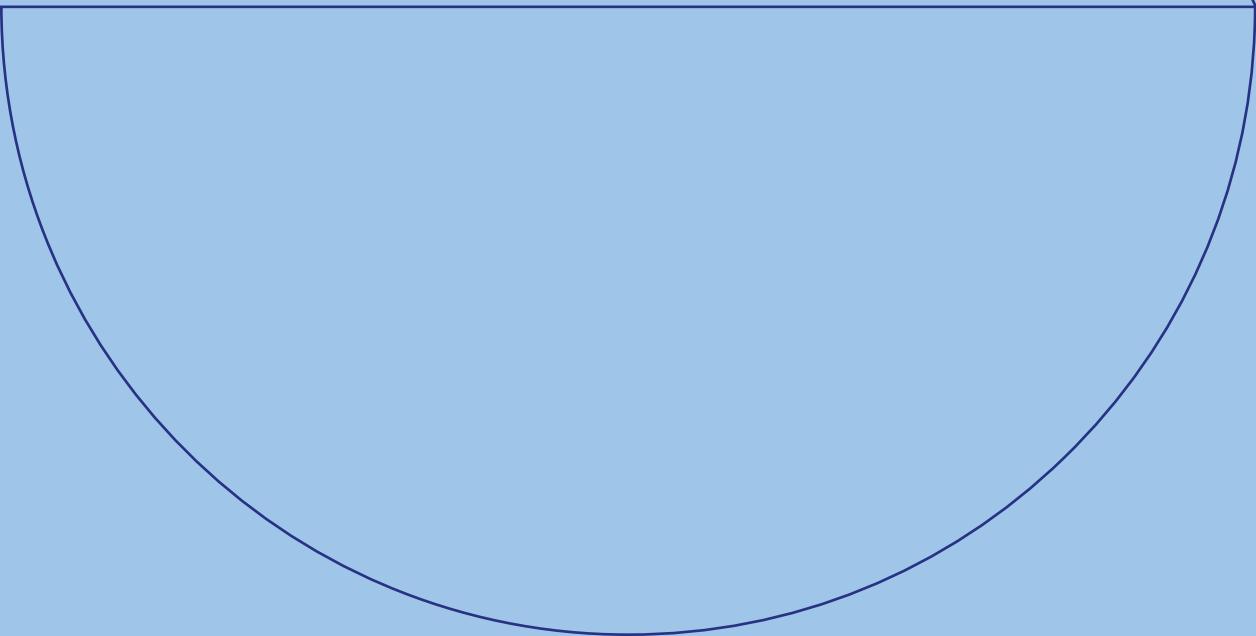
Driving Europe's green transition



# **Bio-based Industries Joint Undertaking**

Driving Europe's green transition

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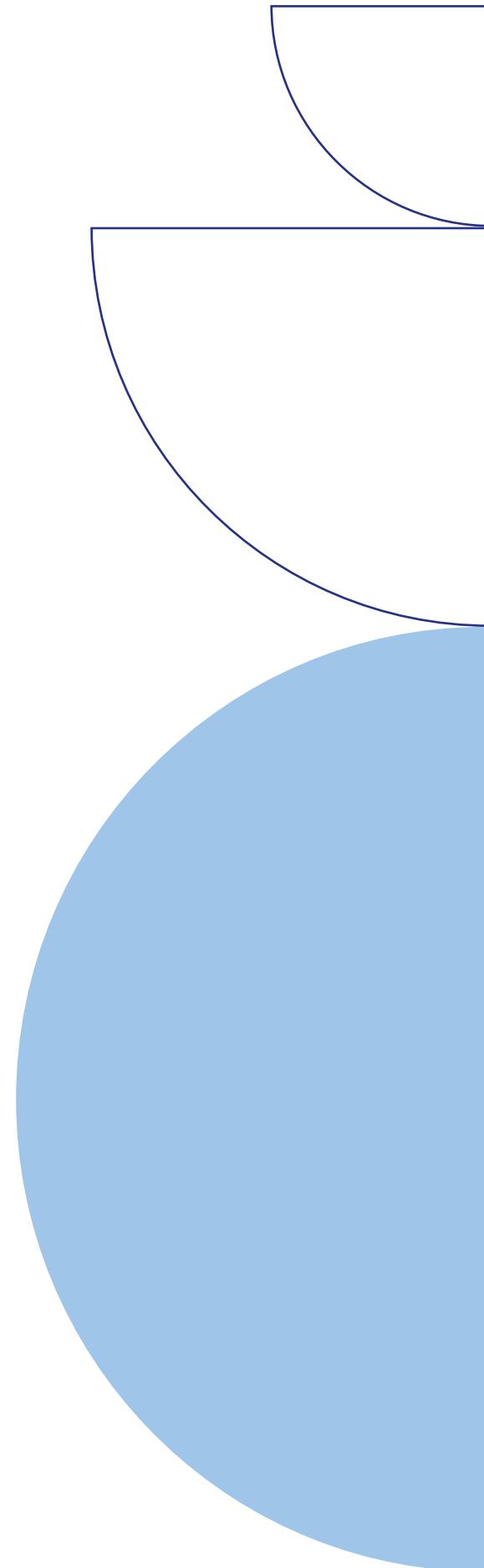
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**First and foremost**



## Foreword: John Bell

*I am glad to be able to contribute to this book, both as Director of the European Commission's DG Research and Innovation Directorate 'Healthy Planet', and as co-chair of the BBI JU Governing Board. It is timely to take stock of the seven years of BBI JU, which was one of the key actions of the 2012 EU Bioeconomy Strategy, and one of the institutional EU private-public partnerships of the European Innovation Package. As we can see in the present publication, the initiative had very ambitious objectives, and actually preceded the EU Green Deal.*

*Now, we can safely call the BBI JU one of the key contributors to the green transition in Europe. We can also be satisfied that it has successfully mobilised key actors in the bio-based sector, building bio-based value chains, contributing to the green recovery, and de-risking investment making Europe an attractive region*

*for investments. As we look back on the JU's achievements, we also need to draw conclusions from the lessons learned and look to the future, particularly now that the bio-based sectors and sustainable bio-based industries are no longer viewed as niche, but as the norm.*

*Here, we should highlight the revised EU Bioeconomy Strategy, updated in 2018. We also welcome the new EU Partnership, following in the footsteps of the BBI JU: the Circular Bio-based Europe (CBE JU), which recently began under the Horizon Europe Programme. In addition, the green transition of Europe's economy will be supported by the EU Missions, a new initiative of the Horizon Europe research and innovation programme for 2021-2027. The EU Missions are a coordinated effort by the Commission to pool all necessary resources in terms of funding programmes, policies and*

*regulations, as well as other activities.*

*The Missions support the Commission's key priorities such as the European Green Deal, Europe fit for the Digital Age, Beating Cancer, and the New European Bauhaus. For example, the Mission Climate is already a concrete element of the new Climate Adaptation Strategy - relevant to the area covered by the BBI JU - while Mission Soil is a flagship initiative of the Long-term Vision for the EU's Rural Areas. Similarly, the Circular Cities and Regions Initiative - part of the new circular economy action plan - offers an ideal template of how to implement circular solutions at local and regional levels while helping deliver on the European Green Deal and the EU Bioeconomy Strategy. I take this opportunity to congratulate everyone who has contributed to the success of the BBI JU to date and encourage newcomers to join and contribute to future efforts.*



**John Bell** is the 'Healthy Planet' Director in DG Research and Innovation (R&I). He leads R&I transitions on climate change, bioeconomy, food systems, environment, biodiversity, oceans, Arctic, circular economy, water and bio-based innovations. This includes harnessing investments for Horizon Europe, the Circular Bioeconomy and the EU Bioeconomy Strategy.

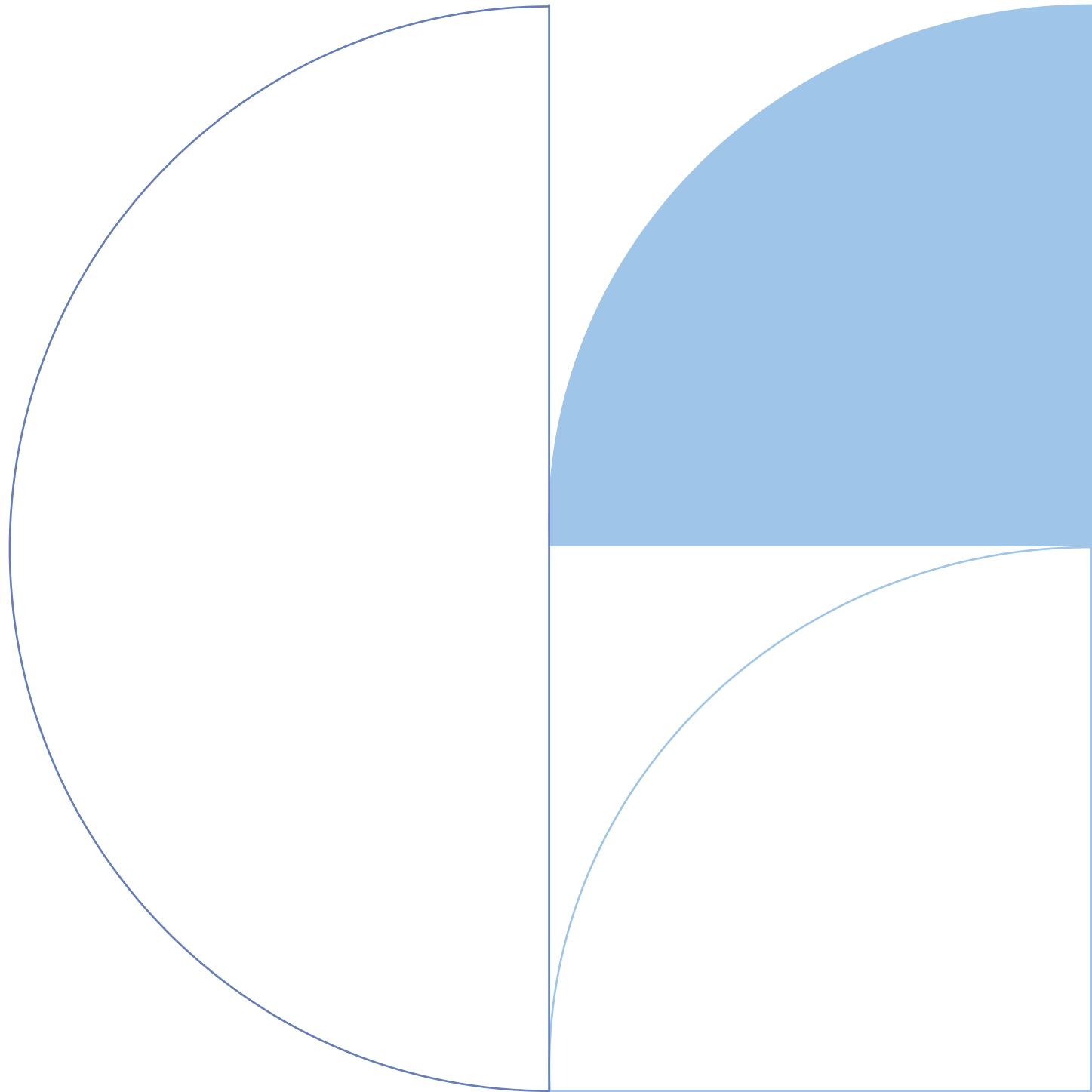
## Preface: Christian Patermann

*The conception of the BBI Joint Undertaking, now over seven years ago, was a challenging one, as those involved will recall. It was only through what I would call the 'obstinate' efforts of certain sectors – the Northern pulp and paper and forestry and wood industries, as well as a number of companies active in enzyme production – that this highly innovative JU was made feasible. Furthermore, it is thanks to the support of senior European Commission officials, including Maive Rute, John Bell, and Waldemar Kuett, that Europe's bio-based industry is in the position it is today.*

*What a difference those seven years have made, and what an impressive number of BBI JU and BIC success stories this excellent publication reveals. It illustrates the key role that the JU has played in building Europe's bio-based industrial landscape. While the pulp and paper, wood and forestry industries remain as important as ever, it is clear that this bold undertaking covers much more than just these areas, embracing every current European industrial sector. The BBI JU and BIC activities have become the industrial backbone of Europe's bioeconomy.*

*Without fully operational bio-based production lines such as biorefineries, biofactories, and in future perhaps even bio-foundries, the bioeconomy concept is always going to remain a 'nice-to-have' idea, limited to the esoteric discussions of politicians and academics. However, Europe – through the BBI JU – has made this a reality. This is why this unique initiative is envied by bioeconomy stakeholders outside Europe.*

*However, without the leadership of the BBI JU and BIC, headed up by Philippe Mengal and Dirk Carrez respectively, Europe's bioeconomy sector would not be what it is today. It is also clear that a viable bioeconomy is absolutely essential for Europe, particularly when given the ever-increasing bioeconomy-related activities in Latin America, parts of Africa, and Asia.*





**Dr. Christian Patermann** is a former European Commission director and advisor to the German government. He is widely accepted as the 'father' of Europe's bioeconomy.

*The CBE JU, successor to the BBI JU, will therefore have to cope with new content and funding challenges, while also considering the so-called 'soft skills', such as education, training, communication, and marketing, required to fully implement this economy. As well as the day-to-day technological and scientific issues, start-up and scale-up companies, new ways to attract*

*investors, as well as the use of social networks, will pose additional challenges – and perhaps also opportunities.*

*Our future – whether we like it or not – is likely to be heavily influenced by the impact left by the COVID-19 pandemic. This has sharpened our senses to issues we never previously considered,*

*such as the pivotal role of global value chains. So, while the next seven years are likely to be difficult, they will also be fascinating. And had we not initiated the BBI JU in 2014, all likelihood we would be doing so today.*

*Bonne continuation and thanks to everyone!*

## Introduction: Philippe Mengal

You will discover in the various chapters of this book why the BBI JU was part of the EU Bioeconomy Strategy adopted in 2012. The book briefly explains what the bioeconomy is about and how BBI JU has contributed to transforming this strategic sector. Based on very concrete figures and illustrations from funded projects, it showcases two major positive impacts on the sector: the first being the structuring effect in organising the value chains across sectors, while the second is that of the innovation-driven mobilising effect of key stakeholders. They are essential in maximising new investments and creating jobs which contribute to making Europe an attractive area to invest in the bioeconomy.

Putting public funding into an institutionalised public-private partnership is key to maximising its socio-economic impact on the sector, while also leveraging other sources of funding. Within BBI JU, 40% of the funding goes to small and medium-sized enterprises (SMEs) and 30% to universities and research organisations. Around 80% of projects report increased collaboration between universities and companies. The present book also brings to attention the crucial role of BBI JU in underdeveloped areas, namely, on full geographic coverage and valorisation of aquatic feedstock and municipal waste in flagship projects.

