



Impact Assessment Study for Institutionalised European Partnerships under Horizon Europe

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Report



Research and
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Impact Assessment Study for Institutionalised European Partnerships under Horizon Europe

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Impact Assessment Study for Institutionalised European Partnerships under Horizon Europe

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In collaboration with

AECOM

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econometrics**
clarity from complexity

**CE
PS**

 **IDATE**
DIGIWORLD


Nomisma
SOCIETÀ DI STUDI ECONOMICI

steer

Think

Trinomics 

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Introduction

This Impact Assessment Study had the primary objective to support and provide input to the impact assessments of the first set of 13 European Institutionalised Partnerships based on Articles 185 and 187 of the Treaty on the Functioning of the EU (TFEU) that are envisaged to be funded under the new Framework Programme for Research and Innovation, Horizon Europe.

In addition, the Impact Assessment Study team contributed to future European policymaking on the overall European Partnership landscape by means of a horizontal analysis of the coherence and efficiency in the implementation of European partnerships. The purpose of this analysis was to draw the lessons learned from the implementation of the impact assessment methodology developed for this study and to formulate recommendations for the refinement and operational design of the criteria for the selection, implementation, monitoring, evaluation and phasing-out for the three types of European Partnerships. Finally, an impact modelling exercise was conducted in order to estimate the potential for longer-term future impacts of the candidate Institutionalised European partnerships in the economic and environmental sustainability spheres.

Technopolis Group was responsible for the overall coordination of the 13 specific impact assessment studies, the development of the common methodological framework, and the delivery of the horizontal analysis. It also conducted specific analyses that were common to all studies, acting as a 'horizontal' team, in collaboration with CEPS, IPM, Nomisma, and Optimat Ltd. For the implementation of the individual impact assessment studies, Technopolis Group collaborated with organisations that are key experts in specific fields covered by the candidate Institutionalised European Partnerships. These partner organisations were Aecom, Idate, Steer, Think, and Trinomics. Cambridge Econometrics took charge of the impact modelling exercise.

The Impact Assessment Study was conducted between July 2019 and January 2020. The 13 Impact Assessment Studies were conducted simultaneously, based upon a common methodological framework in order to maximise consistency and efficiency. The meta-framework reflected the Better Regulation Guidelines and operationalised the selection criteria for European Partnerships set out in the Horizon Europe Regulation. The 'Horizontal analysis of efficiency and coherence of implementation' was conducted in the same time period, building upon the information available on the 44 envisaged European Partnerships landscape as in May 2019, complemented with information on five envisaged European Partnerships as decided by the European Commission in October and November 2019.

This final report contains the reports of all individual impact assessment studies and the 'horizontal' analyses. It is structured in two parts, reflecting the two strands of analysis:

PART I. Impact Assessment Studies for the Candidate Institutionalised European Partnerships

1. Overarching context to the impact assessment studies

This report sets out the overall policy context and methodological framework underlying the impact assessment studies for the candidate Institutionalised European Partnerships. It describes the changes in approach to the public-private and public-public partnerships under Horizon Europe compared to the previous EU Framework Programmes. An example is the requirement that all envisaged European Partnerships be implemented as either co-programmed, co-funded or institutionalised. The impact assessment studies will consider these three scenarios as the different options to be assessed, in compliance with the Better Regulation guidelines and against the functionalities that the candidate partnerships are expected to fulfil. The report describes the common methodological framework to assess the envisaged initiatives accordingly. The report also presents the landscape of European Partnerships at the level of Horizon Europe Pillar 2 clusters, which lay the grounds for all

of the impact assessment studies except the candidate Institutionalised European Partnership for Innovative SMEs.

2. EU-Africa Global Health Candidate Institutionalised European Partnership

This initiative focuses on research and innovation in the area of infectious diseases, with a particular focus on sub-Saharan Africa. It will address the challenges of a sustained high burden of infectious diseases in Africa, as well as the (re)emergence of infectious diseases worldwide. Its objectives will thus be to contribute to a reduction of the burden of infectious diseases in sub-Saharan Africa and to the control of (re)emerging infectious diseases globally. It will do so through investments in relevant research and innovation actions, as well as by supporting the further development of essential research capacity in Africa. The study concluded that an Institutionalised Partnership under Art. 187 of the TFEU is the preferred option for the implementation of this initiative.

3. Candidate Institutionalised European Partnership on Innovative Health

This initiative focuses on supporting innovation for health and care within the EU. It will address the EU-wide challenges raised by inefficient translation of scientific knowledge for use in health and care, insufficient innovative products reaching health and care services and threats to the competitiveness of the health industry. Its main objectives are to create an EU-wide health R&I ecosystem that facilitates translation of scientific knowledge into innovations; foster the development of safe, effective, patient-centred and cost-effective innovations that respond to strategic unmet public health needs currently not served by industry; and drive cross-sectoral health innovation for a globally competitive European health industry. The study concluded that an Institutionalised Partnership based on Article 187 of the Treaty on the Functioning of the EU (TFEU) is the preferred option for the implementation of this initiative.

4. Candidate Institutionalised European Partnership in High Performance Computing

The initiative focuses on coordinating efforts and resources in order to deploy a European HPC infrastructure together with a competitive innovation ecosystem in terms of technologies, applications, and skills. It will address the challenges raised by underinvestment, the lack of coordination between the EU and MS, fragmentation of instruments, technological dependency on non-EU suppliers, unmet scientific demand, and weaknesses in the endogenous HPC supply chain. The initiative has as its main objectives to enhance EU research in terms of HPC and related applications, continued support for the competitiveness EU HPC industry, and fostering digital autonomy in order to ensure long-term support for the European HPC ecosystem as a whole. The study concluded that an Institutionalised Partnership is the preferred option for the implementation of this initiative as it maximises benefits in comparison to the other available policy options.

5. Candidate Institutionalised European Partnership in Key Digital Technologies

This initiative focusses on enhancing the research, innovation and business value creation of European electronics value chains in key strategic market segments in a sustainable manner to achieve technological sovereignty and ultimately make European businesses and citizens best equipped for the digital age. It will address the risks of Europe losing the lead in critical industries and services and emerging KDTs. It will also tackle Europe's limited control over digital technologies that are critical for EU industry and citizens. It has as main objectives to strengthen KDTs which are critical for the competitive position of key European industries in the global markets, to establish European leadership in emerging technologies with high socioeconomic potential and to secure Europe's technological sovereignty to maintain a strong and globally competitive presence in KDTs. The study concluded that the Institutionalised Partnership is the preferred option for the implementation of this initiative.

6. Candidate Institutionalised European Partnership in Smart Networks and Services

This initiative focuses on the development of future networks infrastructure and the associated services. This includes bringing communication networks beyond 5G and toward 6G capabilities, but also the development of the Internet of Things and Edge Computing technologies. It will address the challenges raised by Europe delay in the deployment of network infrastructure and failure to fully benefit from the full potential of digitalisation. It has as main objective to ensure European technological sovereignty in future smart networks and digital services, to strengthen the uptake of digital solutions, and to foster the development of digital innovation that answers to European needs and that are well aligned with societal needs. The study concluded that an institutionalised partnership under article 187 is the preferred option for the implementation of this initiative.

7. Candidate Institutionalised European Partnership in Metrology

This initiative focuses on metrology - that is the science of measurement and the provision of the technical infrastructure that underpins accurate and robust measurements throughout society; measurements that underpin all domains of science and technology and enable fair and open trade and support innovations and the design and implementation of policy and regulations. It will address challenges in the fragmentation of national metrology systems across Europe and the need to meet ever-increasing demands on metrology infrastructure to support the measurement needs of emerging technologies and important policy domains in climate, environment, energy and health. The main objective of the initiative is to establish a sustainable coordinated world-class metrology system in Europe that will increase and accelerate the development and deployment of innovations and contribute to the design and implementation of policy, regulation and standards. The study concluded that an A185 Institutionalised Partnership is the preferred option for the implementation of this initiative.

8. Candidate Institutionalised European Partnership on Transforming Europe's Rail System

This initiative focuses on the development of a pan-European approach to research and innovation in the rail sector. It will address the challenges raised by the lack of alignment of research and innovation with the needs of a competitive rail transport industry and the consequent failure of the European rail network to make its full contribution to European societal objectives. It will also strengthen the competitiveness of the European rail supply industry in global markets. Accordingly, the objectives of the initiative are to ensure a more market-focused approach to research and innovation, improving the competitiveness and modal share of the rail industry and enhancing its contribution to environmental sustainability as well as economic and social development across the European Union. The study concluded that an institutionalised partnership under article 187 is the preferred option for the implementation of this initiative.

9. Candidate Institutionalised European Partnership for Integrated Air Traffic Management

This initiative focuses on the modernisation of the Air Traffic Management in Europe - an essential enabler of safe and efficient air transport and a cornerstone of the European Union's society and economy. The proposed initiative will address the challenges raised by an outdated Air Traffic Management system with a non-optimised performance. The current system needs to be transformed to enable exploitation of emerging digital technologies and to accommodate new forms of air vehicle including drones. The objective is therefore to harmonise European Air Traffic Management system based on high levels of digitalisation, automation and connectivity whilst strengthening air transport, drone and ATM markets competitiveness and achieving environmental, performance and mobility goals. This would create €1,800b benefits to the EU economy if the current initiative can

be built on and accelerated. The study concluded that an Institutionalised Partnership under Art. 187 TFEU is the preferred option for the implementation of this initiative.

10. Candidate Institutionalised European Partnership on Clean Aviation

This initiative focuses on further aeronautical research and innovation to improve technology leading to more environmentally efficient aviation equipment. It will address the challenges raised by the growing ecological footprint of aviation and the challenges and barriers faced by the aviation industry towards climate neutrality. It will also strengthen the competitiveness of the European aeronautical industry in global markets. Accordingly, the objectives of the initiative are to ensure that aviation reaches climate neutrality and that other environmental impacts are reduced significantly by 2050, maintain the leadership and competitiveness of the European aeronautics industry and ensure safe, secure and efficient air transport of passengers and goods. The Impact Assessment study assessed the options for implementation that would allow for an optimal attainment of these objectives. The study concluded that an institutionalised partnership under Art. 187 TFEU is the preferred option for the implementation of this initiative.

11. Candidate Institutionalised European Partnership on Clean Hydrogen

The report assesses the impact of potential initiatives to support, through research and innovation, the growth and development of clean hydrogen, among which an Institutionalised European Partnership is one of the options assessed. The existing challenges for clean hydrogen include the limited high-level scientific capacity and fragmented research activities, the insufficient deployment of hydrogen applications, and consequently weaker EU scientific and industrial value chains. Environmental, health and mobility pressures are also driving the need for cleaner hydrogen generation, deployment and use. An initiative for clean hydrogen must have as a main objective the strengthening and integration of EU scientific capacities, to support the creation, capitalisation and sharing of knowledge. This is necessary to accelerate the development and improvement of advanced clean hydrogen applications, the market entry of innovative competitive clean solutions, to strengthen the competitiveness of the EU clean hydrogen value chains (and notably the SMEs within them), and to develop the hydrogen-based solutions necessary to reach climate neutrality in the EU by 2050. The study concluded that an Institutionalised Partnership under Art. 187 TFEU is the preferred option for the implementation of this initiative.

12. Candidate Institutionalised European Partnership on Safe and Automated Road Transport

This initiative focuses on Connected, Cooperative and Automated Mobility: the use of connected and automated vehicles to create more user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation. With current road traffic collisions and negative local and global environmental impacts not reducing quickly enough, it will address the challenges raised by the current fragmentation of research across the field, and the threat to European competitiveness if the research agenda does not advance quickly enough. The initiative will focus on strengthening EU scientific capacity and economic competitiveness in the field of CCAM, whilst contributing to wider societal benefits including improved road safety, less environmental impact, and improved accessibility to mobility. The study concluded that a co-programmed partnership is the preferred option for the implementation of this initiative.

13. Candidate Institutionalised European Partnership for a Circular Bio-based Europe

This initiative focuses on intensifying research and innovation allowing to replace, where possible, non-renewable fossil and mineral resources with biomass and waste for the production of renewable products and nutrients, in order to drive forward sustainable and climate-neutral solutions that accelerate the transition to a healthy planet and respect

planetary boundaries. It will address the challenges raised by the fact that the EU economy does not operate within planetary boundaries, is not sufficiently circular and is predominantly fossil based. It will also address the insufficient research and innovation (R&I) capacity and cross-sectoral transfer of knowledge and bio-based solutions, as well as risks posed to the European bio-based industry's global competitiveness. The study concluded that Institutionalised European Partnership based upon Article 187 TFEU is the preferred option for the implementation of this initiative.

14. Candidate Institutionalised European Partnership for Innovative SMEs

The initiative is envisaged as a continuation of the Eurostars 2 programme which is managed by the Eureka network. The initiative focuses on international collaborative R&D of innovative companies, facilitated through a network of national funding organisations as included in the Eureka network. The funded projects are bottom-up and involve small numbers of project partners. The candidate partnership addresses a niche issue namely limited opportunities for international bottom-up collaboration. The partnership provides thus an opportunity for SMEs for international R&D collaboration but does not address specific technological, social, or environmental challenges. Its main objective is to improve the competitiveness of European SMEs through collaborative funding. The study concluded that a co-funded partnership is the preferred option for the implementation of this initiative.