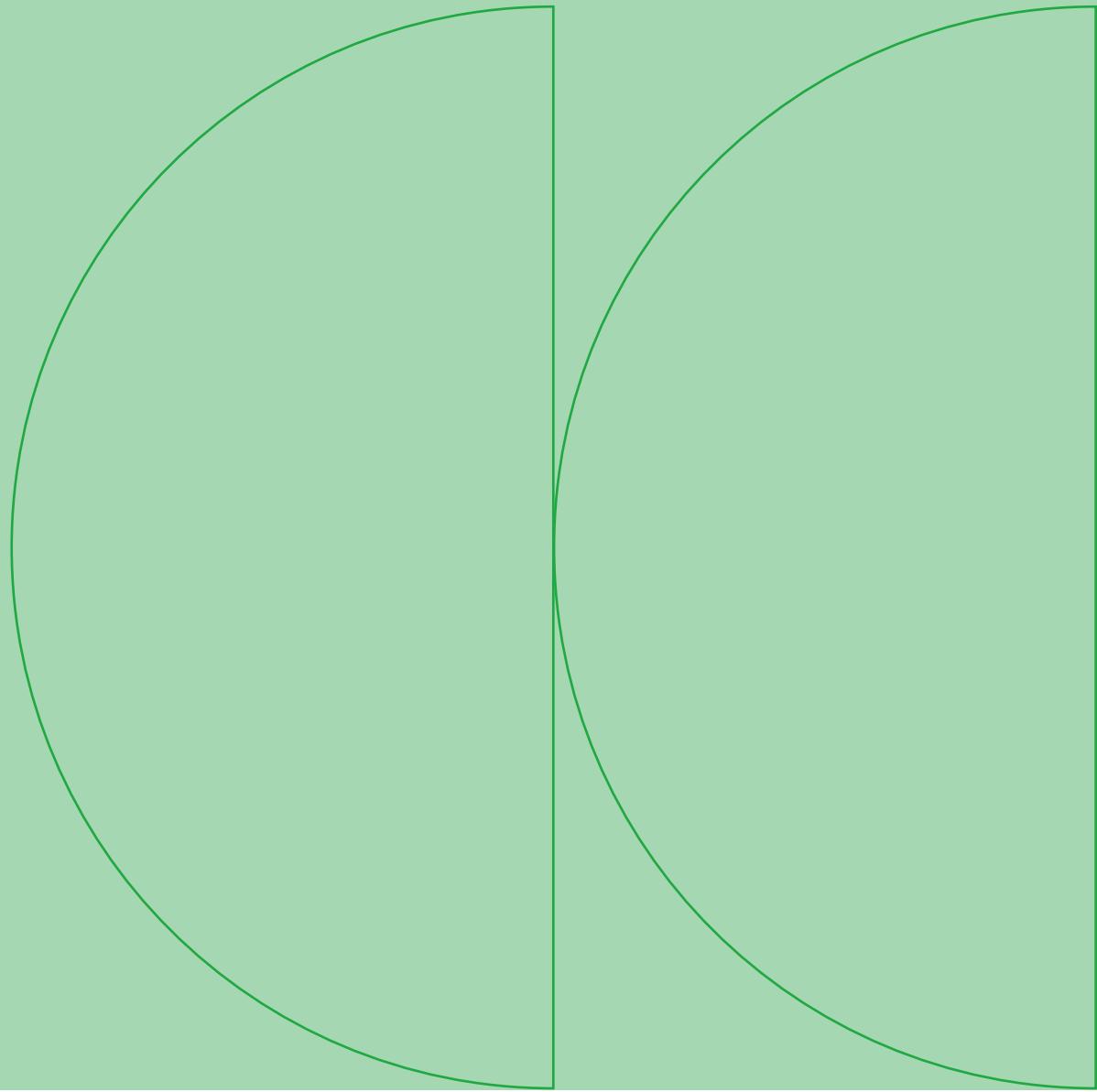
BBI JU projects strive to deliver bio-based products that will lower greenhouse gas emissions, while retaining industrial deployment within our continent, thus triggering sustainable investments. A variety of stakeholders, from the governance bodies to the project beneficiaries and the programme office were interviewed as part of this book, all of whom confirmed the high impact of the initiative that since its inception has been contributing to the objectives of the European Green Deal. The book concludes with a look at the successor of the BBI JU, the Circular Bio-based Europe Joint Undertaking (CBE JU), which will build on the success of the BBI JU while addressing remaining challenges.

None of these achievements would have been possible without the successful cooperation of the two founding partners of BBI and CBE JU, the European Commission, and the Bio-based Industries Consortium (BIC). While writing these lines, I am counting down my last weeks as Executive Director of CBE JU and I would like to thank my team and all our stakeholders for their advice, tireless work and open dialogue.

**Philippe Mengal** is BBI JU's and CBE JU's Executive Director.



# The sector: sustainability and the bioeconomy



## Supported by the BBI JU, Europe now leads the world in placing the bioeconomy front and centre of a sustainable future.

Sustainability is defined as 'meeting the needs of the present generation without compromising the ability of future generations to meet their needs'. **With growing demands on resources, ensuring a viable sustainability strategy is increasingly important;** the bioeconomy is a key component of this.

### What is the bioeconomy?

The **bioeconomy** is an emerging – and rapidly growing – sector that will play a key role in the sustainable production of renewable biological resources from both land and aquatic environments.

In the bioeconomy, renewable biological resources, along with the associated side streams and by-products, replace the existing, non-renewable sources of raw materials for fuel, energy, and manufacturing.

**This is an essential development in the global drive for sustainability and a key element in addressing the world's environmental challenges.**

### The circular lifecycle of materials



## A growing sector

Europe's bioeconomy sector is **experiencing considerable growth** and it is **expected to continue to grow even further**, as more sectors pursue circular strategies and as the technological advancements and innovations of the Bio-based Industries Joint Undertaking (BBI JU) – detailed throughout this book – deliver improved efficiency and productivity.

**The circular nature of the bioeconomy means it delivers a wider range of benefits to society:**

### Environmental

**Minimised waste and CO<sub>2</sub> production** → significant contribution to meeting the EU's economic and climate targets and policies, such as:

- the European Green Deal
- EU Bioeconomy strategy Zero Pollution Action Plan
- the Farm to Fork Strategy
- the New Soil Strategy
- the Circular Economy Action Plan and Common Agricultural Policy

### Social

**New jobs and opportunities** in remote rural and coastal areas that have suffered from urban migration.

### Economic

**Europe's bioeconomy sector's economic worth:**

€2.4  
trillion

↑ 25% in less than 10 years

### Turnover of Europe's bio-based industries

(e.g. bio-based chemicals and plastics, pharmaceuticals, paper and paper products, forest-based industries, textiles, biofuels and bioenergy):

€750  
million

↑ 23% in less than 10 years

### Bioeconomy's turnover



## The EU's bioeconomy strategy

In 2012, in order to stimulate Europe's bioeconomy, the European Commission launched its first **bioeconomy strategy and action plan** with the stated objective to **'pave the way to a more innovative, resource efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection'**. The strategy, adopted by the European Parliament, set out five overarching **goals** to help establish a viable bioeconomy in Europe:

- Ensuring food and nutrition security
- Managing natural resources sustainably
- Reducing dependence on non-renewable, unsustainable resources
- Limiting the impact of, and adapting to, climate change
- Strengthening European competitiveness and creating jobs

With the emergence of the European Green Deal and key EU policies such as the Circular Economy Action Plan, the Farm to Fork, and Biodiversity strategies, **these ambitions remain both economically and strategically relevant today.**



## Putting in practice the bioeconomy action plan

The **Bioeconomy Action Plan**, designed to deliver on the strategy, was based on **three main strands**:



1.

### **Strengthening and upscaling the bio-based sectors,**

to unlock investments and markets.

This will see stakeholders mobilised to develop and deploy sustainable solutions.

2.



### **Rapidly deploying local bioeconomies across Europe,**

through launching a Strategic Deployment Agenda for sustainable food and farming systems, forestry and bio-based products, as well as pilot projects for developing the bioeconomy in rural, coastal, and urban areas. It will also encourage Member States to develop their own national and regional bioeconomy strategies and promote the required skills and training.

3.



### **Understanding the ecological limits of the bioeconomy,**

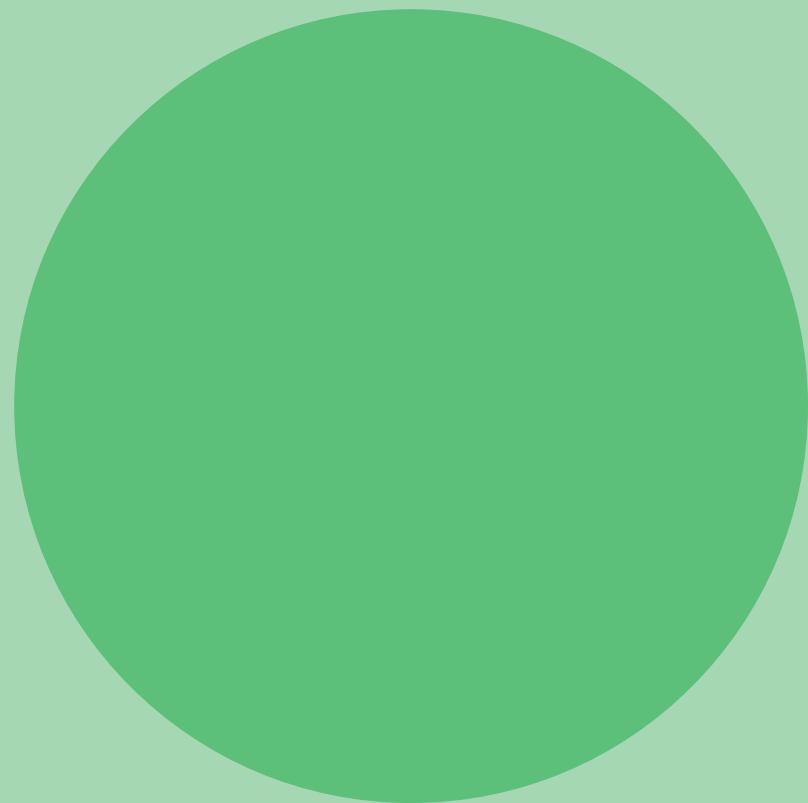
by improving insights into how biodiversity and ecosystems function and interact. This will be important in order to develop those best practices required to ensure that these are not overstressed by bioeconomic activities.

**The BBI JU was established to help implement the Bioeconomy Strategy and Action Plan.** Within this book, you will find examples of significant bio-based technological advancements and innovations that have been accomplished, in line with the key pillars of the Bioeconomy Strategy. This will help visualise how the success of this partnership represents a major step towards a greener future for everyone.

## Connecting national bioeconomy efforts

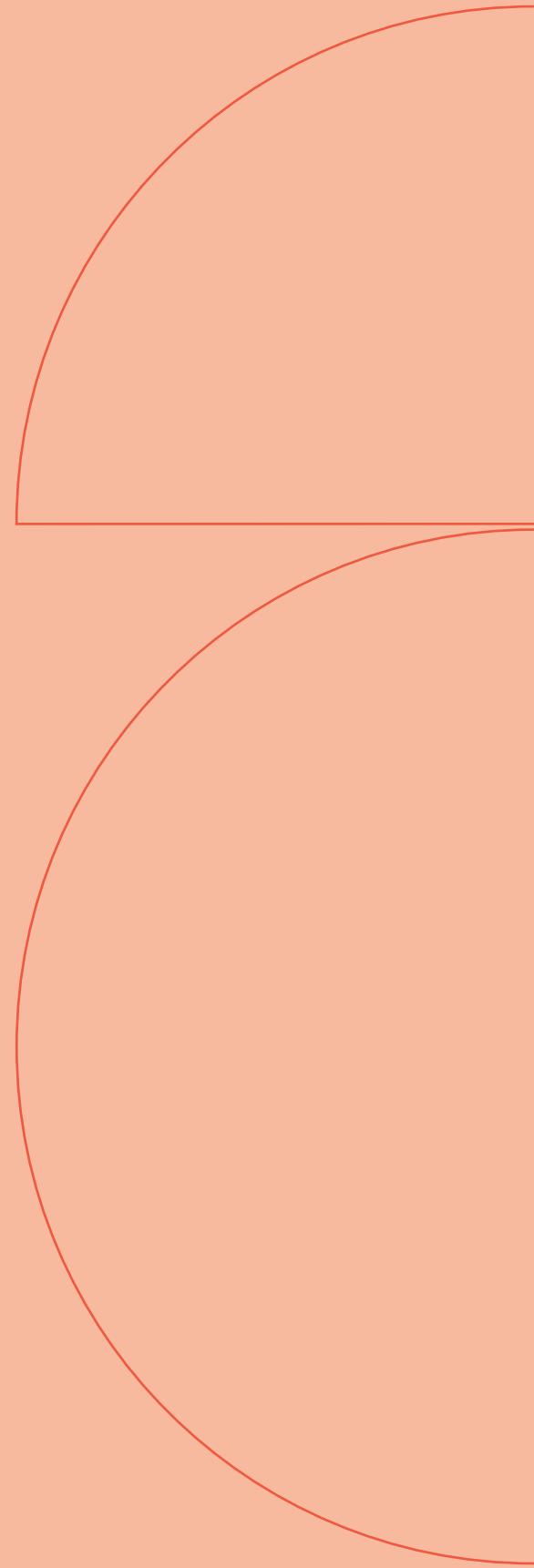
At an EU level, efforts are strongly geared towards **creating interconnections between Member States' bioeconomy strategies**, which are now in place in all countries. The nature of the bio-based activity varies considerably between Member States. Eastern European countries, including Poland, Romania, and Bulgaria perform better in lower value-added sectors of the bio-based economy, which generate higher levels of employment. Meanwhile, countries such as Belgium, Finland, France, and Sweden have the highest added value activities (as measured by the difference between turnover and employment).

**The EU's strategy is focused on ensuring its bioeconomy is competitive with that of other regions around the world, if not in the leading position.**





**BBI JU 2014-2021:  
eight years  
transforming  
the global  
bio-based field**



**The BBI JU's role in contributing to the EU's first bioeconomy strategy in 2012 was key to making Europe's progress towards a sustainable future a reality.**

## **European leadership in the bio-based economy**

The EU recognised that the transition from a fossil-based economy represented an **opportunity to establish Europe as a leader** in developing innovative and competitive bio-based products and industries.

As the focus on minimising environmental impacts and preserving available resources becomes increasingly mainstream, **the pioneering work of the BBI JU, and the projects it supports, will be pivotal** in helping the EU deliver on the economic and climate targets outlined in the European Green Deal and Bioeconomy Strategy.