PART II. Horizontal studies

1. Horizontal Analysis of Efficiency and Coherence in Implementation

The focus of this report is on the coherence and efficiency in the current European Partnership landscape under Horizon Europe and the potential to enhance efficiency in the European Partnerships' implementation.

European Partnerships are geared towards playing a pivotal role in tackling the complex economic and societal challenges that constitute the R&I priorities of the Horizon Europe Pillar II and are in a unique position to address transformational failures. Multiple potential interconnections and synergies exist between the candidate European Partnerships within the clusters, but few are visible across the clusters.

As for the improvement of the efficiency in implementation of institutionalised partnerships under Art. 187, potential efficiency and effectiveness gains could be achieved with enhanced collaboration. An option for a common back-office sharing operational implementation activities is worth exploring further through a detailed feasibility study in order to assess whether efficiency gains can be made. Ideally this would be co-designed as a common Partnership approach, leading to a win-win situation for all partners.

2. Impact Modelling of the Candidate Institutionalised European Partnerships

This report presents the results of the use of a macroeconomic model to assess the economic and environmental impacts of the preferred options identified in the individual 13 impact assessment studies. The model used is E3ME. It includes explicit representation for each EU Member State with a detailed sectoral disaggregation.

The impact modelling estimated the impacts of the envisaged initiatives at an aggregated as well as individual level. In total, 14 macroeconomic models have been run, one per reviewed initiative with a time horizon of 2035 and one that combines all initiatives with a time horizon of 2050. The results of each of these models were compared with those of a baseline scenario, which corresponds to a situation where the initiatives would be funded through regular Horizon Europe calls rather than European Partnerships.

Part I. Impact Assessment Studies for the Candidate Institutionalised European Partnerships

1. Overarching Context to the Impact Assessment Studies

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Introduction

This report sets out the overall policy context of the impact assessment studies for the candidate Institutionalised European Partnerships and the methodological framework that was developed for the impact assessment studies.

It describes the changes in approach to the public-private and public-public partnerships under Horizon Europe compared to the previous EU Framework Programmes. An example is the requirement that all envisaged European Partnerships be implemented as either co-programmed, co-funded or institutionalised. The impact assessment studies will consider these three scenarios as the different options to be assessed, in compliance with the Better Regulation guidelines and against the functionalities that the candidate partnerships are expected to fulfil. The report describes the common methodological framework to assess the envisaged initiatives accordingly.

The report also presents the landscape of European Partnerships at the level of Horizon Europe Pillar 2 clusters, which lay the grounds for all of the impact assessment studies except the candidate Institutionalised European Partnership for Innovative SMEs. This analysis is presented in more depth in the report on the 'Horizontal analysis of efficiency and coherence of implementation' in Part II of the Impact Assessment Study report.

The report is structured around two main headings:

- Chapter 1: Background and context to European Partnerships in Horizon Europe and focus of the impact assessment– What is decided
- Chapter 2: The Candidate European Partnerships under Horizon Europe – What needs to be decided

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1 Background and context to European Partnerships in Horizon Europe and focus of the impact assessment– What is decided

1.1 The political and legal context

1.1.1 Shift in EU priorities and Horizon Europe objectives

Horizon Europe is to be set in the broader context of the pronounced **systemic and holistic approach** taken to the design of the new Framework Programme and the overarching Multi-annual Financial Framework (MFF) 2021-27.

The future long-term budget will be a budget for the Union's priorities. In her Political Guidelines for the next European Commission 2019 – 2024, the new President of the European Commission put forward six overarching priorities for the next five years, which reach well beyond 2024 in scope: A European Green Deal; An economy that works for people; A Europe fit for the Digital Age; Protecting our European way of life; A stronger Europe in the world; and A new push for European democracy. These priorities build upon A New Strategic Agenda for 2019–2024, adopted by the European Council on 20 June 2019, which targets similar overarching objectives. Together with the United Nations Sustainable Development Goals (SDGs), they will shape future EU policy responses to the challenges Europe faces and will steer the ongoing transitions in the European economy and society,

The MFF 2021-27 strives to provide a framework that will ensure a more coherent, focused and transparent response to Europe's challenges. A stronger focus on European added value, a more streamlined and transparent budget, more flexibility in order to respond quickly and effectively to unforeseen demands, and above all, an effective and efficient implementation are among the key principles of the MFF. The objective is to strengthen the alignment with Union policies and priorities and to simplify and reform the system in order to "unlock the full potential of the EU budget" and "turn ambitions into reality". Investment from multiple programmes is intended to combine in order to address key crosscutting priorities such as the digital economy, sustainability, security, migration, human capital and skills, as well as support for small businesses and innovation.¹

These principles underlying the MFF 2021-27 are translated in the intent for Horizon Europe "to play a vital role, in combination with other interventions, for creating new solutions and fostering innovation, both incremental and disruptive."² The new Framework Programme finds its rationale in the daunting challenges that Europe is facing, which call for "a radical new approach to developing and deploying new technologies and innovative solutions for citizens and the planet on a scale and at a speed never achieved before, and to adapting our policy and economic framework to turn global threats into new opportunities for our society and economy, citizens and businesses."

In the Orientations towards the first Strategic Plan for Horizon Europe, the need strategically to prioritise and "direct a substantial part of the funds towards the areas where we believe they will matter the most" is emphasised. The Orientations specify, "Actions under Pillar II of Horizon Europe will target only selected themes of especially high impact that significantly contribute to delivering on the political priorities of the Union."

Figure 1, below, which gives an indicative overview of how the EU political priorities are supported under Horizon Europe, shows the major emphasis placed on contributing to the priority 'A European Green Deal', aimed at making Europe the first climate-neutral

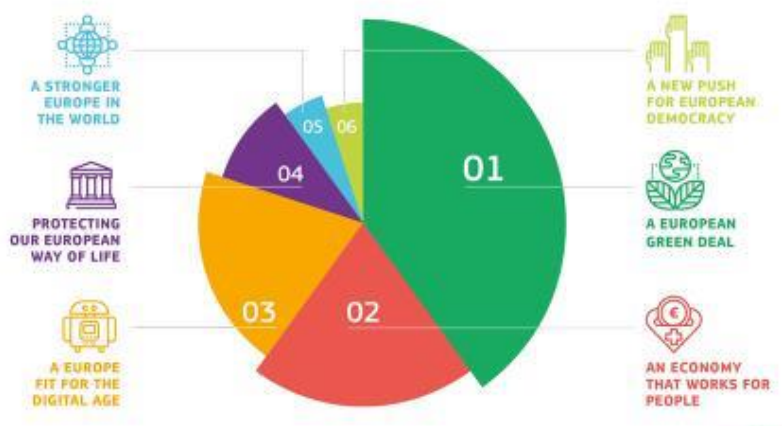
¹ EC (2018) *A Modern Budget for a Union that Protects, Empowers and Defends. The Multiannual Financial Framework for 2021-2027*. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2018) 321 final

² EC (2019), *Orientations towards the first Strategic Plan for Horizon Europe*.

continent in the world. At least 35 % of the expenditure from actions under the Horizon Europe Programme will address the Sustainable Development Goal 13: Climate Action.

Especially the R&I activities funded under Pillar II, including seven Partnership Areas (see below), are expected to contribute to the attainment of these objectives in an interconnected manner.

Figure 1: Targeted impacts under Horizon Europe by priority



Note: Preliminary, as described in the General orientations towards the first Strategic Plan implementing Horizon Europe.
Source: European Commission (2019) Orientations towards the first Strategic Plan for Horizon Europe, December 2019.

1.1.2 Renewed ambition for European Partnerships

Reflecting its pronounced systemic nature aimed at ‘transformation’ of the European R&I system, Horizon Europe intends to make a more effective use of these partnerships with an **ambitious approach** that is impact oriented and ensures complementarity with the Framework Programme. The **rationalisation** of the partnership landscape, both in terms of number of partnership forms and individual initiatives, constituted a first step in the direction of the strategic role that these policy initiatives are expected to play in the context of Horizon Europe. Future partnerships are expected to “provide mechanisms to consistently aggregate research and innovation efforts into more effective responses to the policy needs of the Union”.³ The expectation is that they will act as **dynamic change agents**, strengthening linkages within their respective ecosystems and with other related ecosystems as well as pooling resources and efforts towards the common objectives in the European, national and regional landscape. They are expected to develop *close synergies* with national and regional programmes, bring together a *broad range of actors* to work towards a common goal, translate *common priorities* into concrete roadmaps and coordinated activities, and turn research and innovation into *socio-economic results and impacts*.

The exact budget dedicated to European Partnerships under Horizon Europe will be agreed only upon decisions on the multiannual financial framework (MFF) 2021-2027 and the overall budget for Horizon Europe. In December 2017, the Council nevertheless introduced the principle of a “possible capping of partnership instruments in the FP budget”.⁴ Accordingly, it reached the common understanding, with the European Parliament, that “the majority of the budget in Pillar II [€52.7bn] shall be allocated to actions outside of

³ European Commission (2019) *Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe*. Co-design via web open consultation. Summer 2019.

⁴ Council of the European Union (2017) *From the Interim Evaluation of Horizon 2020 towards the ninth Framework Programme*. Council conclusions 15320/17.

European Partnerships” (Article 8.2(a) of the Common Understanding on the proposal for a regulation establishing Horizon Europe).⁵

1.1.3 Key evolutions as regards the partnership approach

The European R&I partnerships were initially conceived as a means to increase synergies between the European Union and the Member States (Article 181 of the Treaty on the Functioning of the European Union TFEU). Their objectives were to pool the forces of all the relevant actors of R&I systems to achieve breakthrough innovations; strengthen EU competitiveness; and, tackle major societal challenges. The core activities of the European partnerships consist therefore of building critical mass mainly through collaborative projects, jointly developing visions, and setting strategic agendas. They help accelerate the emergence of a programming approach in European R&I with the involvement of all relevant actors and provide flexible structures for partnerships that can be tailored to their goals.⁶

In the consecutive Framework Programmes up to the current Horizon 2020, the partnerships and their forms have mushroomed, leading to an increasing complexity of the partnership landscape. The Horizon 2020 interim evaluation highlighted that the overall landscape of EU R&I funding had become overly complex and fragmented, and a need to improve the partnerships’ openness and transparency. The Lamy report suggested that the European Partnerships should focus on those areas with the greatest European Added Value, contribute to EU R&I missions and would need a simplified and flexible co-funding mechanism.

The Competitiveness Council conclusions of December 2017 called on the Commission and the Member States to jointly consider ways to rationalise the EU R&I partnership landscape. In 2018, the ERAC Ad-hoc Working Group on Partnerships concluded, “the rationalisation of the R&I partnership landscape is needed in order to ensure that the portfolio of R&I partnerships makes a significant contribution to improving the coherence, functioning and quality of Europe's R&I system and that the individual initiatives are able to fully achieve their potential in creating positive scientific and socio-economic impacts and/or in addressing societal challenges”.

Horizon Europe has taken on board these concerns. The Impact Assessment of Horizon Europe gave a clear analysis of the achievements of Partnerships so far as well as the expectations for the new generation of Partnerships. Greater transparency and openness of the partnerships were considered as essential, as well a clear European added value and long-term commitments of the stakeholders involved.

A list of criteria to decide how European Partnerships will be selected, implemented, monitored, evaluated and phased-out was attached as an Annex III to the proposal to establish Horizon Europe (as revised by the partial political agreement). The rationalisation of the Partnership portfolio in Horizon Europe is expected to allow for a reduction from the current 120 to between 45 and 50 partnerships.

⁵ Council of the European Union (2019) *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rule for participation and dissemination*. Common understanding 7942/19.

⁶ European Commission (2011) *Partnering in Research and Innovation*. Communication from the Commission COM(2011) 572 final.

1.1.4 Overview of legal provisions

The Horizon Europe Regulation (common understanding) defines 'European Partnership' as "an initiative where the Union, prepared with early involvement of Member States and/or Associated Countries, together with private and/or public partners (such as industry, universities, research organisations, bodies with a public service mission at local, regional, national or international level or civil society organisations including foundations and NGOs), commit to jointly support the development and implementation of a programme of research and innovation activities, including those related to market, regulatory or policy uptake." It stipulates that "parts of Horizon Europe may be implemented through European Partnerships".

The Horizon Europe Regulation (common understanding) also stipulates that the European Partnerships are expected to adhere to the "principles of Union added value, transparency, openness, impact within and for Europe, strong leverage effect on sufficient scale, long-term commitments of all the involved parties, flexibility in implementation, coherence, coordination and complementarity with Union, local, regional, national and, where relevant, international initiatives or other partnerships and missions." The provisions and criteria set out for the selection and implementation of the European Partnerships reflect these principles.

1.1.5 Overview of the eight Partnership areas

The Horizon Europe Regulation also identifies the following "Areas for possible institutionalised European Partnerships on the basis of Article 185 TFEU or Article 187 TFEU":

- Partnership Area 1: Faster development and safer use of health innovations for European patients, and global health.
- Partnership Area 2: Advancing key digital and enabling technologies and their use, including but not limited to novel technologies such as Artificial Intelligence, photonics and quantum technologies.
- Partnership Area 3: European leadership in Metrology including an integrated Metrology system.
- Partnership Area 4: Accelerate competitiveness, safety and environmental performance of EU air traffic, aviation and rail.
- Partnership Area 5: Sustainable, inclusive and circular bio-based solutions.
- Partnership Area 6: Hydrogen and sustainable energy storage technologies with lower environmental footprint and less energy-intensive production.
- Partnership Area 7: Clean, connected, cooperative, autonomous and automated solutions for future mobility demands of people and goods.
- Partnership Area 8: Innovative and R&D intensive small and medium-sized enterprises.