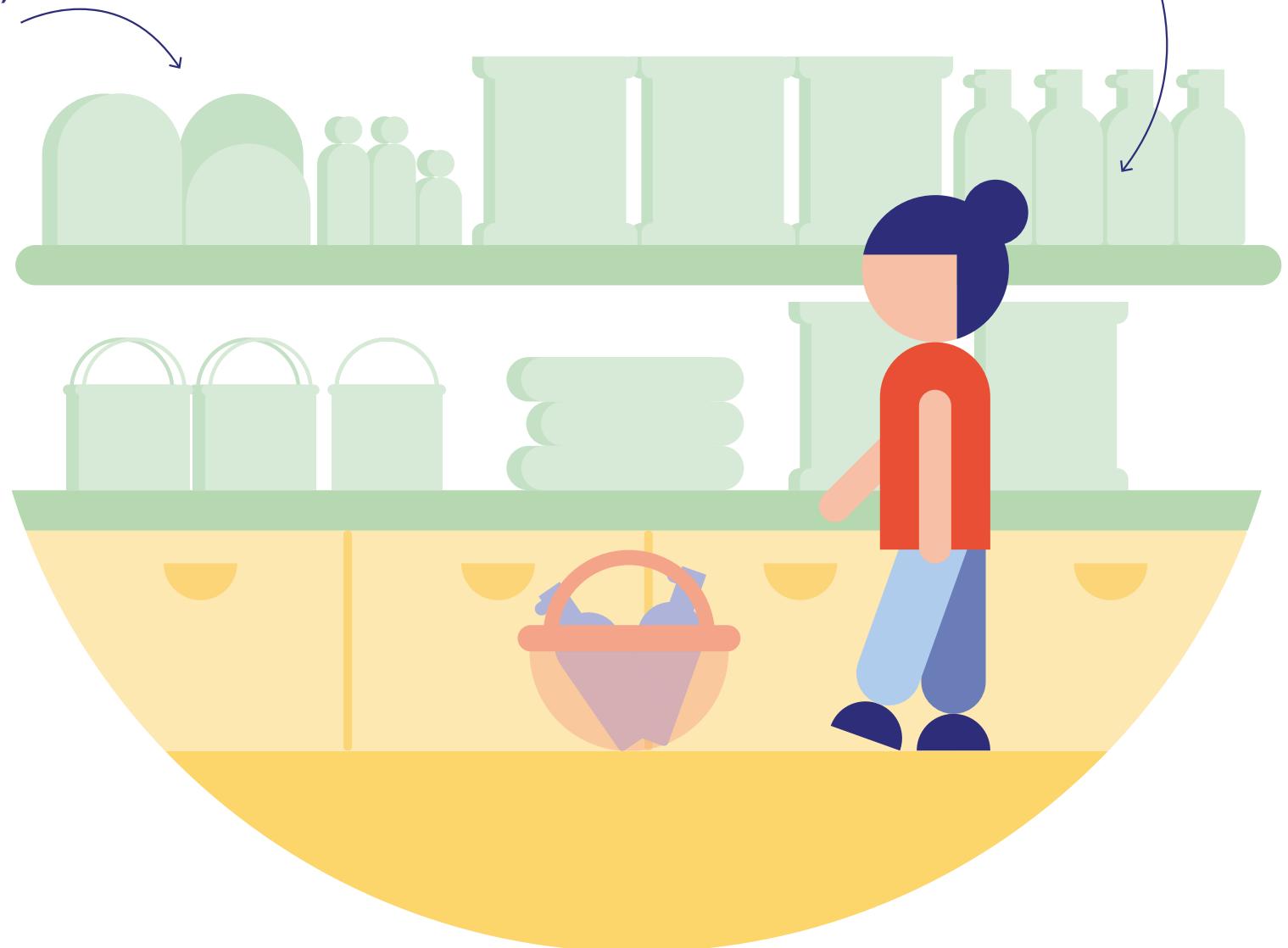


By harnessing the cream of European innovation from academia and business, many **new bio-based products** have **already found their way to market**.

This is **increasing consumer awareness** of their availability and performance and **meeting the growing demand for more eco-friendly, sustainable and locally sourced products**.

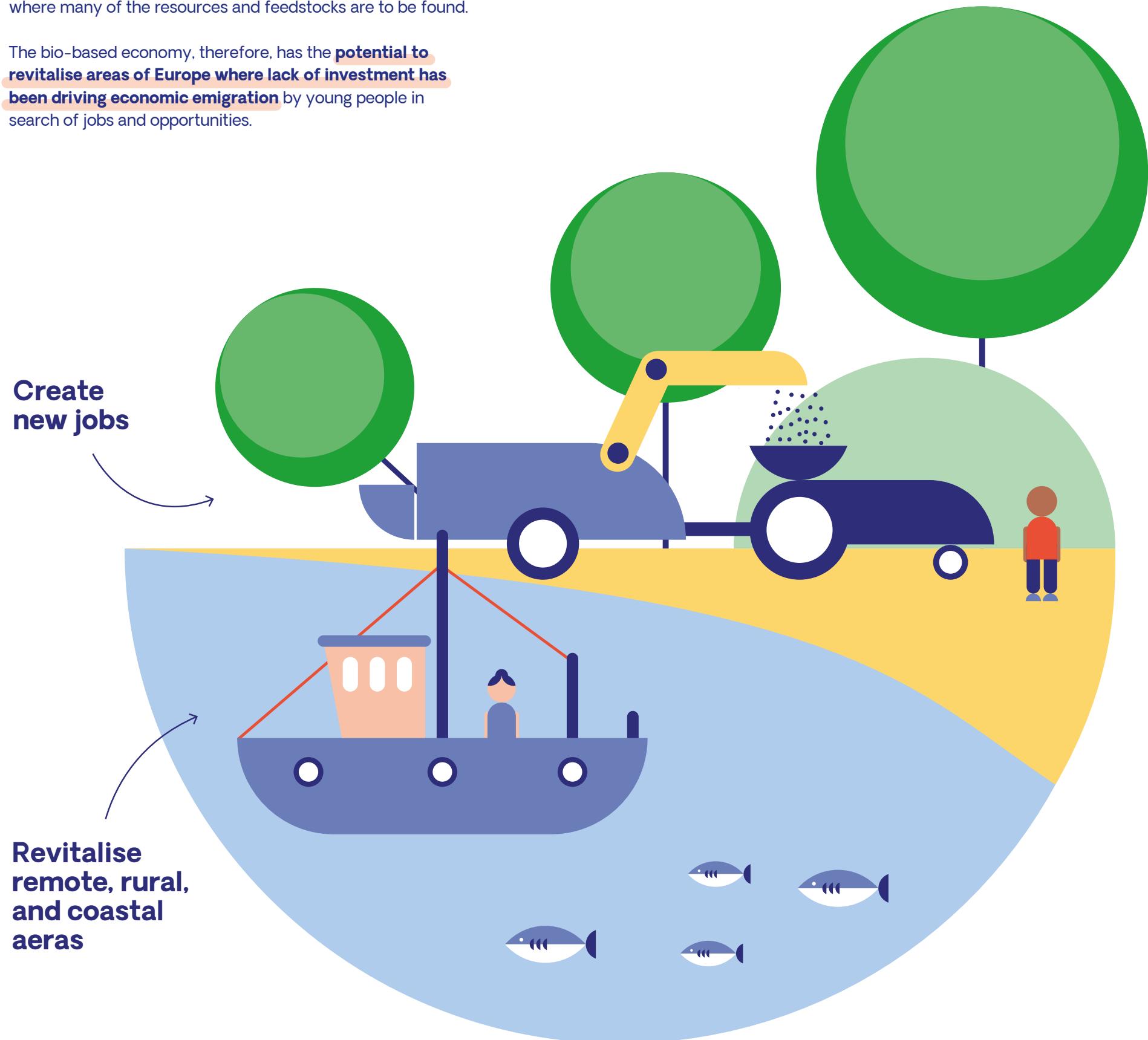
## • BIO-BASED •

Meet demand for more eco-friendly, sustainable, and locally-sourced products



In addition, there are also other gains; the bio-based economy has **encouraged investments and created new employment opportunities**. Many of these are new, highly skilled jobs in remote, rural, and coastal areas, where many of the resources and feedstocks are to be found.

The bio-based economy, therefore, has the **potential to revitalise areas of Europe where lack of investment has been driving economic emigration** by young people in search of jobs and opportunities.



# Our story and milestones

● 2012

**13 Feb**

European Commission publishes the **EU's Bioeconomy Strategy**, paving the way for a public-private partnership (PPP) in the bio-based industries sector

● 2013

**27 Mar**

BIC publishes the first BBI JU **Strategic Innovation and Research Agenda (SIRA)**

**10 Jul**

European Commission proposes to the Council of the EU a regulation establishing **BBI JU Regulation**

● 2014

**6 May**

Council of the EU, following the European Parliament's opinion, adopts the regulation **establishing BBI JU**

**27 Jun**

**BBI JU enters into force**, its Governing Board is established and holds its first meeting

**9 Jul**

**BBI JU launches its first call for project proposals**

**1-3 Sept**

The **advisory bodies** of BBI JU are established: Scientific Committee and States' Representatives Group

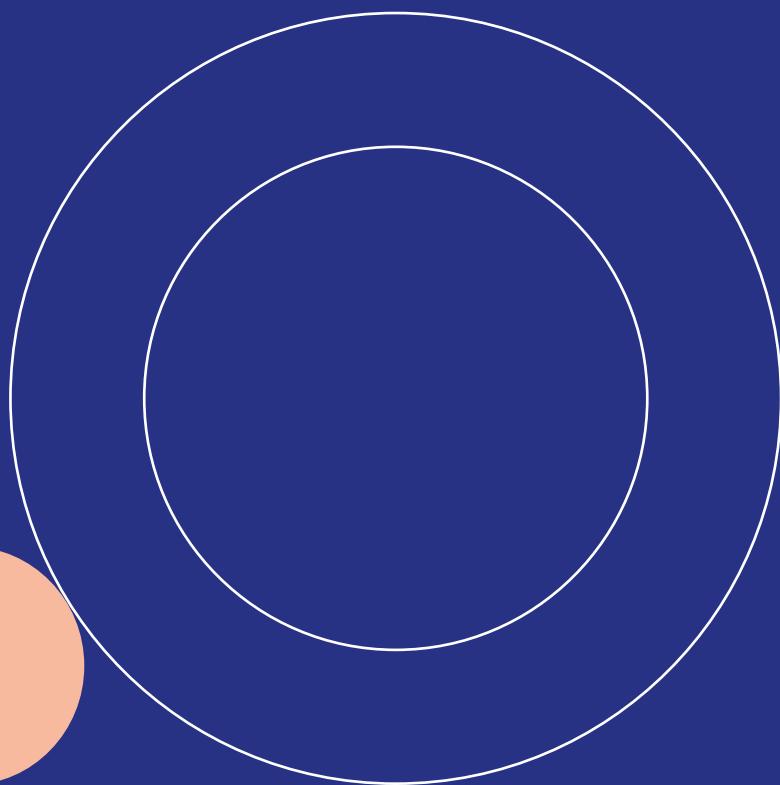
roadmap to translate the BBI JU's ambitions into actions that deliver tangible results

developed through consultation with a group of 40 leading companies and clusters throughout Europe, representing the current and future bio-based sectors

designed to reflect the input, expertise, and consensus of industry and policymakers on the main technological and innovation challenges

aimed at increasing the available opportunities to convert and valorise new feedstocks into a wide array of bio-based products

**The SIRA led to the creating of a PPP between the European Union and BIC: the BBI JU**



● 2015

15 Jun

BBI JU signs **the first 10 grant agreements** with projects for a total of €50 million

1 Oct

**Philippe Mengal** takes office as BBI JU **Executive Director**

● 2017

21 Jun

BIC publishes the **updated BBI JU SIRA**

7 Dec

**First BBI JU Stakeholder Forum** in Brussels, bringing together more than 600 participants

● 2019

10 May

BBI JU signs the **100th grant agreement**

24 Sept

BBI JU awards its **first Synergy Label** to 12 project proposals

4 Dec

**Second BBI JU Stakeholder Forum** in Brussels, with participants from 39 countries

● 2021

23 Feb

European Commission **approves the impact assessment of the proposal** for the successor of BBI JU

18 May

BBI JU signs the **grant agreements with the last 18 projects** bringing the total investment to €821.6 million and the portfolio to 142 projects

30 Nov

Following the adoption by the European Commission, the European Parliament, and the Council of the EU, the **CBE JU is legally established**. The new partnership has a more significant mandate and is the universal successor of BBI JU

The **SIRA** led to the creation of a public-private partnership between the European Union and the BIC and ultimately to the **Bio-Based Industries Joint Undertaking (BBI JU)**.

The **BBI JU was designed to drive the transition to a more resource-efficient, sustainable and low-carbon economy**. In so doing, it would **act as an engine for growth**, bringing skilled work and fresh investment to rural and coastal areas, where much of the raw materials for the bioeconomy are sourced.

The **objectives** set for the BBI JU by the Council in its regulation establishing the partnership were to:



**Demonstrate technologies** for developing novel bio-based chemical building blocks, materials, and consumer products, and help bring them closer to the market to replace fossil-based alternatives.



**Develop business models** that stimulate collaboration between stakeholders from across Europe along entire value chains.



**Establish flagship biorefineries** that deploy these technologies and business models to demonstrate that cost and performance of bio-based products are competitive with those of their fossil-based alternatives.

The BBI JU was a funding body, which issues **annual calls for project proposals**. These are open to all participants of the value chain, such as academic institutions, businesses – both large and small, as well as primary producers (i.e. agricultural producers) – to build consortia and apply for funding. Since its inception, the two founding partners of the BBI JU have **invested €3.7 billion**. The work has focused on seven **key strategic sectors**:

Technology providers

Forestry and pulp and paper

Aquaculture and marine

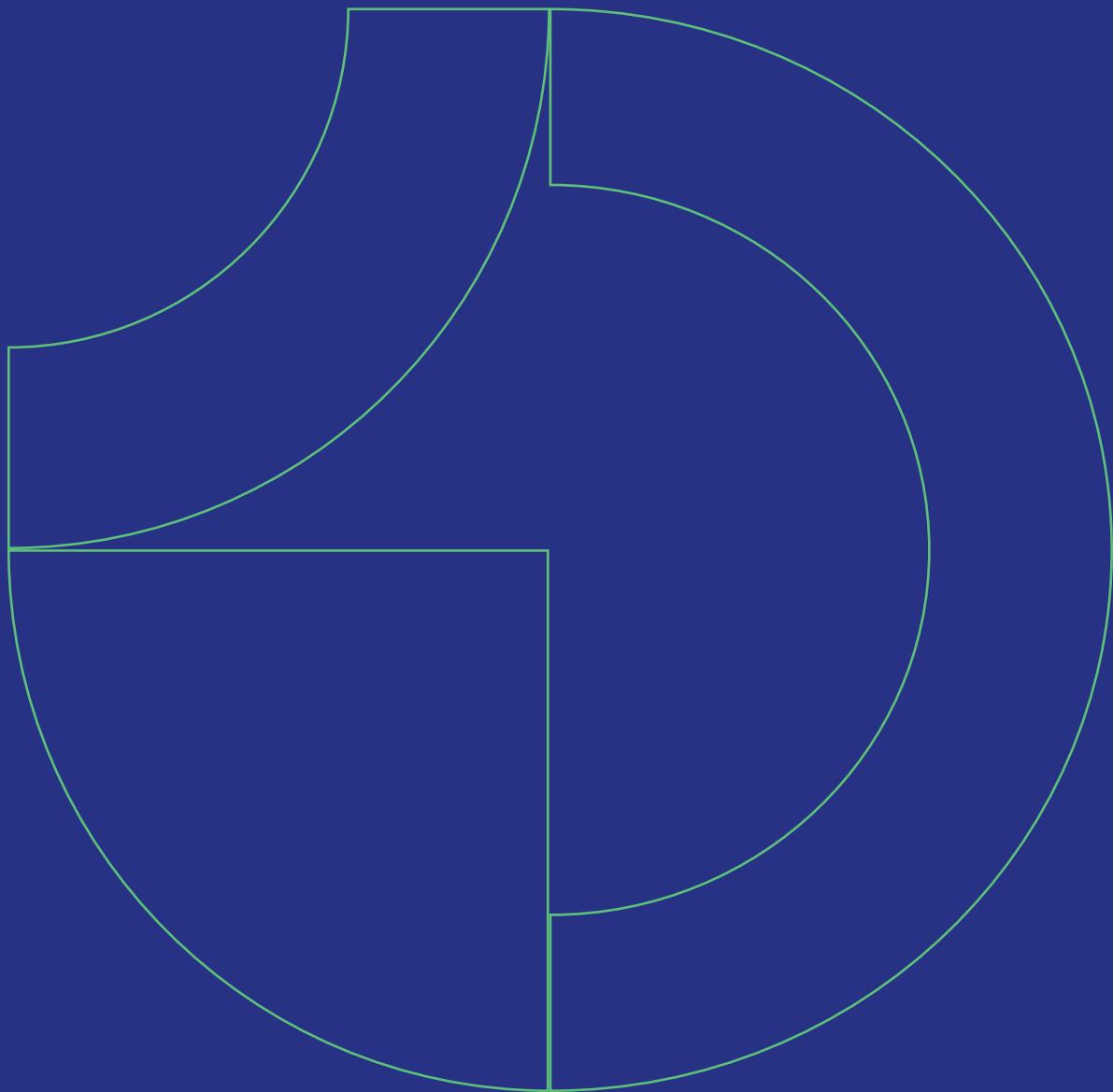
Packaging and building materials

Bio-based chemicals and materials

Waste management and valorisation

Agriculture, food and feed production

**An impactful  
initiative for  
a sustainable  
future**



## The BBI JU has been instrumental in overcoming many of the obstacles to establishing a viable and vibrant European bioeconomy sector.

**The success of the BBI JU - in realising the ambition of the SIRA by bringing the European Union and BIC together in partnership - has been rightly celebrated as visionary.**

BBI JU's innovative, public-private approach has delivered win-win results; not only has it been instrumental in **developing Europe's bio-based industries and sustainable, circular bio-based economy**, but the Joint Undertaking has also played a concrete role in **helping the EU deliver on its economic and climate targets** outlined in the European Green Deal and Bioeconomy Strategy. By any reckoning, BBI JU has been **an inspirational and visionary European success story delivering concrete results and tangible environmental and socio-economic value** for European citizens.

*'The public-private partnership between the European Commission and the Bio-based Industries Consortium has really taken the bioeconomy in Europe beyond the tipping point. Without this support, the landscape would be disjointed and inefficient. Indeed, when travelling outside Europe, the ecosystem which the BBI JU has created is attracting envious glances.'*

**Jim Laird** is CEO & Commercial Director at biotechnology company ENOUGH, coordinator of the PLENITUDE flagship project.

The BBI JU is dedicated to investing in relevant research and innovation projects to advance Europe's bioeconomy through a series of **annual calls for proposals**. These calls were **open to consortia of SMEs, universities, research centres, and other actors** from throughout the EU. In so doing, the partnership **created connections** between key sectors and **helped develop new bio-based value chains and products**, reinforcing Europe's bio-based economy.



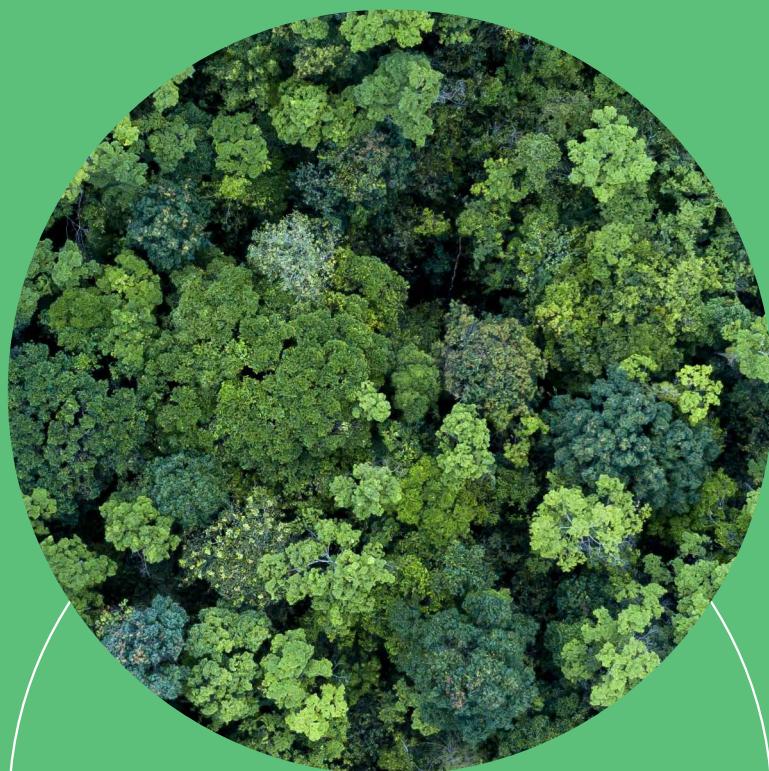
LIGNOFLAG biorefinery © CLARIANT

## Strong, clear, and independent governance

Behind this visionary approach was a **committed team, dedicated to ensuring transparency and openness, and working to the highest standards of governance.**

No organisation can deliver consistent success without a well-knit, quality team - and the BBI JU is no exception.

**The BBI JU's four bodies reflected the identity, mission, and purpose** of the undertaking, and ensured that the partnership took an inclusive and wide-ranging approach to its activities while operating in the best interests of citizens and Europe's growing bio-based sector.



### GOVERNING BOARD

Main decision-making body

Ten members split equally between the joint undertaking's two partners: the European Commission and Bio-based Industries Consortium.

#### Responsibilities

Overall operational responsibility for the annual work plan and budget;

Approve the annual calls for proposals, the selected projects funding list, and the annual activity report.

### STATES' REPRESENTATIVES GROUP

Advisory body

Members are appointed by each Member State and associated countries.

#### Responsibilities

Provide essential expertise and experience on issues:

- Assessing programme progress and how well agreed targets were being achieved;
- Making any required updates to the programme's strategic orientation;
- Ensuring coherence with the Horizon 2020 Framework Programme;
- Providing opinions on the annual work plans;
- Ensuring the involvement of SMEs.

## SCIENTIFIC COMMITTEE

Advisory body

15 independent experts selected by the Governing Board.

### Responsibilities

Provide essential scientific advice on the priorities in the annual work plans and the achievements outlined in the annual activity report.

## PROGRAMME OFFICE

Manages the BBI JU programme and ensures implementation of the partnership

23-strong team grouped into three units.

### Responsibilities

Manage and oversee all aspects of the operation (call management and programme monitoring, administration, financial management, legal control, human resources, and communication).

## EXECUTIVE OFFICE

### Responsibilities

General management, audit, internal, and legal control;

Communication relations with public and private sector stakeholders;

Ensure BBI JU activities respect the Horizon 2020 standards, the EU's research and innovation programme, and its principles of transparency and openness.

## PROGRAMME UNIT

### Responsibilities

Organise and implement the calls for proposals. Managing proposals including quality, likely impact, and potential for addressing the stated challenges.

Carry out a thorough lifecycle analysis of the projects including, processes, products, outputs, KPIs, mid-term assessment, and financial status.

## ADMINISTRATION AND FINANCE UNIT

### Responsibilities

Safeguard BBI JU's financial interests and ensure the fiscal operations were properly carried out;

Provide the tools needed for the BBI JU to deliver on its mission whilst ensuring an effective use of resources in all activities.

*'The BBI JU is a good example of an initiative covering every stage of the scientific process, from fundamental science to technological development and innovation, leading to new products coming to market.'*

MEP **Maria da Graça Carvalho** is a member of the European Parliament's Committee on Industry, Research and Energy and a former Portuguese Minister of Science, Innovation and Higher Education.

**Philippe Mengal** is the Executive Director of BBI JU and CBE JU



**Virginia Puzzolo** is Head of Programme Unit



**Nicoló Giacomuzzi-Moore** is Head of Administration and Finance Unit

## From programming to impact

What were the concrete impacts of the BBI JU's financing of bio-based projects on Europe's environment, society, and economy?

**The results and activities of the 142 projects funded to date speak for themselves.**

### BBI JU projects have:



**Aided the EU's transition** towards a zero-emission, circular economy;



**Protected the environment, ecosystems and biodiversity** by developing new bio-based products, chemicals, and materials with a lower environmental impact than their fossil-based alternatives;



**Delivered socioeconomic benefits** through triggering investments and creating new jobs primarily in rural and coastal areas while contributing to the diversification and growth of farming incomes;



**Driven collaboration** between bioeconomy actors from different sectors and regions;



**Enhanced the global competitiveness** of Europe's bio-based industries;

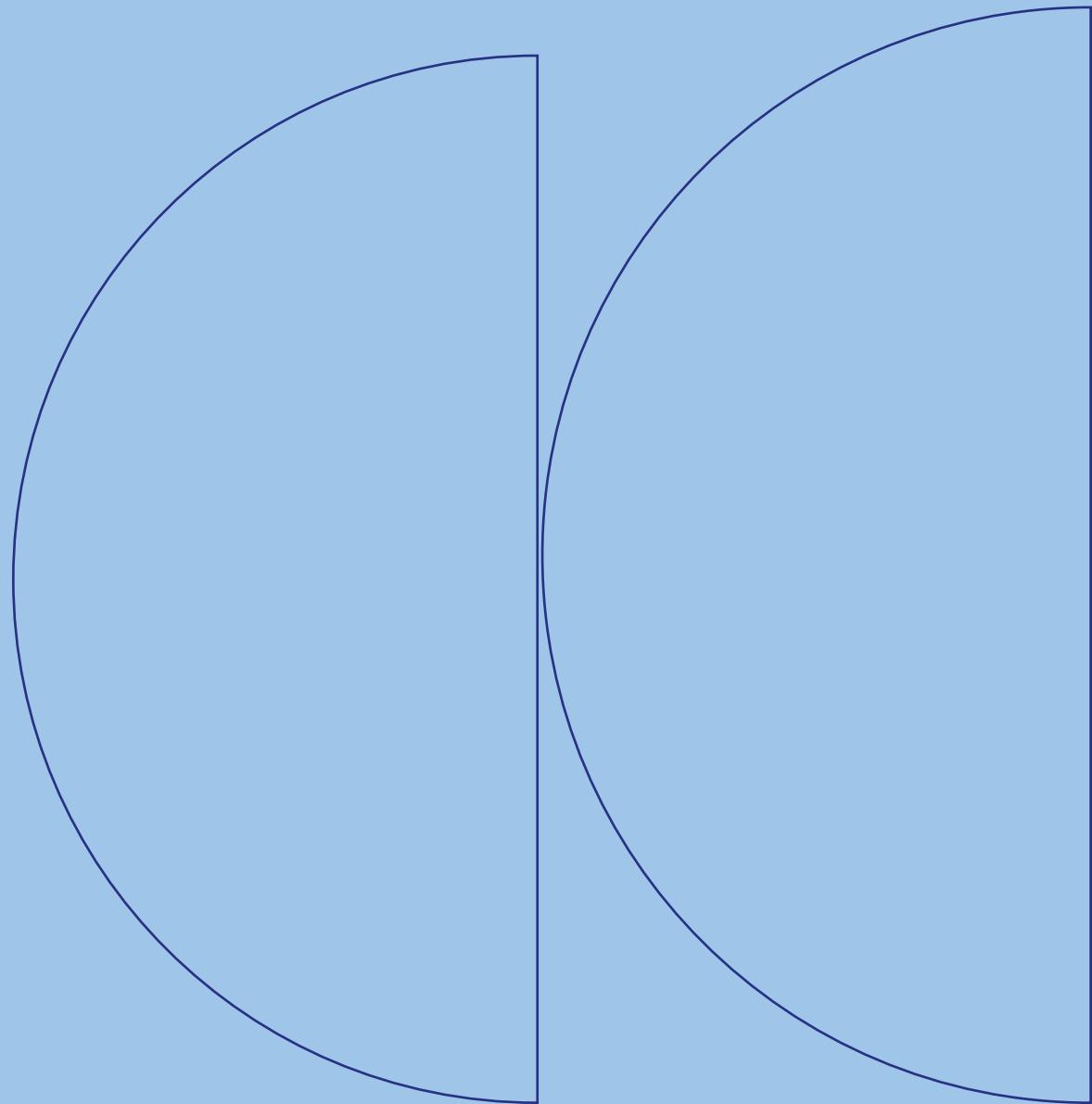


**Established Europe as a key player in research and innovation** in the bio-based industries and increased its appeal as an attractive place for investments.