Considering the realm of these partnership areas, potential synergies exist with the future **missions**. Horizon European introduced these cross-discipline and cross-sector policy instruments as part of its core objective of stimulating further excellence-based and impact-driven R&I. In contrast with the challenges targeted in Horizon 2020, the missions aim at the achievement of well-defined goals to provide solutions, within a specified timeframe, to scientific, technological, economical and/or societal problems. As part of the preparation of Horizon Europe, the European Commission set up five boards to formulate the future missions in the following areas:

- Adaptation to climate change including societal transformation

- Cancer
- Healthy oceans, seas, coastal and inland waters
- Climate-neutral and smart cities
- Soil health and food

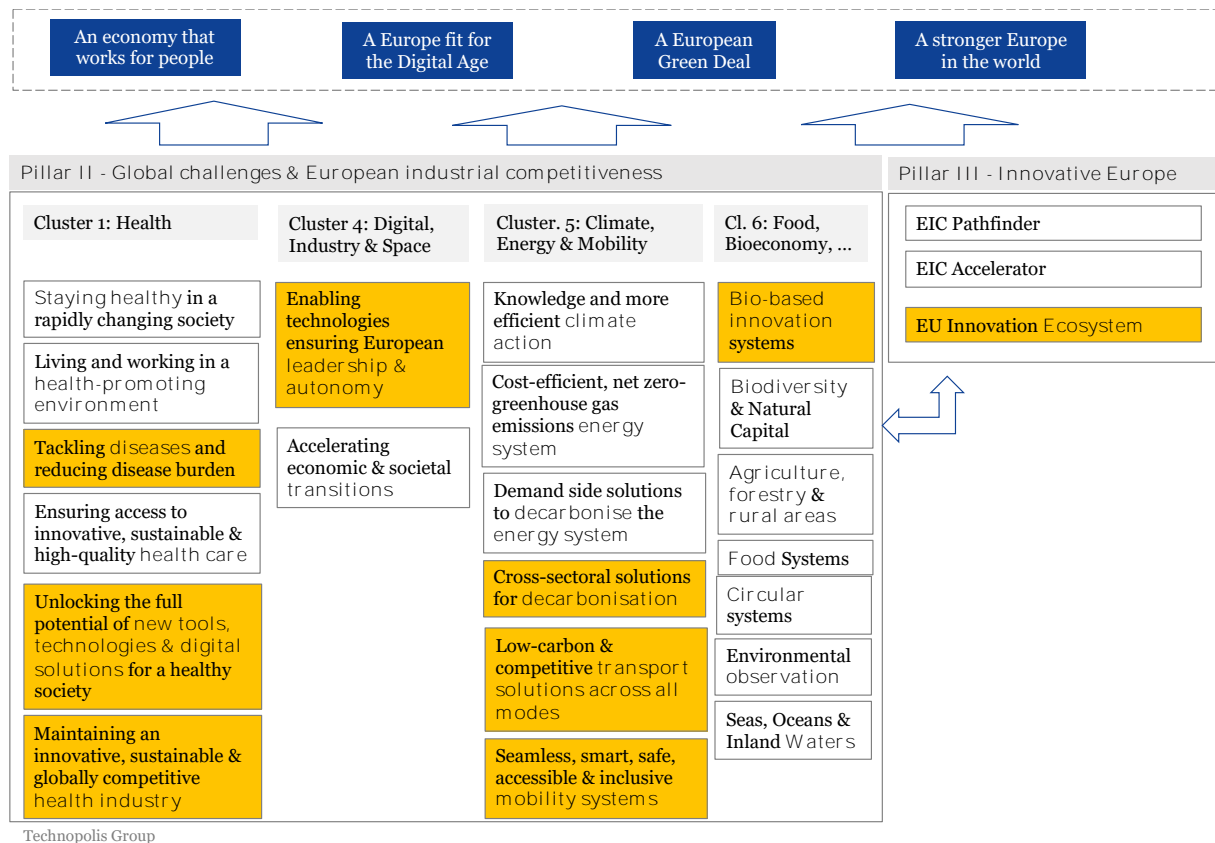
1.2 Typical problems and problem drivers

The European Partnerships are integral part of the framework programme and its three-pillar structure. They are predominantly funded under Pillar 2 “Global Challenges and European industrial competitiveness” and four of its thematic clusters. These clusters cover sectors and technologies, in which research and innovation activities are deemed of crucial importance in solving pressing scientific, societal or economic challenges and ensuring the scientific, technological and industrial leadership of Europe. Only one European Partnership, targeting innovative and R&D intensive SMEs, will instead act under Pillar 3 “Innovative Europe”.

The European Partnerships are intended to contribute to the attainment of the pillars’ and clusters’ **challenges and R&I priorities**. Overarching EU policy priorities addressed are predominantly the European Green Deal, a people-centred economy, the fit for the Digital Age, and a stronger Europe in the world.

In Figure 2, below, the R&I priorities in the Pillars II and III to which the candidate *Institutionalised* Partnerships intend to contribute are highlighted in yellow.

Figure 2: Contribution of Candidate European Institutionalised Partnerships to the Horizon Europe priorities in Pillars II and III



The European Partnerships under Horizon Europe most often find their rationale in addressing **systemic failures**. Their primary function is to create a platform for a strengthened collaboration and knowledge exchange between various actors in the European R&I system and an enhanced coordination of strategic research agenda and/or R&I funding programmes.

The concentration of efforts and resources and pooling of knowledge, expertise and skills on common priorities in a view of solving complex and multi-faceted societal and economic challenges is at the core of these initiatives. Enhanced cross-disciplinary and cross-sectoral collaboration and an improved integration of value chains and ecosystems are among the key objectives of these policy instruments. In the light of Horizon Europe, the aim often is to drive system transitions and transformations.

Especially in fast-growing technologies and sectors such as ICT, the envisaged European Partnerships also react on emerging opportunities and address systemic failures such as shortage in skills or critical mass or cross-sectoral cooperation along the value chains that would hamper attainment of future European leadership and/or strategic autonomy.

Transformational failures addressed aim at reaching a better alignment of the strategic R&I agenda and policies of public and private R&I funders in order to pool available resources, create critical mass, avoid unnecessary duplication of research and innovation efforts, and leverage sufficiently large investments where needed but hardly achievable by single countries.

Market failures are less commonly addressed and relate predominantly to enhancing industry investments thanks to the sharing of risks.

1.3 Description of the options

The proposal for a regulation establishing Horizon Europe⁷ stipulates that parts of the Horizon Europe Framework Programme may be implemented through European Partnerships and establishes three implementation modes: Co-programmed European Partnerships, Co-funded European Partnerships, and Institutionalised Partnerships in accordance with Article 185 TFEU or Article 187 TFEU.

1.3.1 Baseline option – Traditional calls under the Framework Programme

Under this option, strategic programming for research and innovation in the field will be done through the mainstream channels of Horizon Europe. The related priorities will be implemented through traditional calls under the Framework Programme covering a range of activities, but mainly calls for R&I and/or innovation actions. Most actions involve consortia of public and/or private actors in ad hoc combinations, some actions are single actor (mono-beneficiary). There will be no dedicated implementation structures and no further support other than the Horizon Europe actions foreseen in the related Horizon Europe programme or cluster.

Strategic planning mechanisms in the Framework Programmes allow for a high level of flexibility in their ability to respond to particular needs over time, building upon additional input in co-creation from stakeholders and programme committees involving MS. The broad scope of the stakeholders providing their input to the research agenda, however, implies a lower level of directionality than what can be achieved through the partnerships. Often, the long-term perspective of the stakeholder input is limited, which risks reducing strategic capacity in addressing priorities.

The Horizon Europe option also implies a lower level of EU budgetary long-term commitment for the priority. Without a formal EU partnership mechanism, it is also less likely that the stakeholders will develop a joint Strategic Research Agenda and commit to its implementation or agree on mutual financial commitments beyond the single project participation.

⁷ Proposal for a Regulation of the European Parliament and of the Council establishing Horizon Europe - the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination - Common understanding', March 2019

1.3.2 European Partnership

All European Partnerships will be designed in line with the new policy approach for more objective-driven and impactful partnerships. They are based on the common criteria in Annex III of the Horizon Europe Regulation, with few distinguishing elements for the different forms of implementation. All European Partnerships will be based on an agreed Strategic Research and Innovation Agenda / roadmap agreed among partners and with the Commission. For each of them the objectives, key performance and impact indicators, and outputs to be delivered, as well as the related commitments for financial and/or in-kind contributions of the partners will be defined ex-ante.

Option 1 - Co-programmed European Partnership

This form of European Partnership is based upon a *Memorandum of Understanding* or a *Contractual Arrangement* signed by the European Commission and the private and/or public partners. Private partners are typically represented by one or more industry association, which also functions as a back-office to the partnership. It allows for a *high flexibility* in the profile of organisation involved, objectives pursued, and/or activities implemented.

Co-programmed European Partnerships address *broader communities* across a diverse set of sectors and/or value chains and where the actors have *widely differing capacities and capabilities*. They may encompass one or more associations of organisations from industry, research, NGOs etc as well as foundations and national R&I funding bodies, with no restriction on the involvement of international partners from Associated and non-associated third countries. Different configurations are possible: private actors only, public entities only, or a combination of the two.

The basis, as for all European Partnerships, is the rationale is to create a *platform for 'concertation'*, i.e. in-depth and ongoing consultation of the relevant actors in the European R&I system for the co-development of a strategic research and Innovation agenda, typically covering the period of the next 10 years. The primary ambition is to generate *commitment to a common strategic research and innovation agenda* (SRIA). For the private actors involved, this would allow for a de-risking of their R&I investments and provide predictability of investment paths, for the public actors, it serves as a means to: inform national policy-makers on EU investments and allows for coordination and alignment of their efforts to support R&I in the field at the national level.

The *level of 'additionality is possibly lower than for other partnerships*. There is no expectation of a legally binding commitment from the partners to taking an integrated approach in their individual R&I implementation and it is based on 'best efforts'. However, the Union contribution to the partnership is defined for the full duration and has a comparable level of certainty for the partnerships than in the other forms of implementation. The priorities for the calls, proposed by the partnership members for integration in the Framework Programme Work Programmes, are subject to further input from Member States (comitology) and Commission Services. The full implementation of the Union contribution in the Framework Programme implies that the full array of Horizon Europe funding instruments in the related Pillar can be used, ranging from RIAs to CSAs and including grants, prizes, and procurement.

Option 2 – Co-funded European Partnership

The Co-funded Partnership is based on a Grant Agreement between the Commission and the consortium of partners, resulting from a call for a proposal for a programme co-fund action implementing the European Partnerships in the Horizon Europe Work Programme. Programme co-fund actions provide co-funding to a programme of activities established and/or implemented by entities managing and/or funding research and innovation programmes. Therefore, this form of implementation only allows to address public partners

at its core (comparable to the Article 185 initiatives below), while industry can nevertheless be addressed by the activities of the partnerships, but not make formal commitments and contributions to it. The expectation is that these entities would cover most if not all EU Member States (MS). Also 'international' funding bodies can participate as partners, which creates the potential for an efficient interaction with strategic international partners. Legal entities in countries that are not part of the programme co-fund consortium, are usually excluded from funding under the calls launched by the consortium.

The basic rationale for this partnership option is to bring MS together to invest at scale in key R&I issues of general and common interest. The joint programme of activities is agreed by the partners and with the EU and typically focuses on societal grand challenges and specifically, areas of high public good where EU action will add value while reflecting national priorities and/or policies. The ultimate intent is to create the greatest possible impact by pooling and/or coordinating national programmes and policies with EU policies and investments, helping to overcome fragmentation of the public research effort. Member States that are partners in this partnership become the 'owners' of the priority and take sole responsibility for its funding. Commitments of the partners and the European Union are ensured through the Grant Agreement.

Based on national programmes, this partnership option shows a particularly high level of flexibility in terms of activities to be implemented - directly by the national funding bodies (or governmental organisation "owning" institutional programmes), or by third parties receiving financial support (following calls for proposals launched by the consortium). The broad range of possible activities include support for networking and coordination, research, innovation, pilot actions, and innovation and market deployment actions, training and mobility actions, awareness raising and communication, dissemination and exploitation, any relevant financial support, such as grants, prizes, procurement, as well as Horizon Europe blended finance or a combination thereof.

Option 3 – Institutionalised European Partnership

This type of Partnership is the most complex and high-effort arrangement and will be based on a Council Regulation (Article 187) or a Decision by the European Parliament and Council (Art 185) and implemented by dedicated structures created for that purpose. The legal base for this type of partnership limits the flexibility for a change in core objectives, partners, and/or commitments as these would require amending legislation.

The basic rationale for this type of partnership is the need for a strong integration of R&I agenda's in the private and/or public sectors in Europe in order to address a strategic challenge or realise an opportunity. The focus is on major long-term strategic challenges and priorities beyond the framework of a single Framework Programme where collective action – by private and/or public sectors – is necessary to *achieve critical mass* and *address the full extent of the complexities* of the ecosystem concerned.

The long-term commitment expected from the European Union and its partners is therefore much larger than for any of the other options, given the considerably higher investment in the preparation and implementation of the Partnership. As a result, this type of partnership can be selected only if other parts of the Horizon Europe programme, including other forms of European Partnerships, would not achieve the objectives or would not generate the necessary expected impacts. The commitment for contributions by the partnership members is expected to be at least equal to 50% and may reach up to 75% of the aggregated European Partnership budgetary commitments.