*'We believe that without the BBI JU, most of the revolutionary ideas and projects would not have become a reality, as there are few organisations able to deliver these types of funding opportunities. Thanks to the BBI JU, those ideas have not only become a reality but have also provided the opportunity to engage with many stakeholders interested in them. The BBI JU has also helped guide us through the writing, execution, and exploitation of these projects.'*

**Berta Gonzalvo Bas** is Research Director at the AITIIP Centro Tecnológico, coordinator of the BARBARA project.

# Revolutionising the European bio-based industry



completed projects  
**41**  
delivering:

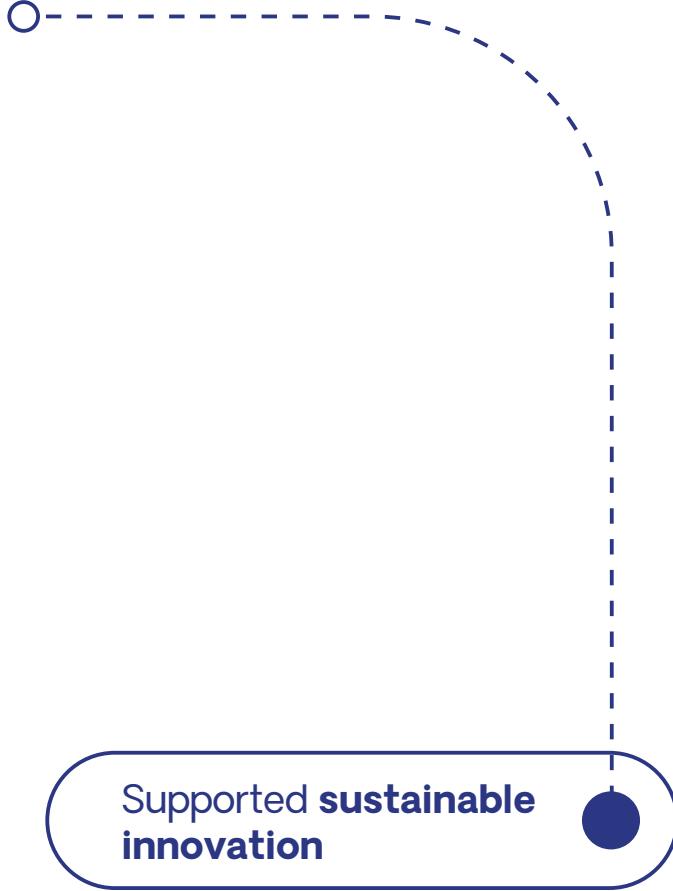
**92**  
new materials

**31**  
new products

**63**  
new bio-based value chains

with performance equal or superior to their fossil-based counterparts

Invested strongly in **green industries** and encouraged **private investors**



**Since 2014, the BBI JU has:**

Supported **sustainable innovation**

A central pillar in establishing Europe's bio-based industry sector as a global leader

**800+**  
kilotons in CO<sub>2</sub> emissions



Contribute to saving

**€822 million**  
invested  
in projects

and every euro  
has attracted almost  
**three times as much**  
in private investment

Stimulated  
**local economies**

**142**  
projects

**40+**  
countries

**1,800+**  
beneficiaries  
40% SMEs  
32% universities  
and research centres

Supported Europe's **research**  
and **business sectors**

The first 13 flagship  
**biorefineries projects**

**4,700+**  
direct jobs

**15,000+**  
indirect jobs

**€1.3 billion**  
investment

Are expected  
to **generate**



In its recent impact assessment report on establishing Circular Bio-based Europe (CBE JU) - the successor to the BBI JU - the European Commission concluded that **one of the unique features of the BBI JU was its ability to foster closer collaboration between the scientific community and industry, to increase Technology Readiness Levels (TRL), and to speed up innovation.**

The report adds that the **BBI JU has been very successful in mobilising SMEs, delivering a positive environmental impact**; two-thirds of projects reported they were producing bio-based products with lower GHG emissions, and more than half said they expected to contribute to waste reduction, reuse, valorisation, recycling, and reduction of their energy consumption.

**The report points out, 'the BBI JU has contributed to the systemic evolution of the bio-based industry in bridging the gap between innovation and market'.**

*'From the outset, when we decided to join forces with our industry partner the Bio-based Industries Consortium and launched the BBI JU, we also set out to reinforce Europe's position as an attractive destination for investment in promising bio-based innovations. Today, we can be proud that not only have we achieved this objective but that we have also exceeded our own expectations. Europe's bio-based industry is now seen as a global leader and the BBI JU has played a central role in this success, by structuring the sector and de-risking the investment needed.'*

**Wolfgang Burtscher** is the European Commission's Director-General for Agriculture and Rural Development.

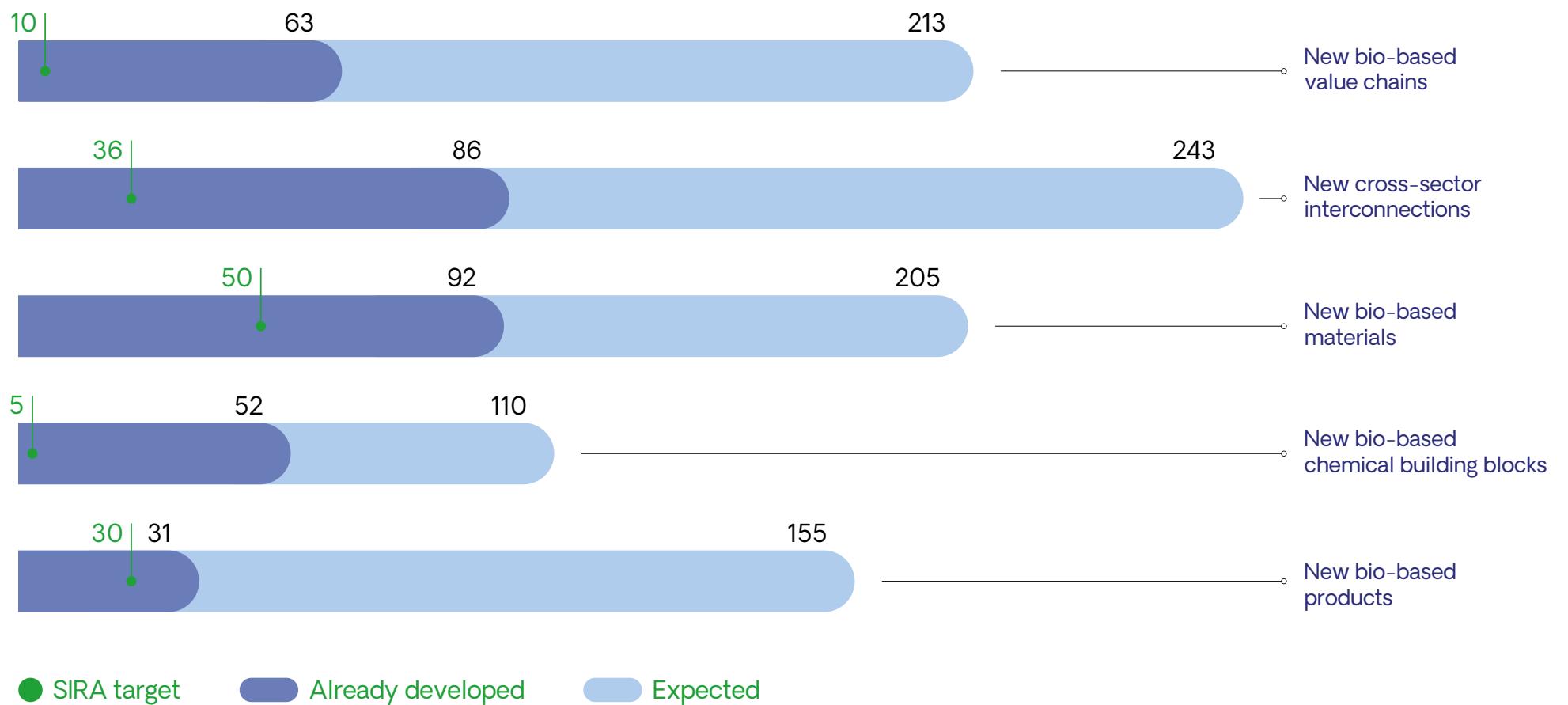
Two principal benefits of the BBI JU are that it has organised and reorganised value chains and it has mobilised key stakeholders' and its **innovation-driven mobilising effect on key stakeholders.**

Invariably, BBI JU projects involve innovative and interconnected bio-based value chains and cross-sectoral collaboration.



© SWEETWOODS biorefinery in Estonia

### Expected outputs of BBI JU projects by 2024



All of these products are expected to be more sustainable than their current fossil-based alternatives.

The BBI JU has been an empowering programme, **encouraging and enabling scientific advancement, and promoting knowledge creation and sharing** throughout the bio-based sector. All the BBI JU's projects have been structured to increase technology maturity levels, push science and knowledge, **and make the transition from lab-scale testing to industrial-scale biorefineries.**

Technological advancements for core technologies are expected to be performed by BBI JU's 2024 end date. However, **the full value of the undertaking's impact on Europe's sustainable future is likely to be seen for much longer.**

*'The construction of pilot and flagship plants is a critical step in demonstrating the viability of new technologies, but gaining funding is difficult. The financing provided by the BBI JU through the PEference project provided the first piece of the puzzle, adding the all-important credibility and visibility needed to attract other investors and bridge the financing gap.'*

**Tom van Aken** is CEO of Avantium, a pioneer in the emerging industry of renewable and sustainable chemistry, and coordinator of the PEference flagship project.



### Going from strength to strength

The BIC recognises the key role of **BBI JU in attracting private investment at previously unforeseen levels.**

The Consortium members **'more than doubled their investment plans in the bioeconomy from €2.1 million in 2014 to €5.5 billion in 2018, a trend expected to continue with the BBI JU's support'.**

However, perhaps the **BBI JU's most important contribution has been the unlocking of the potential for cooperation between EU industry and academia,** and the way it has helped put them at the forefront of a strategically important sector. As the need to change how economies and societies live, work, and consume becomes increasingly more present, **the seeds planted by the BBI JU are coming to fruition.** This way Europe, and Europe's industries, will be able to lead by example.

### The BBI JU approach

The BBI JU approached this challenge by funding **four distinct types of projects,** each geared towards stimulating specific types of development:

**1.**

#### Flagship projects

Flagship projects – first-of-their-kind large-scale production facilities in Europe – provide support for designing and constructing novel, commercial-scale biorefineries. The goal is to deliver technically

mature facilities that achieve 8 on the NASA-developed Technology Readiness Level scale (meaning they are ready for commercial operations) by the completion of the project. Flagship projects seek to offer processes with improved environmental and economic performance compared to existing, fossil-based competitors. Flagship projects also demonstrate the viability of chosen production methods, as well as the whole value chain from the sourcing of biomass until the end use.

### FIRST2RUN Maximising the value of marginal lands

**The FIRST2RUN project repurposed an abandoned petrochemical plant into a biorefinery** to convert vegetable oils from cardoons (or artichoke thistle) into biomonomers.

Cardoons can grow in dry and poor-quality soil of the Mediterranean. This means that they can provide feedstocks for bioproducts without competing for land that can be used for edible crops.

**The FIRST2RUN biorefinery has already cultivated hundreds of hectares of cardoons and has trained local farmers in how to grow, harvest, and store the crops.**

**The vegetable oils can be used in high added-value bioproducts** such as cosmetics, bioplastics, and biolubricants for a variety of applications. The biorefinery has already produced usable compounds.

*'Thanks to FIRST2RUN, a cardoon crop has been successfully established, through the involvement of around 80 local farmers (...). In addition, the project has contributed to the reconversion of a disused petrochemical site in Porto Torres, Sardinia, into a first-of-its-kind biorefinery, processing vegetable oils. Adopting a FIRST2RUN model will make it possible to generate around 60 new skilled jobs for every kilotonne of bioplastics produced.'*

**Catia Bastioli** is CEO of Novamont, coordinator of the FIRST2RUN flagship project

# CBE JU flagship projects

13 projects

€250m in funding



1 Co. Tipperary Ireland



6 Saint-Avoid France



11 Imavere Estonia



2 Zaragoza & Sesto San Giovanni Spain & Italy



7 Saint-Avoid France



12 Riga Latvia



3 Sarpsborg Norway



8 Amiens France



13 Podari Romania



4 Delfzijl The Netherlands



9 Baillargues France



5 Sas van Gent The Netherlands



10 Porto Torres Italy

● Flagship biorefinery

## 2.

**Demonstration actions**

Demonstration actions, as the name suggests, are designed to demonstrate the technical and financial feasibility of new or improved bio-based processes. By the end of the BBI JU's mandate, these projects are expected to reach TRLs of 6 or 7 and be of sufficient scale to produce enough products to allow market testing and entire business models.

**PULP2VALUE**  
**Capturing more than sugar from sugar beet**

**The PULP2VALUE consortium has realised the potential of sugar beet.** Sugar beet is one of Europe's major crops and its pulp is primarily used as low-value animal feed. However, treated correctly, this pulp has great potential as a source of other, higher value products, such as microcellulose fibres, arabinose, and galacturonic acid. These substances can be used for a wide variety of applications such as chemical building blocks, in food and flavour applications, and in detergents and personal care products.

**PULP2VALUE has constructed demonstration plants and developed positive business cases** for microcellulose fibres and galacturonic acid, and confirmed the health benefits of arabinose.

Currently, these microcellulose fibres are being used as new structurants for particles in solution in **detergents, adhesives, paints and coatings, and drilling muds**. Arabinose is being used to develop **foods** with a low glycaemic index, and galacturonic acid is finding applications in **personal care** and as an environmentally friendly corrosion inhibitor.

**39**  
projects

**€274m**  
in funding



## 3.

## Research and innovation actions

Research and innovation actions fund the examination and development of potential innovative technologies that offer the capacity to fill the gaps in existing bio-based value chains by developing, improving, or optimising key technologies.

### **BARBARA** Advanced automotive components from biowaste

The **BARBARA project** was established to **address the need for plastic in automotive applications.**

The project is developing a range of **bio-based plastics from food waste.** These can replace those plastics derived from the unsustainable fossil-based resources, and have all the required properties - mechanical, thermal, aesthetical, optical, and antimicrobial - for this demanding environment.

The project has **produced organic materials suitable for manufacturing bio-based plastics** for a range of applications such as filaments for 3D printing. With FIAT (carmaker), these were used to print car door trims and a dashboard fascia, and with ACCIONA (building infrastructure company) they were used to fabricate truss joints.

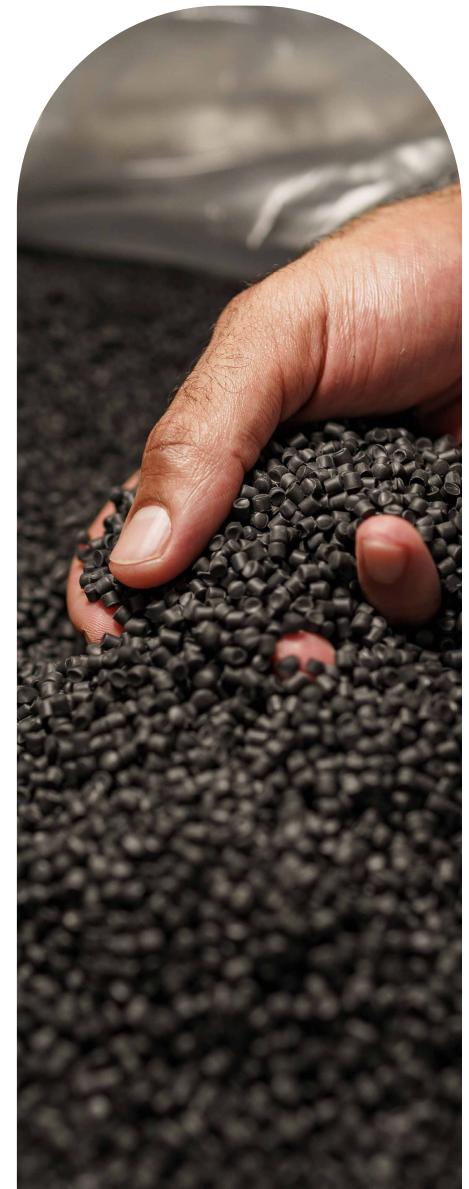
**There is a high potential for BARBARA technologies in other areas,** including in biotechnology, nanotechnology, advanced materials and advanced manufacturing technologies.

*'We believe that without the BBI JU, most of the revolutionary ideas and projects would not have become a reality, as there are few organisations able to deliver these types of funding opportunities. Thanks to the BBI JU, those ideas have not only become a reality but have also provided the opportunity to engage with many stakeholders interested in them.'*

**Berta Gonzalvo**, Research Director of Aitiip Technology Centre, coordinator of the BARBARA project

**71**  
projects

**€256m**  
in funding



**18**  
projects

**€20m**  
in funding

**4.**

#### Coordination and support actions

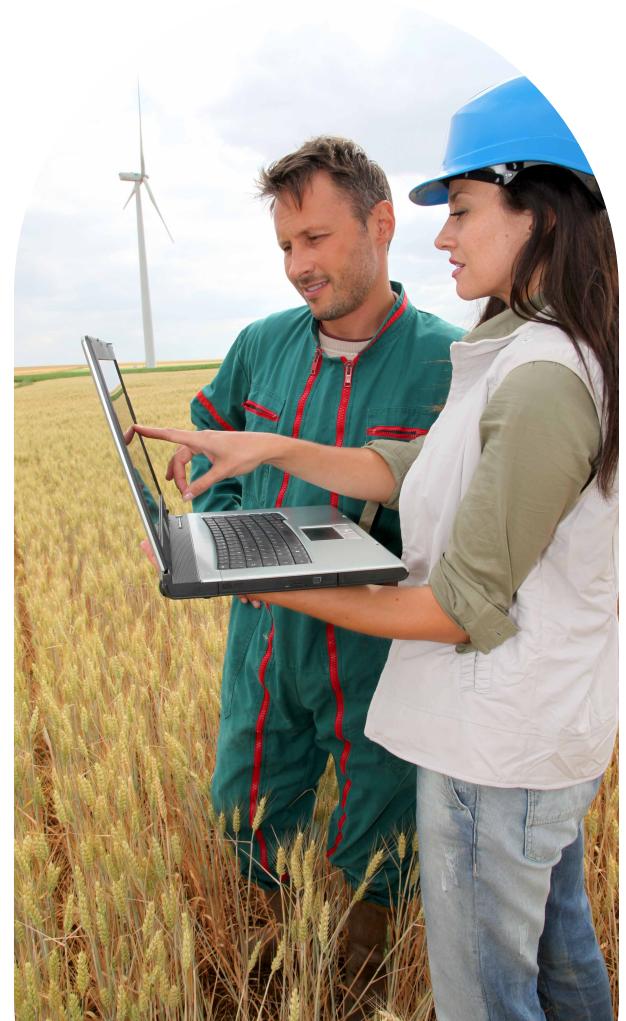
While developing these technologies advances Europe's bio-based industry sector, their long-term future success relies on ensuring they reach the market, and once there, boost their uptake and build share of use. This is the role of the BBI JU Coordination and Support Actions, which address the cross-sectoral challenges of the bioeconomy in order to facilitate this process.

#### **PILOTS4U** Multipurpose pilot and demo infrastructures database

**PILOTS4U provides an easily accessible database of relevant facilities for the bioeconomy** available to all companies and research institutes. The open access pilot- and multipurpose demo-infrastructures can **act as shared investment in research infrastructure and making product and service developers aware** of their existence and availability.

This addresses the challenge of locating and accessing the facilities needed to scale up to pilot and demonstration size before commercial production.

The database can be searched according to specific requirements of each project. This way, **PILOTS4U helps new bio-based products and techniques stepping from the laboratory bench to the market.**



### Encouraging businesses and researchers

The BBI JU realised, at an early stage, the **need to attract all those capable of adding value to the EU's green recovery**. Therefore, the projects that the BBI JU fund offer opportunities for stakeholders, including SMEs, large industries, primary producers, trade associations, and end users, **to develop technologies and business models that can drive Europe's green economy while helping organisations scale up their own technologies and improve their market access.**

### Academia and research centres represent:

BBI JU funding **30%**

Participations in projects **25%**

### SMEs represent:

BBI JU funding **37%**

Beneficiaries **40%**

Private organisations involved in projects **66%**

*'For the Metsä group and also for the forest industry, the networking platform provided by the BBI JU has enabled the greatest impact, followed by co-financing, particularly for the demonstration and flagship projects, where the ability to get co-financing allows for risk mitigation'*

**Niklas von Weymarn** is CEO of Metsä Spring, a wood-based value chain development company, and Member of BIC Board of Directors.

### Beneficiaries:

**40+**  
countries

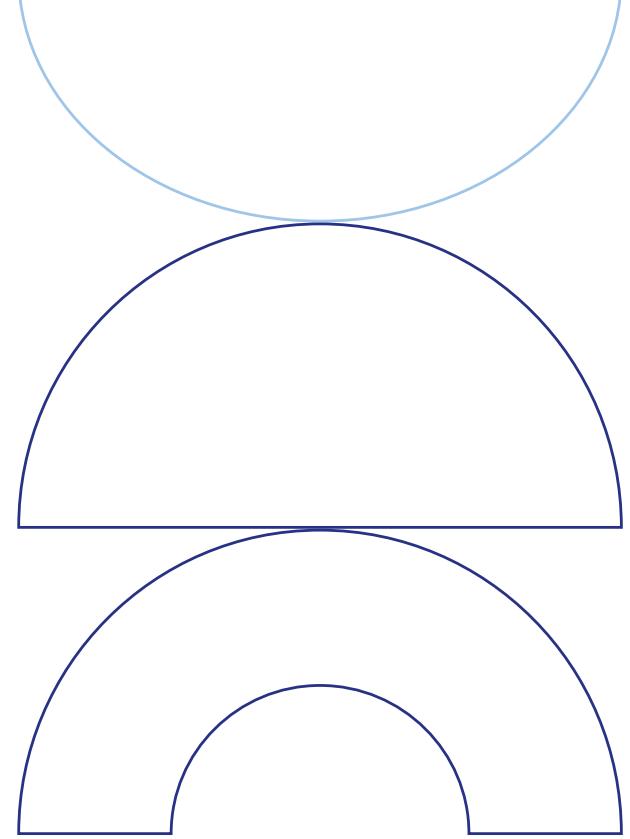
**1,800+**  
projects



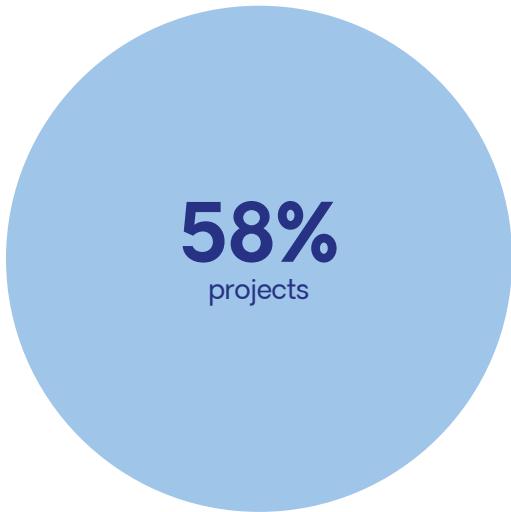
### A significantly improved environmental impact

As the BBI JU is dedicated to developing bio-based products in pursuit of a circular economy, it **makes a significant contribution to reducing many environmental impacts.**

All demonstration and flagship projects must undertake a **Life Cycle Assessment analysis to guarantee the sustainability of their whole value chain.** This ensures they avoid environmental damage and do not compete with land or other resources needed for food production.



Reducing emissions

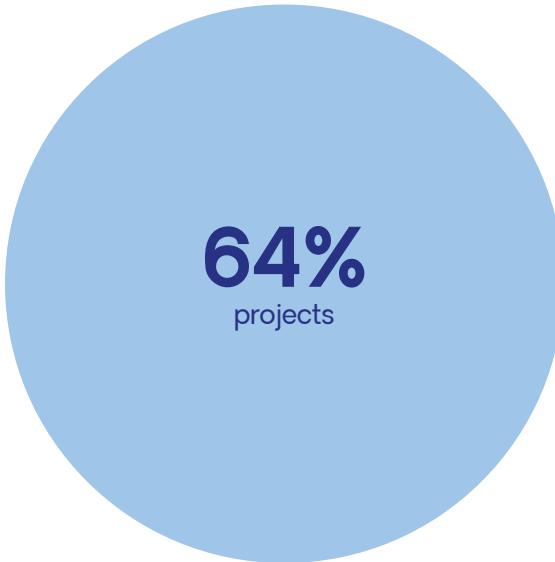


58% projects



will deliver bio-based alternatives to fossil-based products lowering greenhouse gas emissions

Enhancing sustainability and circularity

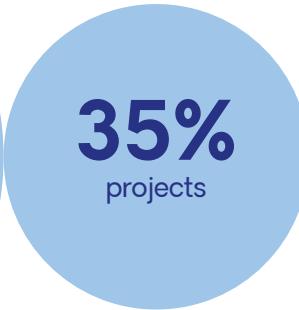


64% projects



will help reduce waste and encourage reuse and recycling

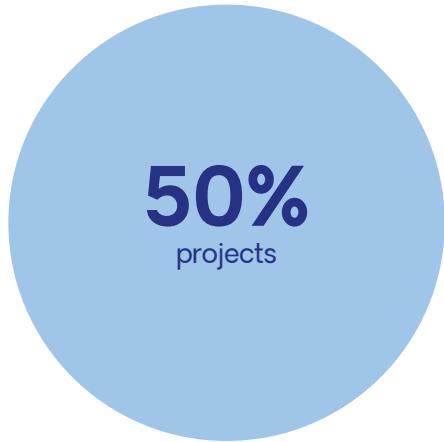
Reducing energy consumption



35% projects



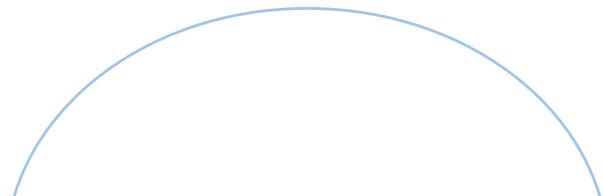
will improve land use



50% projects

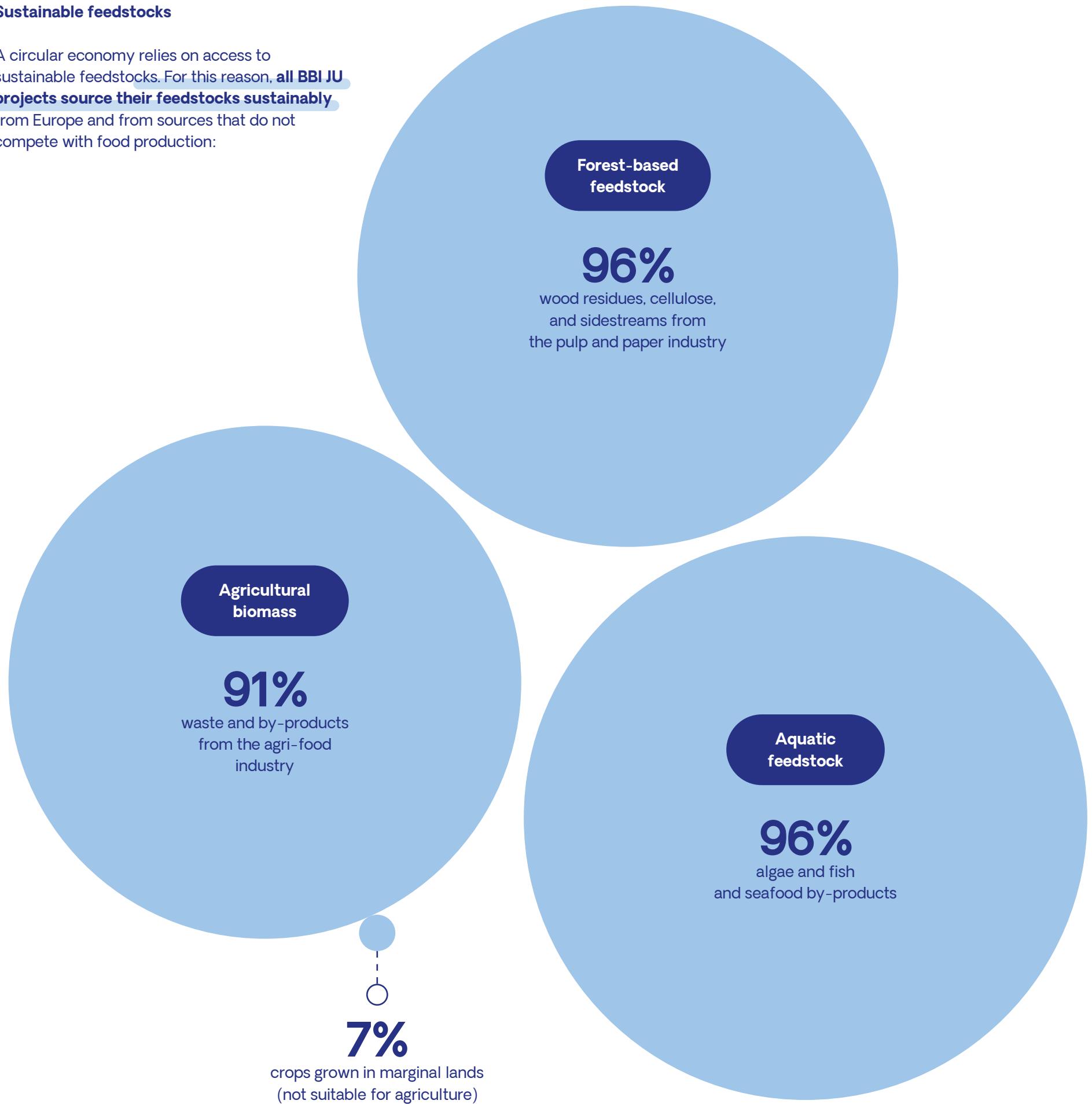


will reduce overall energy consumption



## Sustainable feedstocks

A circular economy relies on access to sustainable feedstocks. For this reason, **all BBI JU projects source their feedstocks sustainably** from Europe and from sources that do not compete with food production:



## Creating a greener future through bio-based innovation

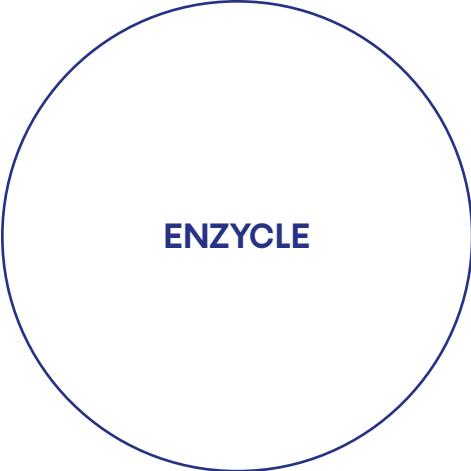
As the EU's efforts to **create a greener and cleaner future** gather pace - through the advent of initiatives such as the Zero Pollution Action Plan and the Farm to Fork Strategy - the importance of many of the BBI JU-funded projects has become ever-clearer.