The partnership members have a high degree of autonomy in developing the strategic research agenda and annual work programmes and call topics, based on a transparent and accessible process, and subject to the approval of the Commission Services. The choice of topics addressed in the (open) calls are therefore strongly aligned with the needs defined. Normally, the strategic priorities are fully covered by the annual work programmes in the

partnership, even though it is in principle possible to keep certain topics for calls in the FP thus complementing the activities in the partnership. The full integration in the Framework Programme implies that the full array of Horizon Europe funding instruments in the related Pillar can be used, ranging from RIAs to CSAs and including grants, prizes, and procurement.

Two forms of Institutionalised Partnerships are of direct relevance to this study, influencing the constellation of partners involved.

Institutionalised Partnerships based upon Art 185 TFEU

Article 185 of the TFEU allows the Union to participate in programmes jointly undertaken by Member States and limits therefore the scope of partners to Member States and Associated Third countries. This type of Institutionalised Partnership aims therefore at reaching the greatest possible impact through the integration of national and EU funding, aligning national strategies in order to optimise the use of public resources and overcome fragmentation of the public research effort.

It brings together R&I governance bodies of most if not all EU Member States (legal requirement: at least 40% of Member States) as well as Associated Third Countries that designate a dedicated legal entity (Dedicated Implementation Structure) for the implementation. By default, membership of non-associated Third Countries is not foreseen. Such membership is possible only if it is foreseen in the basic act and subject to conclusion of an international agreement. Eligibility for participation and funding follows by default the rules of the Framework programme, unless a derogation is introduced in the basic act.

Institutionalised Partnerships under Art. 187 TFEU

This type of Institutionalised Partnership aims at reaching the greatest possible impact by integrating the strategic R&I agendas of private and/or public actors and by leveraging the partners' investments in order to tackle R&I and societal challenges and/or contribute to Europe's wider competitiveness goals.

It brings together a stable set of partners with a strong commitment to taking a more integrated approach and requires the set-up of a dedicated legal entity (Union body, Joint Undertaking) that carries full responsibility for the management of the partnership and implementation of the calls.

Different configurations are possible: partnerships focused on creating strategic industrial partnerships where, most often, the partner organisations are represented by one or more industry associations, or in some cases individual private partners; partnerships coordinating national ministries, public funding agencies, and governmental research organisations in the Member States and Associated Countries; or a combination of the two (the so-called tripartite model). By default, membership of non-associated Third Countries is not foreseen. Such membership is possible only if it is foreseen in the basic act and subject to conclusion of an international agreement. Eligibility for participation and funding follows by default the rules of the Framework programme, unless a derogation is introduced in the basic act.

2 The Candidate European Partnerships under Horizon Europe – What needs to be decided

2.1 Portfolio of candidates for Institutionalised Partnerships under Horizon Europe

2.1.1 The process for identifying the priorities for Institutionalised Partnerships under Horizon Europe

In May 2019, the European Commission consulted the Member States on a list of 44 possible candidates for European Partnership which it had identified as part of the preparation of the first Strategic Planning of Horizon Europe. This list was also part of the

Orientations towards the first Strategic Plan implementing Horizon 2020⁸ which served as a basis for an Open Public Consultation from July to October 2019. In October and November 2019, the European Commission and the Member States agreed on increasing the number of candidate European partnerships to 49. Subsequent discussions until the adoption of Horizon Europe will focus on ensuring the overall consistency of the EU partnership landscape and its alignment with the EU overarching priorities and on defining the precise implementation modalities.

In parallel, the European Commission completed inception impact assessments on the candidate institutionalised European partnerships. Stakeholders had the opportunity to provide their feedback on these inception impact assessments in August 2019. A web-based open public consultation to collect opinions on all candidate institutionalised partnerships (but the candidate EuroHPC partnership) was organised between September and October 2019.

2.1.2 Overview of the overall landscape of candidate European Partnerships subject to the impact assessment

Figure 3, below, gives an overview of all European Partnerships that are currently envisaged for funding under Horizon Europe. The candidate Institutionalised Partnerships that are the subject for this impact assessment study are coloured in dark orange.

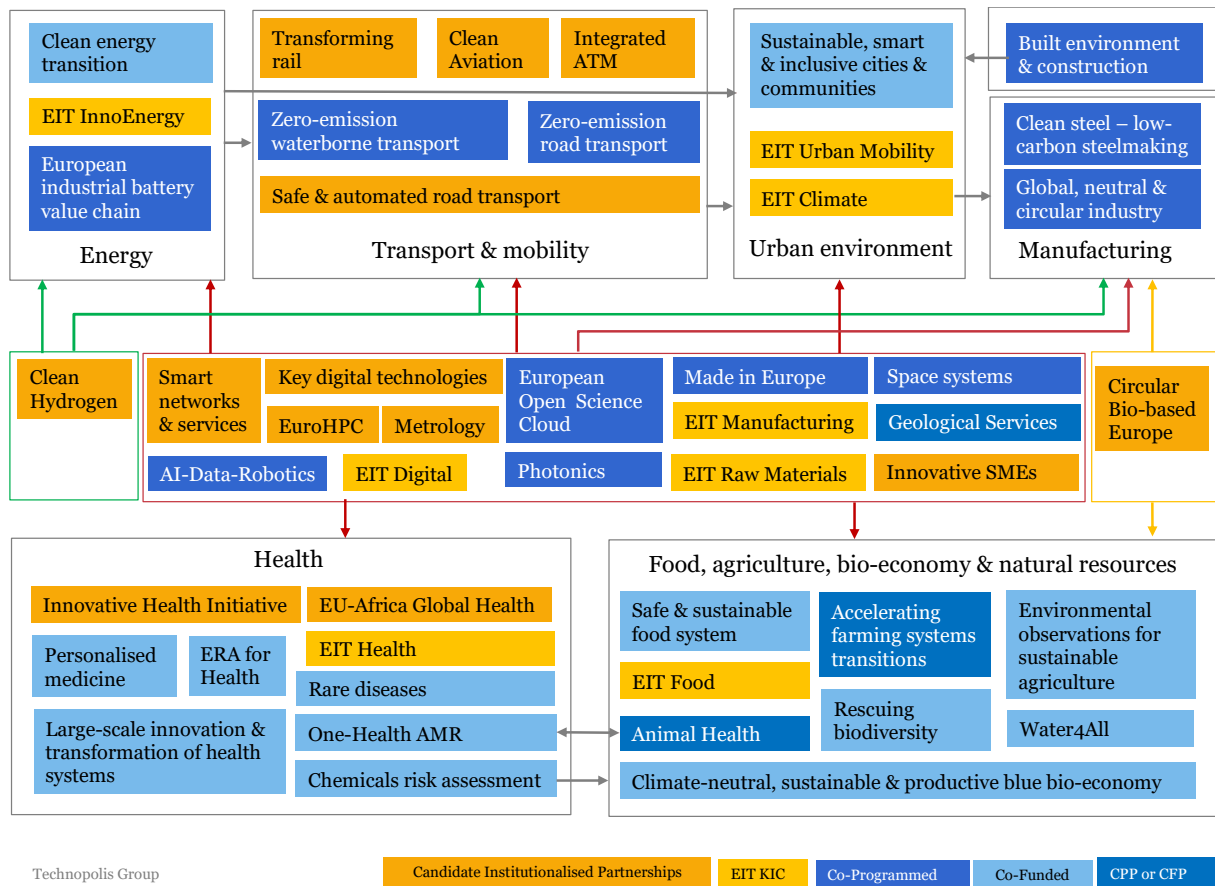
The European Partnerships can be categorised into two major groupings: '*horizontal*' partnerships focused on the development of technologies, methods, infrastructures and resources/materials, and '*vertical*' partnerships focused on the needs and development of a specific application area, be it industrial or societal.

The diagram below shows the central position of the '**horizontal**' partnerships in the overall landscape, developing methodologies, technologies or data management infrastructures for application in the other priority areas. These 'horizontal' partnerships are predominantly proposed as Institutionalised or Co-programmed Partnerships, in addition to a number of EIT KICs. The European Open Science Cloud (EOSC) partnership, for example, will support research partnerships by providing an infrastructure for the storage, management, analysis and re-use of research data.

The upper banner of the diagram groups the **industry-oriented 'vertical' partnerships**. Under Horizon Europe, they have in common a pronounced focus on enhancing sustainability. In this context, the banner includes also one of the most recent agreed-upon partnerships focused on the urban environment. This partnership illustrates the introduction under Horizon Europe of *challenge-oriented* cross-cluster partnerships. Multiple interconnections are envisaged among the 'vertical' partnerships in the different industry sectors covered. In the transport sector, the partnerships are predominantly proposed as Institutionalised Partnerships. In the other sectors, we see a mix of Co-Programmed Partnerships and EIT KICs. There are only two Co-Funded Partnerships.

⁸ Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe, Co-design via Web Open Consultation (2019), see more here https://ec.europa.eu/research/pdf/horizon-europe/ec_rtd_orientations-towards-the-strategic-planning.pdf

Figure 3: Landscape of European Partnerships under Horizon Europe (2019)



The lower banner includes the **'vertical' partnerships in the societal application areas**. Striking is the dominance of the Co-Funded Partnerships (to be noted that in the Food/agriculture cluster, the partnership type still needs to be decided for several envisaged partnerships). We also note the limited interconnections that are envisaged between the two areas. An exception is the newly envisaged cross-cluster European Partnerships 'One Health AMR'.

2.2 Assessing the necessity of a European Partnership, possible options for implementation and their cost-effectiveness

In this section we set out the methodological framework that underpins the impact assessment studies. In line with the Better Regulation Guidelines, the impact assessment is intervention logic-based and impact-oriented.

The impact assessment allowed also for the conduct of the 'necessity test' for a European Partnership as set out in the Horizon Europe regulation. Pivotal in this context was the identification of the Horizon Europe calls as Option 0 as well as Baseline Option, allowing for a comparative analysis of the three partnership forms (Options 1-3) along all of the assessment dimensions – in relation to each other as well as to the Horizon Europe calls. The options assessment therefore incorporated the required 'necessity test'.

2.2.1 Assessment of the selection criteria

The common methodological framework that we defined for the 13 individual Impact Assessment studies reflects the approach defined in the Better Regulation guidelines. It also integrates the specific criteria for the use of the different types of European Partnerships as they are defined in the Horizon Europe Common Understanding (Article 8 and Annex III). Specifically this regards the **selection criteria** which have to be demonstrated as a minimum in order to justify the necessity of a European Partnership instead of regular Horizon Europe calls only and the implementation criteria in Article 8

1(a), (b) and (c) with certain elements distinguishing the use of the different partnership implementation modes (Table 1).

Table 1: Horizon Europe selection criteria for the European Partnerships

| Common selection criteria and principles | Specifications |
|---|--|
| More effective (Union added value) clear impacts for the EU and its citizens | <ul style="list-style-type: none"> • delivering on global challenges and research and innovation objectives |
| | <ul style="list-style-type: none"> • securing EU competitiveness |
| | <ul style="list-style-type: none"> • securing sustainability |
| | <ul style="list-style-type: none"> • contributing to the strengthening of the European Research and Innovation Area |
| | <ul style="list-style-type: none"> • where relevant, contributing to international commitments |
| Coherence and synergies | <ul style="list-style-type: none"> • within the EU research and innovation landscape |
| | <ul style="list-style-type: none"> • coordination and complementarity with Union, local, regional, national and, where relevant, international initiatives or other partnerships and missions |
| Transparency and openness | <ul style="list-style-type: none"> • identification of priorities and objectives in terms of expected results and impacts |
| | <ul style="list-style-type: none"> • involvement of partners and stakeholders from across the entire value chain, from different sectors, backgrounds and disciplines, including international ones when relevant and not interfering with European competitiveness |
| | <ul style="list-style-type: none"> • clear modalities for promoting participation of SMEs and for disseminating and exploiting results, notably by SMEs, including through intermediary organisations |
| Additionality and directionality | <ul style="list-style-type: none"> • common strategic vision of the purpose of the European Partnership |
| | <ul style="list-style-type: none"> • approaches to ensure flexibility of implementation and to adjust to changing policy, societal and/or market needs, or scientific advances, to increase policy coherence between regional, national and EU level |
| | <ul style="list-style-type: none"> • demonstration of expected qualitative and significant quantitative leverage effects, including a method for the measurement of key performance indicators |
| | <ul style="list-style-type: none"> • exit-strategy and measures for phasing-out from the Programme |
| Long-term commitment of all the involved parties | <ul style="list-style-type: none"> • a minimum share of public and/or private investments |
| | <ul style="list-style-type: none"> • In the case of institutionalised European Partnerships, established in accordance with article 185 or 187 TFEU, the financial and/or in-kind, contributions from partners other than the Union, will at least be equal to 50% and may reach up to 75% of the aggregated European Partnership budgetary commitments |