Many BBI JU-funded projects will help the zero pollution action plan achieve its target of reducing plastic pollution by 30%, by the end

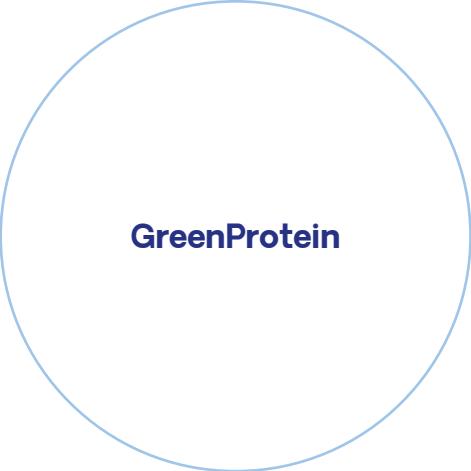
of the decade. Many BBI JU-funded projects will help the Action Plan achieve its target. The **ENZYCLE** project, for example, is **developing enzymes to treat and reuse previously unrecyclable plastic residues**. **EMBRACED**, meanwhile, is **transforming hygiene products such as nappies into fertilisers and packaging materials**.

The Farm to Fork Strategy aims to increase the resilience of Europe's food supplies, part of which is focused on reducing food loss and waste. Here again, BBI JU-funded projects are

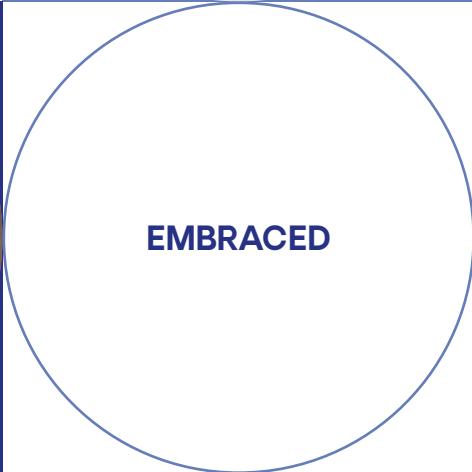
making a key contribution, by turning food waste and by-products into new foods and food ingredients. The **GreenProtein** project, for example, **uses agricultural residues to produce high-quality food-grade proteins and other ingredients**, such as alternatives to egg white preparations or whey protein. Meanwhile, in the field of aquaculture, the **SYLFEED** project will **produce proteins for fish from wood residues**, reducing the reliance on soybeans.



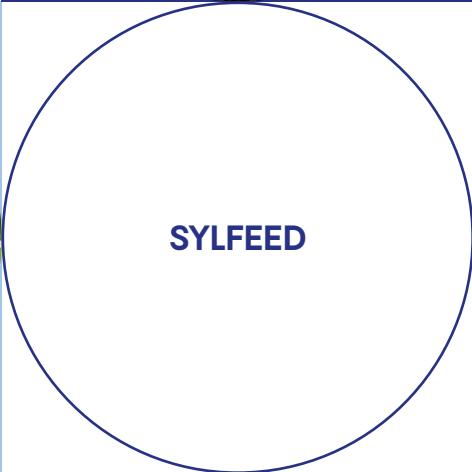
ENZYCLE

GreenProtein

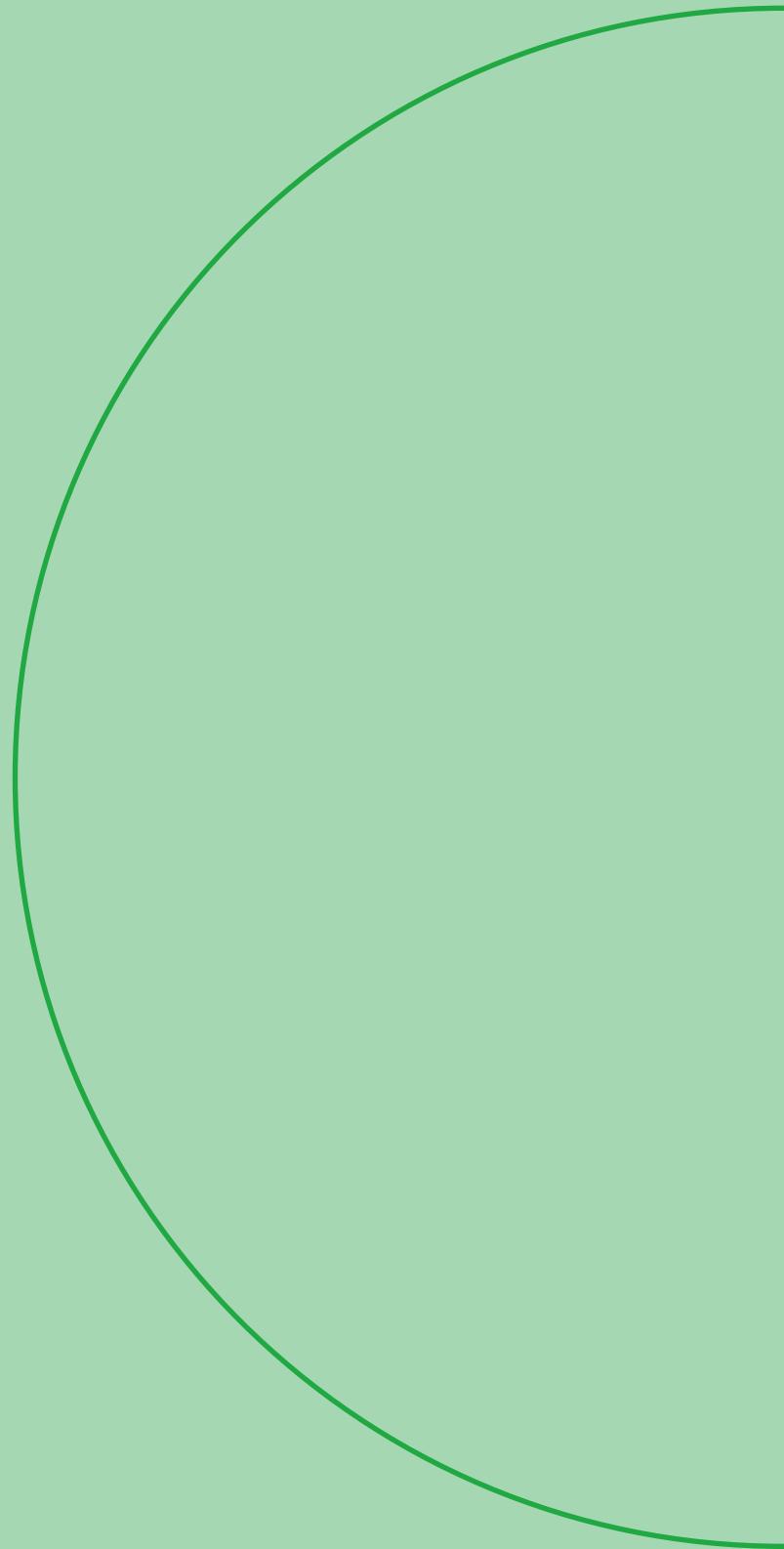



EMBRACED

SYLFEED

# **Building a competitive and sustainable bio-based community**



**Establishing a successful bio-based industry in Europe required financing. The BBI JU helped build the confidence needed to attract substantial inward industry investment into the sector.**

### Made in Europe

Generating investment and creating a competitive, sustainable bio-based sector in Europe laid at the heart of the BBI JU initiative. **The BBI JU's unique funding structure** - which brings together both public and private funding - **has been pivotal in attracting industry financing and augmenting the EU's Horizon 2020 budget resources.**

From 2014 until the conclusion of the BBI JU projects in 2024, the BIC including its constituent entities **will have contributed more than €2.7 billion alongside an EU contribution of €975 million.**

### Multiplier effect

This highlights the BBI JU's considerable impact as a multiplier - by the end of the initiative in 2024, **every euro of public money will have generated the equivalent of nearly three times its value in private contributions.** It is this innovative and high-impact funding structure of collaborative research that has allowed the **BBI JU to play such a crucial role as a catalyst for investment** - sustaining the R&I activities of SMEs, universities, research centres, and academia working in the sector.



*'For me, the most important element of the BBI JU has been the public-private partnership aspect, which saw many important initiatives instigated, in particular the flagship programmes. These have helped achieve first deployment results and create real breakthroughs in certain technologies. I think this focus on a larger scale, one where the risks are mitigated, has been the big difference with other bioeconomy programmes and initiatives, and I'm in favour of more flagships.'*

**Ludo Diels**, research manager for sustainable chemistry at the Flemish Institute for Technological Research (VITO), coordinator of the InDIRECT project.



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## Cooperation with other sources of funding

The BBI JU receives a number of innovation actions project proposals that may have been deemed appropriate for funding following evaluation, but sadly fail to qualify, due to budget constraints.

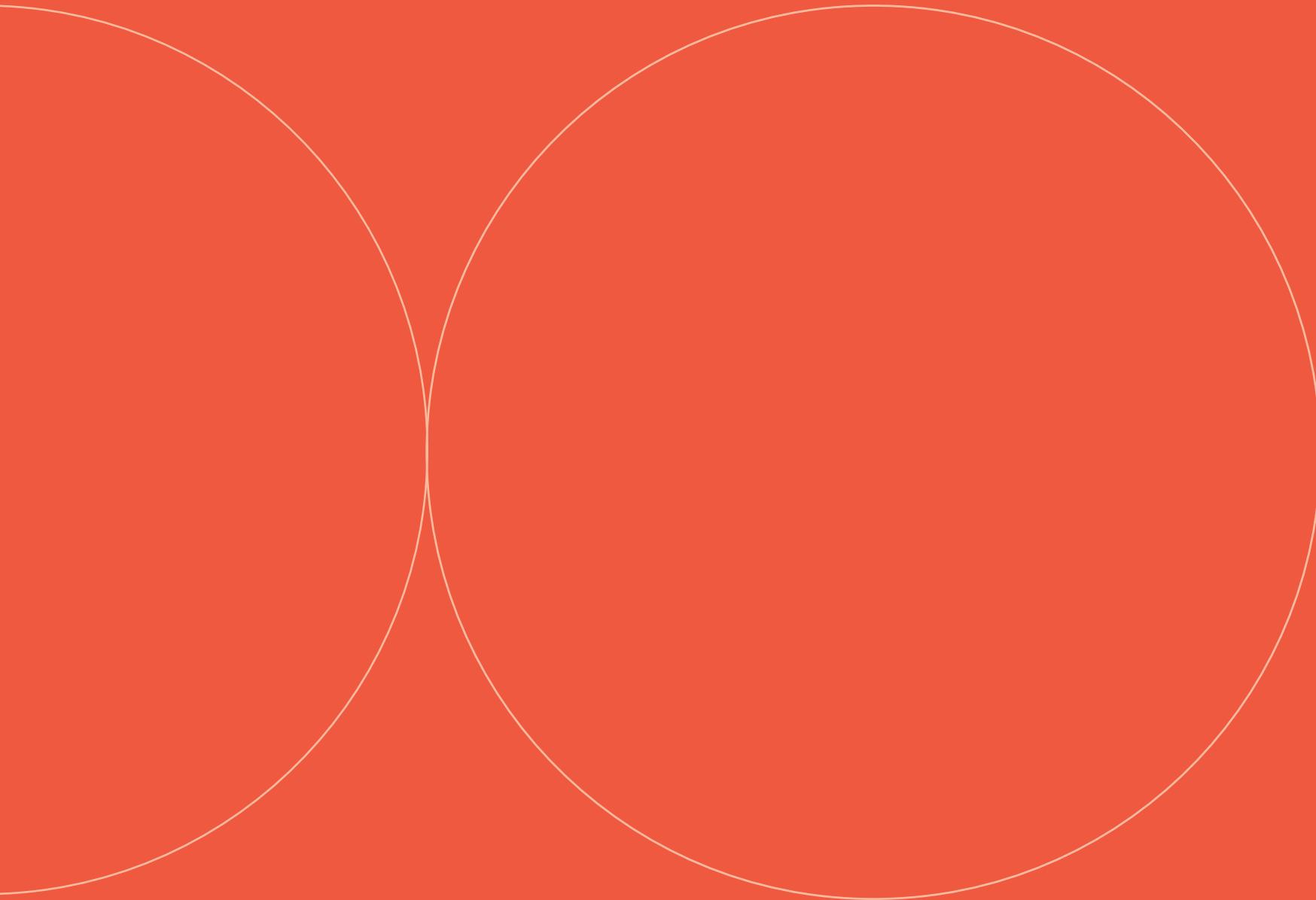
**The BBI JU Synergy Label initiative**, which entered its third year in 2021, was created to **provide these project proposals with an extra impetus** by formally acknowledging their potential and offering value and excellence.

This is possible through the application of the Synergy Label, **a unique BBI JU certification scheme that has already helped recognise the value and excellence of over 20 Innovation Actions proposals.**

The label can help boost the reputation of the recognised organisations and aid them in their search for alternative funding from EU organisations and funding bodies, Member States, and regions or private organisations. To assist projects that have been awarded the Synergy label, the BBI JU has signed Memoranda of Understanding with several **potential funding bodies** such as **the European Bank for**

**Reconstruction and Development** (reviewing proposals for potential funding), **the European Circular Bioeconomy Fund** (allowing Synergy label projects to access venture capital), **the European Investment Bank** (offering advice on appropriate financing strategies and capital structures). BBI JU has signed a collaboration agreement with the **European Forest Institute**, which develops new models, innovations, policies and investments in forest bioeconomy.'

# The way ahead





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**The BBI JU successfully demonstrated how an effective bioeconomy can work in practice and delivered tangible evidence of what can be achieved.**

By any measure, the BBI JU has been an **inspirational and visionary European success story, delivering concrete results and tangible environmental and socioeconomic value.** Through the partnerships it has established and projects it has supported, it has been **instrumental in developing Europe's bio-based industry sector and promoting a circular economy.** It is also playing a pivotal role in **helping the EU deliver on its economic and climate targets** outlined in the Green Deal and Bioeconomy Strategy.

## A great deal done, but a great deal left to do

The elements for a sustainable European bioeconomy are increasingly in place. It **already makes an important contribution to the EU economy**, being responsible for **close to five per cent of the EU's GDP** and **almost nine per cent of the workforce**. Although this process still has some distance to go – we are at an early stage on the journey foreseen by the EU – the **BBI JU has already outperformed expectations** in terms of concrete results.

## A plan for the coming years

To this end, the European Commission has published its **'European bioeconomy in 2050' vision for how it sees the transition to a green, digital, and fair Europe** coming about. In its first Strategic Foresight Report, entitled 'Charting A Course To A More Resilient Europe', the EU pointed to the **key role that developing clean, bio and circular production methods and services would play in Europe's future competitiveness and growth**.

The report highlighted how the EU's support for a sustainable bioeconomy aims to transform Europe's agricultural and industrial base by creating new bio-based value chains, as well as greener, more cost-effective industrial processes. As well as restoring and enhancing the current status of the EU's (and the world's) natural resources and ecosystems, **by 2030 bio-based industries could create up to a million new jobs**.

## And a long-term vision for the future

Given the undisputed success of the BBI JU initiative, and the success of the cooperation between the European Commission and industry, it should come as no surprise that **its successor Circular Bio-based Europe Joint Undertaking was established at the end of 2021.**



**Circular  
Bio-based  
Europe**  
Joint Undertaking

The new **€2 billion partnership is building on BBI JU's success while enlarging its scope and addressing the remaining challenges** of Europe's bio-based industries. **CBE JU is focusing on:**

**Supporting research and innovation** for sustainable bio-based solutions

**De-risking investments** in innovative, circular bio-based production plants

**Addressing the technological, regulatory, and market challenges** of the bioeconomy

Placing **sustainability at the heart** of its operations

**Strengthening the collaboration** of all bioeconomy actors

**Engaging with more stakeholders** along the value chains

The CBE JU, in addition to the European Green Deal, **presents an opportunity for Europe's bio-based industries** to continue their work and expand their contribution to the EU's flagship policy goals.

*'My hope is that the CBE JU can continue to stimulate innovation in the bio-based industry, paving the way for future investments and the realisation of ever-more ambitious projects. This way, I hope it will play an even more incisive role, solving both technological challenges and overcoming the regulatory and market challenges that still prevent and jeopardise the full realisation of the circular bioeconomy.'*

**Catia Bastioli** is CEO of Novamont, coordinator of the FIRST2RUN flagship project

Many of the European Green Deal's objectives are already aligned with those of the CBE JU – on biodegradable and bio-based plastics, reducing greenhouse gas emissions, and creating green jobs.

**The CBE JU will be at the centre of the EU's bio-based economy over the next decade**, leveraging the knowledge and experience that has been built up within the BBI JU and will be a key industrial partnership for the circular bioeconomy and a backbone of the European Green Deal.

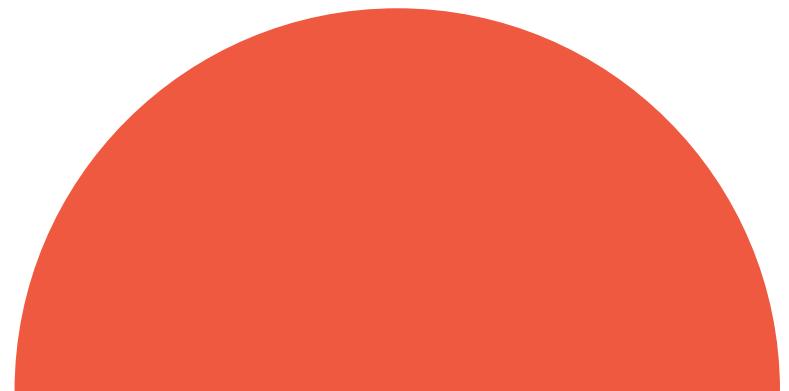
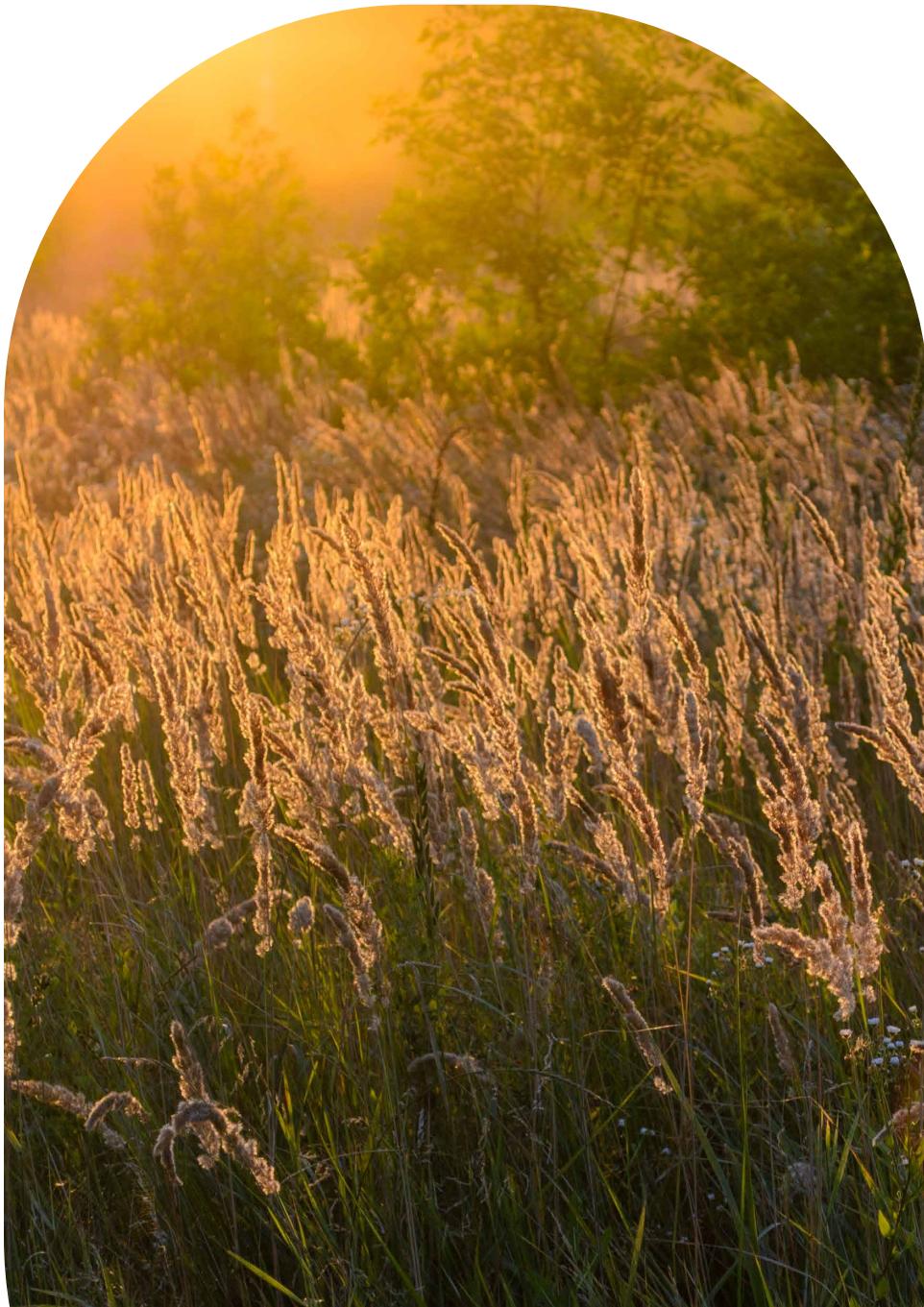


## An exciting and rewarding journey

It has been a long journey since the BBI JU's establishment in 2014, but also an exciting and rewarding one. It has proved successful and productive, with bio-based products and services increasing in range, scope, variety, and public acceptance. And perhaps most importantly, **it has created a solid foundation for the next phase of Europe's transition to a greener, circular economy.**

*'We can safely call the BBI JU one of the key contributors to the green transition in Europe. We can also be satisfied that it has successfully mobilised key actors in the bio-based sector, building bio-based value chains, contributing to the green recovery and de-risking investment making Europe an attractive region for investments.'*

**John Bell** is the 'Healthy Planet' Director in the European Commission's DG Research and Innovation (R&I) and Chair of the CBE JU's Governing Board.





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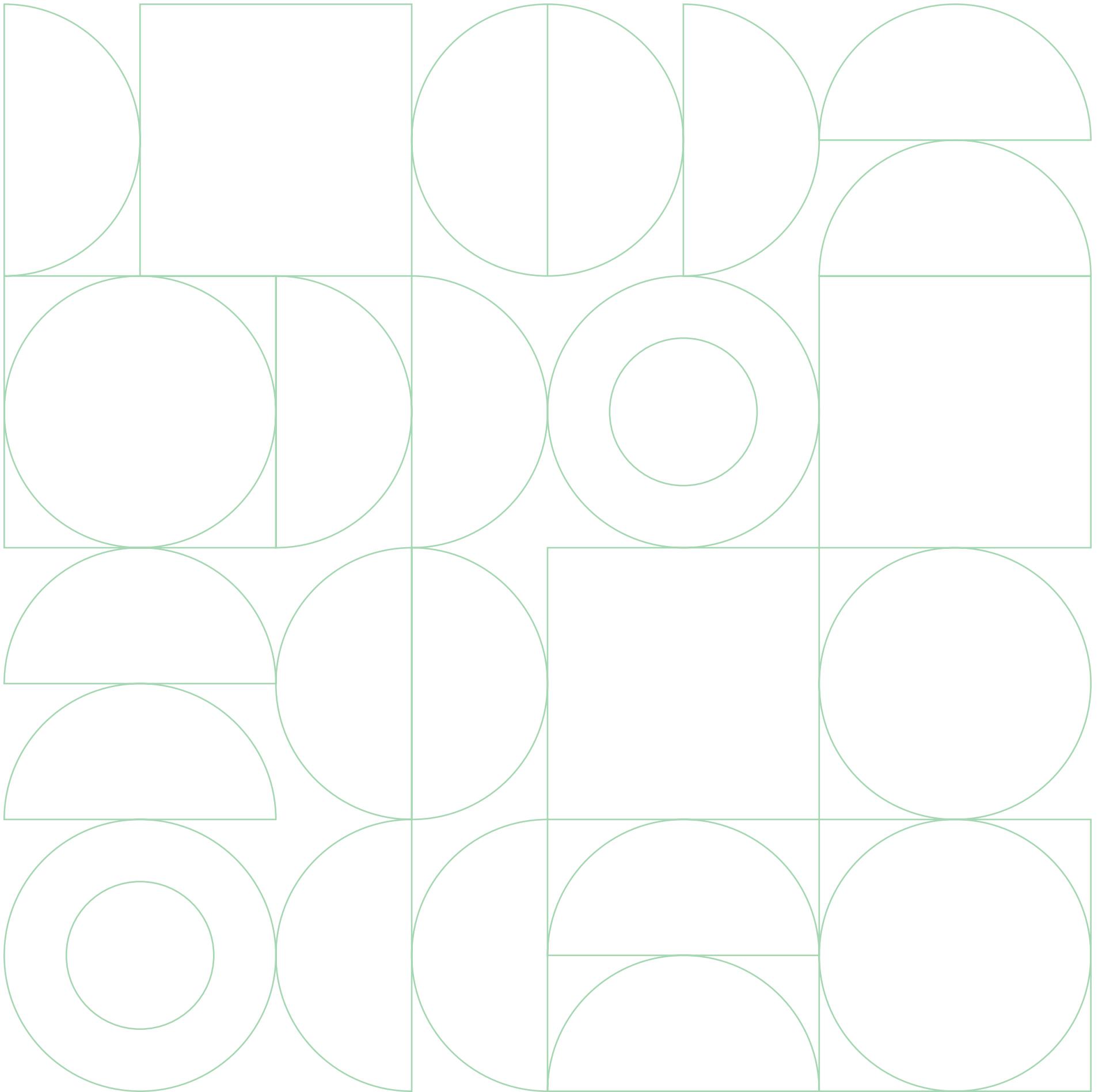
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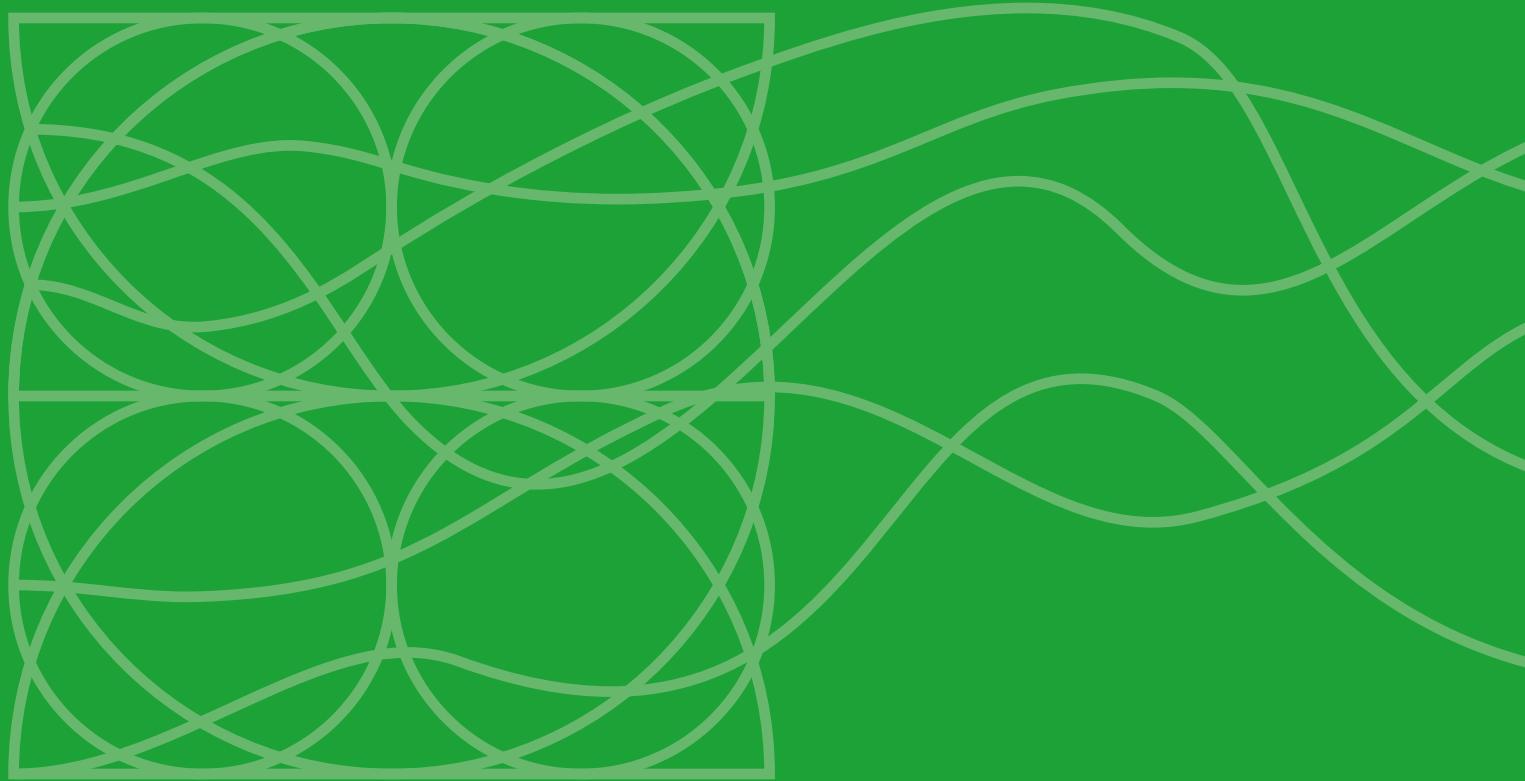
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