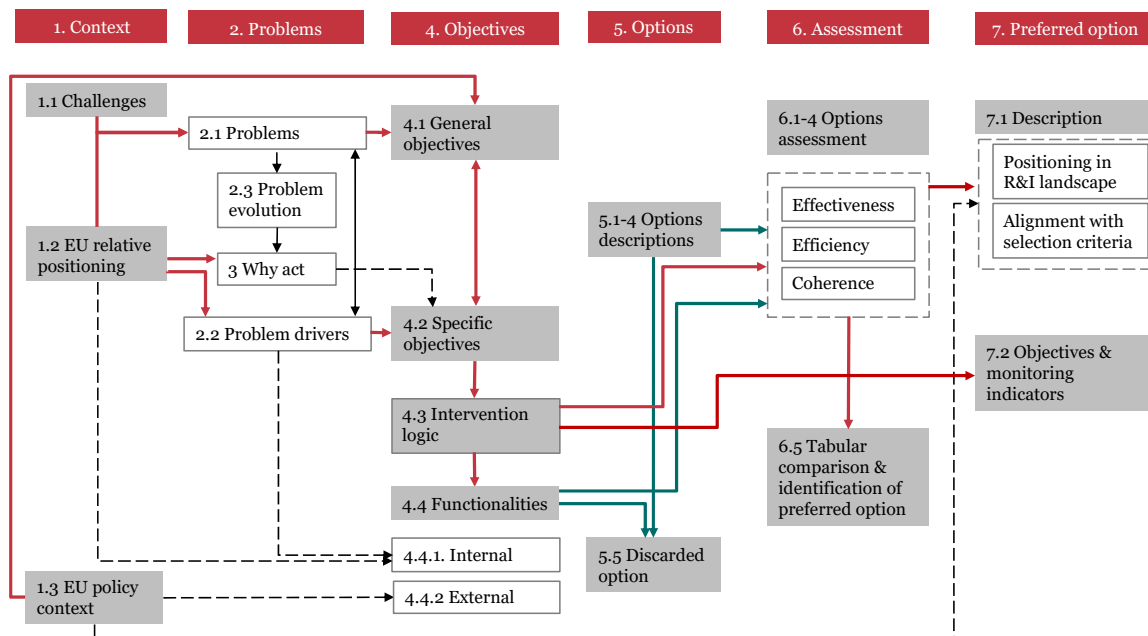
The **Better Regulation guidelines** remained the primary point of reference for the 13 individual Impact Assessment studies. The different steps of the IA process were carried out in a consistent manner in the 13 individual IA studies, supported by horizontal analyses (i.e. common to all studies) such as bibliometrics/patent analysis, social network analysis, the partnership portfolio mapping and analysis, as well as the analysis of the Open Public Consultation data.

The **selection criteria** for the European Partnerships related to effectiveness and coherence fit reasonably well in the Better Regulation impact assessment structure. More problematic was the coverage of the other three criteria groupings, i.e. the criteria of Openness and Transparency, Additionality and Directionality, and the Ex-ante demonstration of commitment.

The solution was the introduction of a section on the '**Functionalities of the initiative**', in which set out our view on *how* the initiative should *concretely* respond to the selection criteria of 'coherence and synergies', 'openness and transparency' and 'additionality and directionality' in order to reach its objectives. We focused on those aspects that are not covered in other sections of this report, such as coherence and synergies, and covered those elements that from our analysis of the partnership options resulted being **key distinguishing features** of the partnership options, i.e. the composition of the partnership ('openness', including from a geographical perspective), the type of activities implemented ('flexibility'), and the level of directionality and integration of the stakeholders' R&I strategies needed ('directionality and additionality').

The logical process is summarised in Figure 4, below. The diagram shows how the 'functionality' sections constituted an important passage from the objectives and intervention logic sections to the options assessment. Building upon information collected in the previous sections (context, problem and objectives analysis) and in combination with the description of the available options, the description of the desirable 'functionalities' allowed for, on the one hand, the identification of the discarded option(s) and, on the other hand, the options assessment against coherence and against the selection criteria of 'Openness and Transparency' and 'Additionality and Directionality'. In the final chapter of the Impact Assessment report, the alignment of the preferred option with the criteria for the selection of European Partnerships was described, emphasising the outcomes of the 'necessity test'.

Figure 4: Flow of the analysis



Notes: the numbers indicate the related chapters or sections in the Impact Assessment reports

2.2.2 Methodological approach

Overview of the methodologies employed

The understanding of the overall context of the candidate institutionalised European Partnerships relies on a desk research partly covering the main impacts and lessons learned

from their predecessor partnerships (if any). This was complemented with a set of quantitative analyses of the Horizon 2020-funded partnerships, or in case these did not exist, the H2020-funded projects in the field. The analyses included a portfolio analysis, a stakeholder and social network analysis in order to profile the actors involved as well as their co-operation patterns, and an assessment of the partnerships' outputs (bibliometrics and patent analysis). A cost modelling exercise was performed in order to feed into the efficiency assessments of the partnership options (see below).

Public consultations (open and targeted) supported the comparative assessment of the policy options. Each study interviewed up to 50 relevant stakeholders (policymakers, business including SMEs and business associations, research institutes and universities, and civil organisations, among others). They also used the results from the Open Public Consultation organised by the European Commission (Sep – Nov 2019) and the feedback on the Inception Impact Assessments of the 13 candidate institutionalised European Partnerships that the European Commission received in September 2019.

The timing of the Impact Assessment studies, in parallel to the negotiations between the European Commission and the existing Joint Undertakings on the specific implementation of the rules for the future European Partnership, as well as the ongoing discussions within the existing partnership on their future research directions, has set potential limits to the validity of the input and feedback collected from the stakeholders during the consultations.

A more detailed description of the methodology is provided in the Annexes C of each impact assessment report.

Method for identifying the preferred choice

The four policy options were compared along a range of key parameters. The comparison along these parameters was carried out in an evidence-based manner. A range of quantitative and qualitative evidence was used, including ex-post evaluations; foresight studies; statistical analyses of Framework Programmes application and participation data and Community Innovation Survey data; analyses of science, technology and innovation indicators; econometric modelling exercises producing quantitative evidence in the form of monetised impacts; reviews of academic literature on market and systemic failures and the impact of research and innovation, and of public funding for research and innovation; sectoral competitiveness studies; expert hearings; etc.

Options assessment related to effectiveness and coherence

On the basis of the evidence collected and gathered, the Impact Assessment study teams assessed the effectiveness of the retained policy options along three dimensions corresponding to the different categories of likely impacts: scientific, economic and technologies, and societal (including environmental) impacts. The Impact Assessment study teams considered to which extent the retained policy options fulfilled the desirable 'functionalities' and were therefore likely to produce the targeted impacts. This analysis resulted in a scoring of the policy options along a three-point scale.⁹ Instead of a compound score, the assessment of the effectiveness of the policy options concluded on as many scores as there are expected impacts.

Likewise, the impact assessment study teams attributed scores (using the same approach as above) reflecting the potential of each retained policy option for ensuring coherence with programmes and initiatives within (internal coherence) and beyond (external coherence) Horizon Europe.

⁹ Scores vary from + to +++, where + refers to low potential for presenting a low potential for reaching the likely impacts, ++ to a good potential, and +++ to a high potential.

Scores were justified in a consistent and detailed manner in order to avoid arbitrariness and spurious accuracy. A qualitative or even quantitative explanation was provided of why certain scores were given to specific impacts.

When assessing the respective efficiency of the retained policy options, the Impact Assessment study teams considered the scores related to effectiveness and the identified costs to conduct a “value for money” (or cost-effectiveness) analysis. They accordingly attributed a comparative score to each of the options ranging from 1 (option with the highest costs) to 3 (options with the lowest costs).

Options assessment related to efficiency

A standard cost model

The ‘horizontal’ team has reviewed the cost categories and costs for each of the four policy options, at some length. Our first model used published data from past partnerships and Horizon 2020 calls working with the Commission’s standard accounting codes (Title 1, Title 2, Title 3). The analysis revealed wide-ranging differences in costs across partnerships and functions, which was thought to be too complex to be helpful to the current exercise. As a result, we created a static, common model using average costs as a means by which to indicate the order of magnitude of effort and thereby reveal the principal differences between each of the policy options.

The model was developed jointly with the European Commission services and is presented in the study Data report (D1.2), along with an explanation of the data sources used and the assumptions made.

It is important to note that the costs identified are theoretical and do not reflect the actual costs of any existing individual partnership. In light of this fact, and to avoid any risk of misunderstanding, we have transposed the financial estimates into a qualitative presentation using + / - system in order to compare the various cost elements for each policy option with the equivalent costs for the baseline policy options (see Table 2).

The principal differences in costs as compared with regular Horizon Europe calls relate to the European Partnerships’ one-off costs (e.g. developing the proposal and Strategic Research and Innovation Agenda), additional supervision by the European Commission and any additional programme management effort. The main difference between the three types of European Partnership are twofold: (i) the extent to which a partnership will need to run a limited or comprehensive programme management unit and (ii) the extent to which a new partnership may benefit from a pre-existing programme management unit that will greatly reduce or eliminate the set-up costs that would apply to a wholly new partnership.

Table 2: Intensity of additional costs compared with HEU Calls (for Partners, stakeholders, public and EC)

| Cost items | Option 0 | Option 1 | Option 2 | Option 3 -Art. 185 | Option 3 -Art. 187 |
|---|----------|----------|----------|------------------------|--------------------------|
| Preparation and set-up costs | | | | | |
| Preparation of a partnership proposal (partners and EC) | 0 | ++ | ++ | ++ | ++ |
| Set-up of a dedicated implementation structure | 0 | 0 | 0 | Existing: + New: ++ | Existing: ++ New: +++ |
| Preparation of the SRIA / roadmap | 0 | ++ | ++ | ++ | ++ |

| Cost items | Option 0 | Option 1 | Option 2 | Option 3 -Art. 185 | Option 3 -Art. 187 |
|--|--|--|----------|--------------------|--------------------|
| Ex-ante Impact Assessment for partnership | 0 | 0 | 0 | +++ | +++ |
| Preparation of EC proposal and negotiation | 0 | 0 | 0 | +++ | +++ |
| Running costs (Annual cycle of implementation) | | | | | |
| Annual Work Programme preparation | 0 | + | 0 | + | + |
| Call and project implementation | 0 | 0 In case of MS contributions: + | + | + | + |
| Cost to applicants | Comparable, unless there are strong arguments of major differences in oversubscription | | | | |
| Partners costs not covered by the above | 0 | + | 0 | + | + |
| Additional EC costs (e.g. supervision) | 0 | + | + | + | ++ |
| Winding down costs | | | | | |
| EC | 0 | 0 | 0 | 0 | +++ |
| Partners | 0 | + | 0 | + | + |

Notes: 0: no additional costs, as compared with the baseline; +: minor additional costs, as compared with the baseline; ++: medium additional costs, as compared with the baseline; +++: higher costs, as compared with the baseline

Rationale for the comparative scoring on 'overall costs' and 'cost-efficiency' in the scorecard

In the scorecard analysis, the scores related to the set-up and implementation costs will allow the study teams to consider the scale of the expected benefits and thereby allow a simple "value for money" analysis (cost-effectiveness).

Table 3 shows how we translated the cost analysis into a series of numerical scores.

Table 3: Cost-efficiency matrix

| | Option 0: Horizon Europe calls | Option 1: Co-programmed | Option 2: Co-funded | Option 3: Institutionalised |
|-----------------|--------------------------------|-------------------------|---------------------|-----------------------------|
| Overall cost | 3 | 2 | 1 | 1 |
| Cost-efficiency | 3 | 3 | 2 | 2 |

For the 'overall cost' dimension, we assigned a score 1 to the option with the highest additional costs and a score 3 to the option with the lowest additional costs compared to the baseline. This was based on the following considerations:

- **Horizon Europe regular calls** will have the lowest overall cost among the policy options and have therefore been **scored 3** on this criterion, using a scale of 1-3 where 3 is best (lowest additional costs). This adjudged score is based on two facts: firstly, that Horizon Europe will not entail any additional one-off costs to set up or discontinue

the programme, where each of the other policy options will require at least some additional set-up costs; and secondly, that Horizon Europe will not require any additional running costs, where each of the other policy options will involve additional efforts by the Commission and partners in the carrying out of necessary additional tasks (e.g. preparing annual work programmes).

- A **co-programmed partnership** (Option 1 - CPP) will entail slightly higher overall costs as compared with the baseline policy option and has therefore been given a **score of 2**, using a scale of 1-3 where 3 is best (lowest additional costs). There will be some additional set-up costs linked for example with the creation of a strategic research and innovation agenda (SRIA) and additional running costs linked with the partners role in the creation of the annual work programmes and the Commission's additional supervisory responsibilities. A CPP will have lower overall costs than each of the other types of European Partnership, as it will function with a smaller governance and implementation structure than will be required for a Co-Funded Partnership or an Institutionalised Partnership and – related to this – its calls will be operated through the existing HEU agencies and RDI infrastructure and systems.
- The **Co-Funded Partnership** (Option 2 – CFP) has been **scored 1** on overall cost, using a scale of 1-3 where 3 is best (lowest additional costs). This reflects the additional set-up costs of this policy option and the substantial additional running costs for partners, and the Commission, of the distributed, multi-agency implementation model.
- The **Institutionalised Partnership** (Option 3 - IP) has been **scored 1** on overall cost, using a scale of 1-3 where 3 is best (lowest additional costs). This reflects the substantial additional set-up costs of this policy option – and in particular the high costs associated with preparing the Commission proposal and negotiating that through to a legal document – and the substantial additional running costs for the Commission associated with the supervision of this dedicated implementation model.

In relation to **cost-efficiency**, we considered that while there is a clear gradation in the overall costs of the policy options, the cost differentials are less marked when we take into account financial leverage (co-financing rates) and the total budget available for each of the policy options, assuming a common Union contribution. From this perspective, there are only one or two percentage points that split the most cost-efficient policy options – the baseline and CPP policy options – and the least cost-efficient – the CFP and IP. We have therefore assigned a score of 3 to the baseline Option 0 and CPP options for cost-efficiency (no or minor additional costs, as compared with the baseline) and a score of 2 for the CFP and IP policy options (medium additional costs, as compared with the baseline).

Scorecard analysis for the final options assessment

The scorecard analysis built a hierarchy of the options by individual criterion and overall. The scorecard exercise supported the systematic appraisal of alternative policy options across multiple types of monetary, non-monetary and qualitative dimensions. It also allowed for easy visualisation of the pros and cons of alternative options.

Each option was attributed a value of 1 to 3, scoring the adjudged performance against each criterion with the three broad appraisal dimensions of effectiveness, efficiency and coherence.

Scores were justified in a consistent and detailed manner in order to avoid arbitrariness and spurious accuracy. A qualitative or even quantitative explanation was provided of why certain scores were given to specific impacts, and why one option scores better or worse than others.

The scorecard analysis allowed for the identification of a single preferred policy option or in case of an inconclusive comparison of options, a number of 'retained' options or hybrid. The final selection is a policy decision.

2.3 Cross-partnership challenges in Horizon Europe clusters

In this section we set the envisaged and candidate partnerships in the context of the Horizon Europe clusters and the related higher-level EU policy objectives and priorities. We focus on the evolution of the policy context including the new European Green Deal/climate neutrality objectives, the Horizon Europe Framework relevant to this cluster, and the link to the relevant Sustainable Development Goals. Seeing the focus on the Pillar II clusters, this section excludes the candidate *Institutionalised Partnership for Innovative SMEs*.

2.3.1 Cluster 1 – Health

Research and innovation (R&I) actions under this cluster will aim at addressing the major socio-economic and societal burden that diseases and disabilities pose on citizens and health systems of the EU and worldwide.

The R&I activities funded under the Pillar II Cluster Health aim at contributing to the achievement of the Sustainable Development Goal 'Ensuring healthy lives and promoting well-being for all at all ages' resulting from investments in research and innovation focused on three overarching EU policy objectives: 'An economy that works for people', 'A Europe fit for the Digital Age', and 'A European Green Deal' (see Figure 5, below). The Horizon Europe proposal for a regulation defined the areas for possible institutionalised European partnerships on the basis of Article 185 TFEU or Article 187 TFEU as "*Partnership Area 1: Faster development and safer use of health innovations for European patients, and global health*".

At the core in this cluster are the R&I orientations that aim at ensuring that citizens *stay healthier throughout their lives* due to improved health promotion and disease prevention and the adoption of healthier behaviours and lifestyles, the development of *effective health services* to tackle diseases and reduce their burden, and an improved access to *innovative, sustainable and high-quality health care*. These objectives require an unlocking of the full potential of *new tools, technologies and digital solutions* and ensuring a *sustainable and globally competitive health-related industry* in the EU, allowing for the delivery of, e.g. personalised healthcare services. Last but not least, the citizens' health and well-being need to be *protected from environmental degradation and pollution*, addressing a.o. climate-related challenges to human health and health systems.

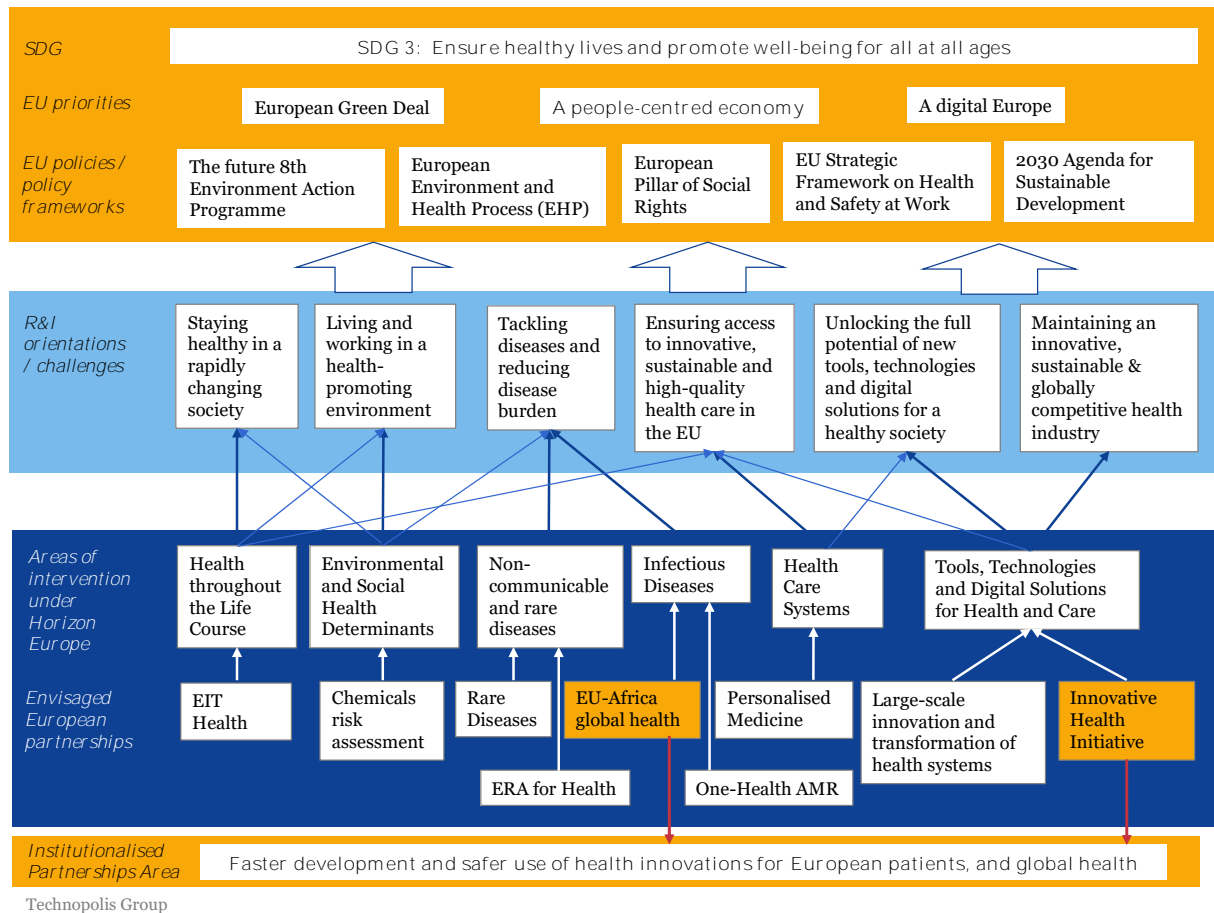
Figure 5, below, shows that the portfolio of envisaged European Partnerships in this cluster¹⁰ aims to contribute to all of the R&I orientations in this cluster. However, there is a pronounced focus on the 'tackling diseases and reducing the disease burden' objective, addressed by five out of the ten partnerships (amongst which there is one candidate Institutionalised Partnership). The objectives focused on an improved exploitation of digital solutions and competitiveness of the EU health-related industry are addressed by two partnerships amongst which one is a candidate Institutionalised Partnership.

In this context, it should be noted that the portfolio of European Partnerships in this cluster predominantly encompasses Co-funded Partnerships, focused on joining the R&I programmes and investments at the national level. There is therefore overall a limited level of involvement of the private sector in the development of the SRIAs (i.e. as partners of the envisaged partnerships), be it from the supply or user side in the value chains. The only exceptions are the Innovative Health Initiative and the EIT KIC Health. European Partnerships also provide limited support for the assessment of environmental and social health determinants, uniquely addressed from a chemical risks perspective.

¹⁰ As proposed in the Horizon Europe 'Orientations towards the first Strategic Plans', dd. December 2019

The description of the interconnections between the partnerships in this cluster and the ones funded in the context of other clusters, provided in the reports of the individual impact assessment studies, sheds more light on this topic.

Figure 5: R&I priorities and higher-level objectives of the Horizon Europe Cluster 1 – Health



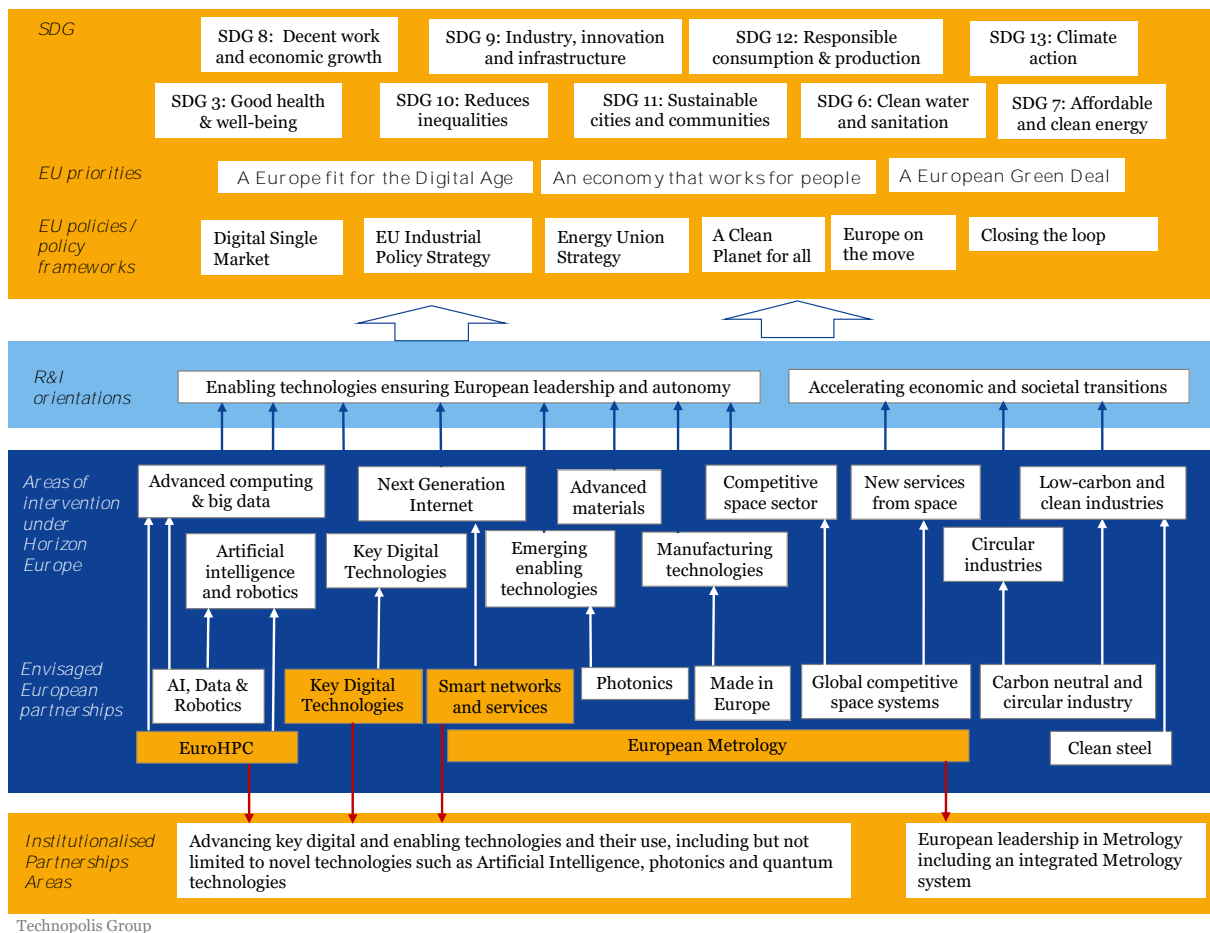
2.3.1 Cluster 4 – Digital, Industry and Space

In this cluster the focus is on the digitisation of European industry and on advancing key enabling, digital and space technologies which will underpin the transformation of our economy and society at large. The overarching vision for R&I investments in this cluster is “a European industry with global leadership in key areas, fully respecting planetary boundaries, and resonant with societal needs – in line with the renewed EU Industrial Policy Strategy.” The expected effects on the European economy and society imply that the R&I activities under this cluster will contribute to various Sustainable Development Goals and respond to three key EU policy priorities: ‘A European Green deal’, ‘A Europe fit for the digital age’, and ‘An economy that works for people’ (Figure 6).

The cluster pursues three objectives: 1) ensuring the competitive edge and sovereignty of EU industry; 2) fostering climate-neutral, circular and clean industry respecting planetary boundaries; and 3) fostering social inclusiveness in the form of high-quality jobs and societal engagement in the use of technologies. A human-centred approach will be taken, i.e. technology development going hand in hand with European social and ethical values.

The key R&I priorities are grouped in two general categories: (I) Enabling technologies ensuring European leadership and autonomy; and (II) Accelerating economic and societal transitions (these will be complemented by priorities of other clusters). European Partnerships envisaged to support the R&I in the specific intervention areas are mainly co-programmed partnerships. Exceptions are the three candidate Institutionalised Partnerships in the digital field and the candidate Institutionalised Partnership in metrology, reflecting their related Partnership Areas.

Figure 6: R&I priorities and higher-level objectives of the Horizon Europe Cluster 4 – Digital, Industry and Space



Multiple convergences exist between the technologies that are covered in the first strand of the priorities in this cluster, i.e. “enabling technologies ensuring European leadership and autonomy”. In their function of ‘enabling’ technologies, they will also make critical contributions to the attainment of the desired ‘transitions’ in the ‘vertical’ industry sectors targeted in the second strand of priorities in this cluster as well as in the other clusters. A major contribution from this perspective can be expected from the four candidate Institutionalised Partnerships as well as from the ‘Made in Europe’ partnership, focused on manufacturing technologies.

2.3.2 Cluster 5 – Climate, Energy and Mobility

The main objectives of this cluster are to fight climate change, improve the competitiveness of the energy and transport industry as well as the quality of the services that these sectors bring to society. This is supportive of several Sustainable Development Goals including affordable and clean energy (SDG7); industry, innovation & infrastructure (SDG9); sustainable cities & communities (SDG11); sustainable consumption & production (SDG12); and climate action (SDG13). The cluster is most closely aligned to the EU priority for ‘A European Green Deal’ but also has synergy with two of the other five priorities; ‘An economy that works for people’ and ‘A Europe fit for the Digital Age’. This extends across various policies including a Clean Planet for all, the Energy Union strategy, Single European Railway Area, European ATM Master Plan, Single European Sky, and Europe on the Move (Figure 7).

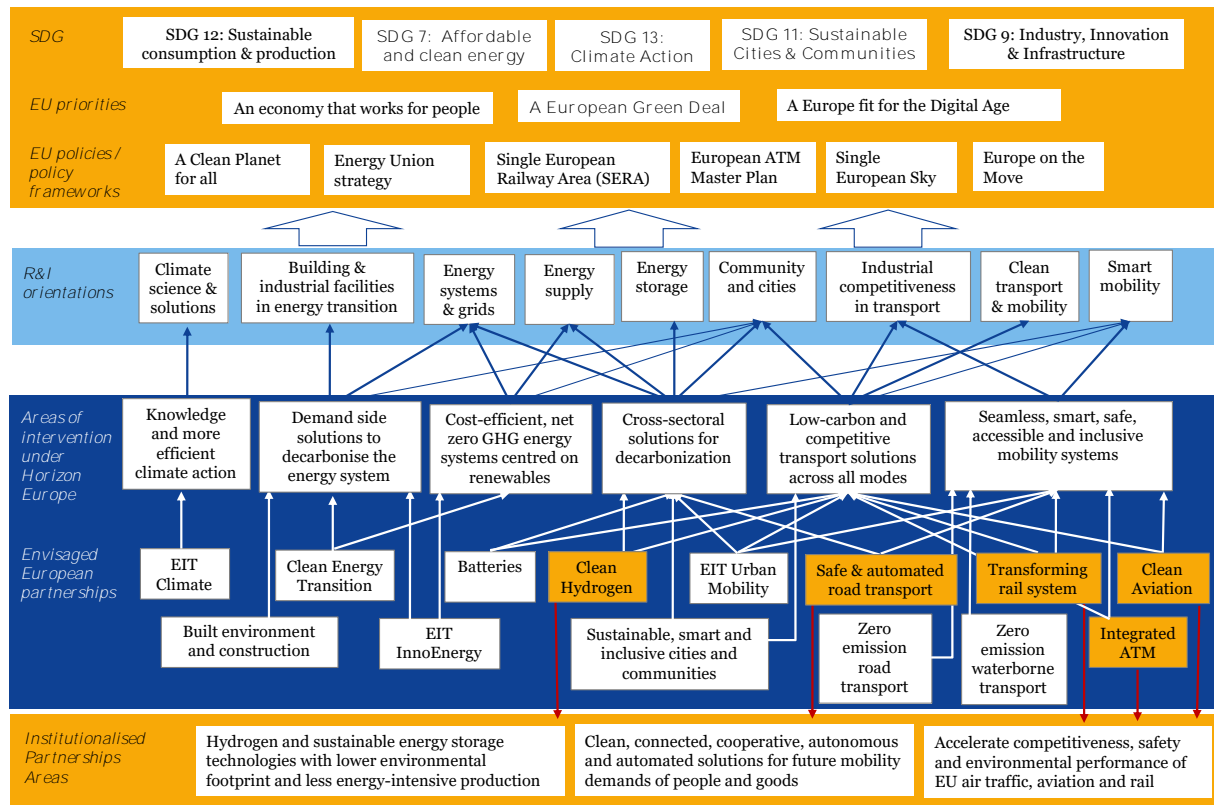
The cluster is directly relevant to several of the areas for possible institutionalised European partnerships on the basis of Article 185 TFEU or Article 187 TFEU, namely:

- Partnership Area 4: Accelerate competitiveness, safety and environmental performance of EU air traffic, aviation and rail

- Partnership Area 6: Hydrogen and sustainable energy storage technologies with lower environmental footprint and less energy-intensive production
- Partnership Area 7: Clean, connected, cooperative, autonomous and automated solutions for future mobility demands of people and goods

Cluster 5 is structured under six areas of intervention under Horizon Europe and nine R&I orientations. Figure 7, below, shows the portfolio of envisaged European Partnerships that are relevant to this cluster and their link to the areas of intervention.

Figure 7: R&I priorities and higher-level objectives of the Horizon Europe cluster Climate, Energy and Mobility



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There are 14 candidate Partnerships that align with this cluster of which eight are possible Institutionalised Partnerships, including five Article 187 initiatives and three EIT-KICs. There are no candidate Article 185 Partnerships in this cluster. The other partnerships are envisaged as either Co-programmed and/or Co-funded Partnerships.

The diagram above shows the strong orientation of the possible Institutional Partnerships towards the mobility area and more limited direct synergies between the envisaged Partnerships and the 'climate science & solutions' priority. Of course, the climate change challenge underpins the whole of this cluster, except where the focus is on industrial competitiveness, but this will also be at least partially dependent on innovation related to clean energy and mobility products and services.

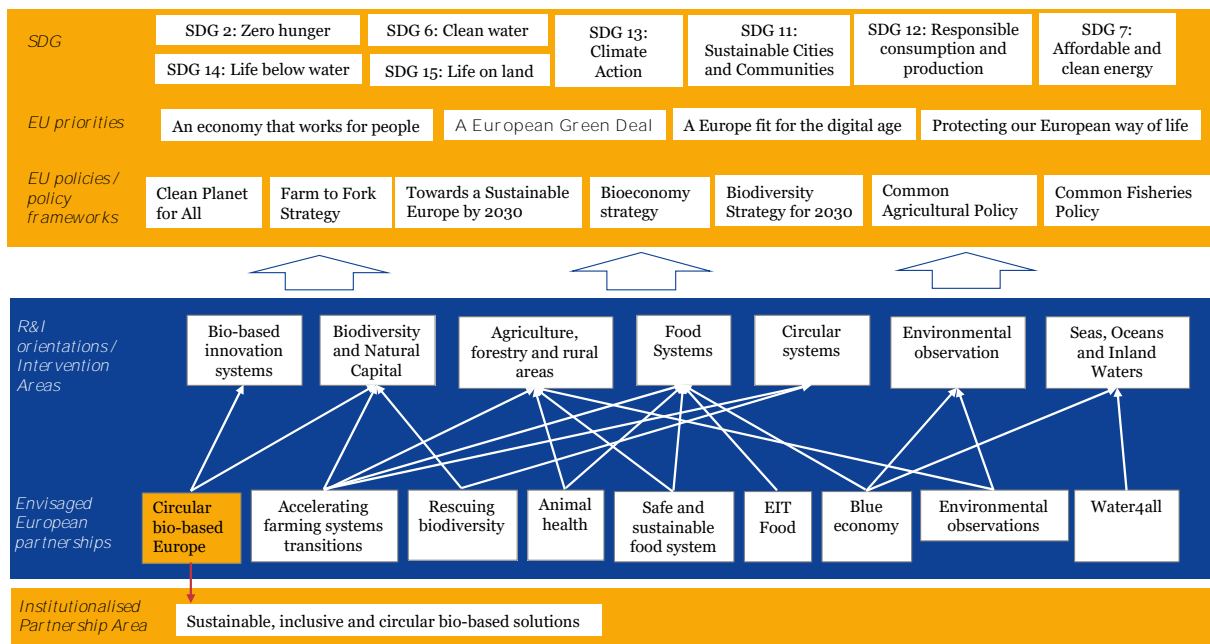
2.3.3 Cluster 6 – Food, Bioeconomy, Natural Resources, Agriculture and Environment

The key objective of Cluster 6, 'Food, Bioeconomy, Natural Resources, Agriculture and Environment' is to advance knowledge, expand capacities and deliver innovative solutions to accelerate the transition towards the sustainable management of natural resources (such as biodiversity, water and soils). The cluster has a large realm and aims to address a wide range of challenges relating to climate change, biodiversity and ecosystems, natural resources, and the production and consumption patterns that may affect them. It encompasses a single area for possible institutionalised European Partnerships aimed at the development of "sustainable, inclusive and circular, bio-based solutions".

The R&I activities funded under the Pillar II Cluster 6 contribute first and foremost to the ‘European Green Deal’. More precisely, they will be instrumental to the announced climate change actions, the Biodiversity Strategy for 2030, the “Farm to Fork Strategy”, the zero-pollution ambition, the New Circular Economy Action Plan, and the comprehensive strategy on Africa and trade agreements. However, through cooperation with the other clusters, Cluster 6 may make some contribution to the other EU overarching policy priorities. The R&I activities funded under this cluster therefore aim to contribute to the achievement of several United Nations SDGs including: SDG 2: Zero hunger; SDG 6: Clean water and sanitation; SDG 7: Affordable and clean energy; SDG 11: Sustainable cities and communities; SDG 12: Responsible consumption and production; SDG 13: Climate action; SDG 14: Life below water; and, SDG 15: Life on land.

Cluster 6 is structured around six targeted impacts and seven research and innovation orientations, as shown in Figure 8, below. The R&I activities funded under this cluster aim to (1) develop solutions for mitigation of, and adaptation to, *climate change*; (2) halt the *biodiversity* loss and foster the restoration of *ecosystems*; (3) encourage the sustainable (and circular) management and use of *natural resources*; (4) stimulate inclusive, safe and health *food and bio-based systems*; (5) a better understanding of the determinants of *behavioural, socio-economic and demographic changes* to accelerate system transformation; and, (6) improve solutions for *environmental observations and monitoring systems*.

Figure 8: R&I priorities and higher-level objectives of the Horizon Europe Cluster 6 – Food, Bioeconomy, Natural Resources, Agriculture and Environment



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The European Commission envisages nine partnerships under Cluster 6, two of which would be institutionalised (Circular bio-based Europe and EIT Food), four would be either co-programmed or co-funded (Animal Health; A climate-neutral, sustainable and productive Blue Economy; Safe and Sustainable Food Systems for People, Planet and Climate; Water4All), and three would be co-funded (Accelerating Farming System Transition; Agriculture for Data; Rescuing Biodiversity to safeguard life on Earth).

There is seemingly a good balance between the three types of partnerships. However, industry may have some interest in being involved in the design of the Strategic Research and Innovation Agendas regarding living labs and other research infrastructure (‘Towards more sustainable Farming’ envisaged partnership) to develop solutions for accelerating the transition of farming systems, and technologies to collect agriculture data.

The proposed portfolio of European Partnerships covers the full range of R&I orientations under Cluster 6.

All but one of the proposed partnerships contribute to orienting R&I activities towards the development of food systems that will ensure both sustainable and healthy diets and food and nutrition security for all. The food system has an impact on several challenges. It directly relates to nutrition and diets, access to food, food security, and has an influence on the use of natural resources, water and soil pollution, climate change. Food waste is a key component of circular systems and biomass has strong potential to offer bio-based energy solutions. Finally, the transformation of food systems should take into consideration demographic changes and the accelerating urbanisation (which reduces lands available for food production but offers opportunities for new types of agriculture such as urban farming).

Two R&I orientations are covered by less than half of the proposed partnerships: Environmental Observations (even though achievement in this area could make significant contribution to the other areas) and Bio-based innovation systems (which is nevertheless at the core of the candidate institutionalised partnership for a circular bio-based Europe).

Part I. Impact Assessment Studies for the Candidate Institutionalised European Partnerships

13. Candidate Institutionalised European partnership for a Circular Bio-based Europe

Authors

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Abstract

This document is the final report of the Impact Assessment Study for the candidate Institutionalised European Partnership for a Circular Bio-based Europe under Horizon Europe. The study was conducted by Technopolis Group from July to December 2019. The methodological framework reflects the Better Regulation Guidelines and operationalises the selection criteria for European Partnerships set out in the Horizon Europe Regulation.

This initiative focuses on intensifying research and innovation allowing to replace, where possible, non-renewable fossil and mineral resources with biomass and waste for the production of renewable products and nutrients, in order to drive forward sustainable and climate-neutral solutions that accelerate the transition to a healthy planet and respect planetary boundaries.

It will address the challenges raised by the fact that the EU economy does not operate within planetary boundaries, is not sufficiently circular and is predominantly fossil based. It will also address the insufficient research and innovation (R&I) capacity and cross-sectoral transfer of knowledge and bio-based solutions, as well as risks posed to the European bio-based industry's global competitiveness. To address these challenges, this study has as its main objectives:

- *Contribute to a sustainable circular economy and climate neutrality in the EU;*
- *Ensure the circularity and environmental sustainability of bio-based industries;*
- *Secure the long-lasting competitiveness of the European bio-based industry.*

The study concluded that Institutionalised European Partnership based upon Article 187 of the Treaty on the Functioning of the European Union is the preferred option for the implementation of this initiative.

Executive Summary

This document is the final report of the Impact Assessment Study for the candidate Institutionalised European Partnership for a Circular Bio-based Europe (CBE) under Horizon Europe. The study was conducted by Technopolis Group from July to December 2019. The methodological framework for this study reflects the Better Regulation Guidelines and operationalises the selection criteria for European Partnerships set out in the Horizon Europe Regulation.

Circular and bioeconomy models could offer balanced solutions to many sustainability and climate challenges, by helping to achieve greener and inclusive growth and jobs, closing material loops and finding alternatives to fossil-based solutions. The European Union's role as an active partner in fostering bioeconomy transformation is reflected by the active uptake of bioeconomy policies in many Member States. Yet the EU faces competition from China and other third countries, disputing the EU's scientific leadership. Innovations in the area of bio-based solutions have been supported under the Horizon 2020 Framework Programme, including the current partnership initiative Bio-based Industries Joint Undertaking (BBI JU) which engaged in R&I, demonstrations, bio-refinery infrastructure and other projects. The new initiative will build upon and expand the activities of H2020 and BBI JU, ensuring higher relevance to the ambitions adopted by the EU in promoting climate neutrality and circular bioeconomy.

Three key *problems* and *problem drivers* have been identified in setting the scope for the new CBE initiative's intervention strategy. The first problem is that the EU economy does not operate within planetary boundaries, is not sufficiently sustainable or circular and is predominantly fossil based. The second problem concerns insufficient levels of R&I capacity, cross-sectoral transfer of knowledge and bio-based solutions in the EU. The third problem is that the global competitiveness of the European bio-based industry is at risk. These problems are driven by insufficient development of interlinked value chains for the valorisation of European biomass, by-products and bio-waste, an underdeveloped market for bio-based products, insufficient environmental and circular features of the current bio-based economy, weak commercialisation of research results and a lack of support infrastructure. Addressing these problems and their drivers requires coordinated and well-structured intervention at EU level.

The general objectives of the initiative are to contribute to a sustainable circular economy and climate neutrality in the EU; to ensure the circularity and environmental sustainability of bio-based industries; and to secure the long-lasting competitiveness of the European bio-based industry.

When assessing the policy options, a set of functionalities was considered, reflecting the selection criteria for European Partnerships defined in the Commission proposal for the Horizon Europe Regulation. So called *internal* functionalities required securing (i) openness and involvement of various types and compositions of actors from across the entire bio-based value chain including industries, small and medium-sized enterprises (SMEs), farmers, research, public bodies, etc.; (ii) a wide range of activities while ensuring the required balance in supporting innovation along all value chain segments and covering all Technology Readiness Levels (TRLs); and (iii) directionality and additionality through ensuring that all participating stakeholders have a common recognition of the partnership's objectives, consolidation of fragmented stakeholders, creation of knowledge spillovers and leverage. The *external* functionalities require the partnership to ensure coordination and complementarity with Union, local, regional, national and, where relevant, international initiatives, as well as to reflect on the emergence of new trends and contribute to building a *policy framework favourable* to supporting the viability of new bio-based value chains and new innovations.

The relevant policy options for this assessment were Horizon Europe calls (Option 0), Co-programmed Partnerships (Option 1), Institutionalised Partnerships based upon Article 187 of the Treaty on the Functioning of the European Union (TFEU) (Option 3). Our conclusion is that an *Institutionalised Partnership based upon Article 187 is the preferred option*. This option well addresses the criteria related to the selection of the European Partnership. It can offer a higher level of effectiveness in achieving the related objectives of the Programme, coherence and synergies of the partnership within the EU research and innovation landscape, transparency and openness in the selection of priorities and objectives and the involvement of partners and stakeholders, high additionality by structuring the bio-based industries, directionality by formalising commitments of partners, and long-term commitment by formalising agreements with the industries. Furthermore, this type of partnership provides a greater long-term perspective than the other options, which helps maintain a high interest of industry actors and potential investors that see the partnership as a strong incentive tool to invest in Europe.

Résumé exécutif

Ce document est le rapport final de l'étude de support à l'analyse d'impact de la proposition de partenariat européen institutionnalisé pour une Europe fondée sur la bioéconomie circulaire (CBE) dans le cadre d'Horizon Europe. L'étude a été menée par Technopolis Group de juillet à décembre 2019. Le cadre méthodologique de cette étude tient compte des lignes directrices pour une meilleure réglementation et opérationnalise les critères de sélection des partenariats européens définis dans le règlement d'Horizon Europe.

Les modèles circulaires et bioéconomiques pourraient offrir des solutions équilibrées à de nombreux défis en matière de durabilité et de climat, en contribuant à une croissance et à des emplois plus verts et inclusifs, en fermant les boucles matérielles et en trouvant des alternatives aux solutions basées sur les énergies fossiles. Le rôle de l'Union européenne en tant que partenaire actif dans la promotion de la transformation de la bioéconomie se reflète dans l'adoption active de politiques de bioéconomie dans de nombreux États membres. Pourtant, l'UE est confrontée à la concurrence de la Chine et d'autres pays tiers, qui mettent à mal le leadership scientifique de l'UE. Les innovations dans le domaine des solutions biologiques ont été soutenues au cours du programme-cadre Horizon 2020, notamment l'initiative de partenariat actuelle, l'entreprise commune Bio-based Industries (BBI), qui s'est engagée dans des activités de recherche, de démonstration et de déploiement, notamment de bioraffineries, et d'autres projets. La nouvelle initiative s'appuiera sur les activités de H2020 et de l'entreprise commune BBI et les développera, assurant ainsi une plus grande pertinence aux ambitions adoptées par l'UE en matière de promotion de la neutralité climatique et de la bioéconomie circulaire.

Trois problèmes clés et facteurs déterminants ont été identifiés pour définir le champ d'application de la stratégie d'intervention de la nouvelle initiative CBE. Le premier problème est que l'économie de l'UE ne fonctionne pas à l'intérieur des frontières planétaires, n'est pas suffisamment durable ou circulaire et repose essentiellement sur les énergies fossiles. Le deuxième problème concerne les niveaux insuffisants de capacité de R&I, de transfert intersectoriel de connaissances et de solutions biologiques dans l'UE. Le troisième problème est que la compétitivité mondiale de la bio-industrie européenne est menacée. Ces problèmes sont dus à un développement insuffisant de chaînes de valeur interconnectées pour la valorisation de la biomasse, des sous-produits et des biodéchets européens, à un marché sous-développé pour les produits d'origine biologique, à l'insuffisance des caractéristiques environnementales et circulaires de l'actuelle bioéconomie, à une faible commercialisation des résultats de la recherche et à un manque d'infrastructures de soutien. Pour résoudre ces problèmes et leurs causes, il faut une intervention coordonnée et bien structurée au niveau de l'UE.

Les objectifs généraux de l'initiative sont de contribuer à une économie circulaire durable et à la neutralité climatique dans l'UE, d'assurer la circularité et la durabilité environnementale des bio-industries et de garantir la compétitivité à long terme de la bio-industrie européenne.

Lors de l'analyse des options politiques, un ensemble de fonctionnalités a été pris en compte, reflétant les critères de sélection des partenariats européens définis dans la proposition de la Commission pour le règlement Horizon Europe. Les fonctionnalités dites internes exigeaient de garantir (i) l'ouverture et la participation de divers types et compositions d'acteurs de l'ensemble de la chaîne de valeur de la biotechnologie, y compris les industries, les petites et moyennes entreprises (PME), les agriculteurs, la recherche, les organismes publics, etc. ; (ii) un large éventail d'activités tout en assurant l'équilibre requis dans le soutien à l'innovation tout au long des segments de la chaîne de valeur et en couvrant tous les niveaux de préparation technologique (NPT) ; et (iii) l'orientation et l'additionnalité en veillant à ce que toutes les parties prenantes participantes aient une reconnaissance commune des objectifs du partenariat, la consolidation des parties

prenantes fragmentées, la création de retombées et de leviers de connaissances. Les fonctionnalités externes exigent que le partenariat assure la coordination et la complémentarité avec les initiatives de l'Union et aux niveaux local, régional, national et, le cas échéant, international, ainsi que de réfléchir à l'émergence de nouvelles tendances et de contribuer à l'élaboration d'un cadre politique favorable au soutien de la viabilité des nouvelles chaînes de valeur biologiques et des nouvelles innovations.

Les options politiques pertinentes pour cette analyse étaient les appels à projets d'Horizon Europe (option 0), les partenariats co-programmés (option 1), les partenariats institutionnalisés au titre de l'article 187 du Traité sur le fonctionnement de l'Union européenne (TFUE) (option 3). Notre conclusion est qu'un partenariat institutionnalisé au titre de l'article 187 est l'option préférée. Cette option répond bien aux critères liés à la sélection du partenariat européen. Elle peut offrir un niveau plus élevé d'efficacité dans la réalisation des objectifs connexes du programme, la cohérence et les synergies du partenariat dans le paysage de la recherche et de l'innovation de l'UE, la transparence et l'ouverture dans la sélection des priorités et des objectifs et la participation des partenaires et des parties prenantes, une forte additionnalité en structurant les bio-industries, la directionnalité en formalisant les engagements des partenaires et l'engagement à long terme en formalisant les accords avec les industries. En outre, ce type de partenariat offre une perspective à long terme plus large que les autres options, ce qui contribue à maintenir un intérêt élevé des acteurs industriels et des investisseurs potentiels qui voient dans le partenariat un outil d'incitation fort pour investir en Europe.

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Glossary

| | |
|-----------------|--|
| BBI | Bio-based industry |
| BBI JU | Bio-based Industries Joint Undertaking |
| BERD | business expenditures in R&D |
| BIC | Bio-based Industries Consortium |
| CAP | common agricultural policy |
| CBE | Circular Bio-based Europe |
| CEAP | Circular Economy Action Plan |
| CFP | Co-funded Partnership |
| CO ₂ | carbon dioxide |
| CORDA | Copernicus Reference Data Access |
| CPP | Co-programmed Partnership |
| CSA | Coordination and Support Action |
| DEMO | demonstration (projects) |
| EAFRD | European Agricultural Fund for Rural Development |
| EC | European Commission |
| EIB | European Investment Bank |
| EIP | European Innovation Partnership |
| EMFF | European Maritime and Fisheries Fund |
| EP | European Parliament |
| ERDF | European Regional Development Fund |
| ESIF | European Structural & Investment Funds |
| EU | European Union |
| FLAG | Flagship |
| GDP | gross domestic product |
| GHG | greenhouse gases |
| H2020 | Horizon 2020 |
| HEU | Horizon Europe |
| IA | Impact Assessment |
| IIA | Inception Impact Assessment |
| IP A185 | Institutionalised Partnership Article 185 |
| IP A187 | Institutionalised Partnership Article 187 |
| IPR | Intellectual Property Rights |
| JRC | Joint Research Centre |

| | |
|-------|---|
| KET | key enabling technologies |
| KPI | key performance indicators |
| LCA | Life Cycle Assessment |
| LIFE | Programme for Environment & Climate Action |
| MFF | Multiannual Financial Framework |
| MS | Member States of the European Union |
| NACE | Nomenclature des Activités Économiques dans la Communauté Européenne – a European industry standard classification system |
| NGO | non-governmental organisation |
| OPC | open public consultation |
| PPP | public-private partnership |
| PROs | private research organisations |
| R&D | research and development |
| R&I | research and innovation |
| RIA | Research and Innovation Action |
| S&T | science and technology |
| SC | societal challenge |
| SDGs | Sustainable Development Goals |
| SIRA | Strategic Innovation and Research Agenda of BBI JU |
| SME | small and medium-sized enterprise |
| SO | strategic objective |
| SPIRE | Sustainable Process Industry through Resources and Energy Efficiency |
| TFEU | Treaty on the Functioning of the European Union |
| TRL | Technology Readiness Level |
| VC | value chain |

1 Introduction: Political and legal context

This document presents the impact assessment of the candidate Institutionalised Partnership for a Circular Bio-based Europe, which is one of the initiatives that will implement the Commission's vision for the period beyond 2020 under the Horizon Europe Pillar II, specifically the Cluster 6 (Food, Bioeconomy, Natural Resources, Agriculture and Environment). It is one of the envisaged European Partnerships in the Partnership Area of 'sustainable, inclusive and circular bio-based solutions'. The need for the present assessment was predefined by the EC Inception impact assessment entitled *European Partnership on Circular bio-based Europe* published in early 2019.¹

1.1 Emerging challenges in the field

Circular and bioeconomy models, namely their combination, could offer balanced solutions to many environmental and socio-economic problems. However, we still face technological challenges related to closing material loops, and to the development of new bio-based products and biowaste valorisation value chains to substitute fossil-based solutions. There is a lack of supporting technologies and facilities like bio-refineries of both small and large scale to unlock the bio-based business potential, especially in rural areas. These innovations are greatly needed for Europe to achieve the Sustainable Development Goals (SDGs), build a climate-neutral future, offer greener and inclusive growth and jobs, and ensure competitiveness.^{2 3 4 5}

Science, research and innovation may radically change production and consumption patterns with the potential to reduce pressure on ecosystems, via the multifunctional use of land and aquatic resources and biomass side-streams from various sectors, the production of alternative proteins for food and alternative materials with minimum harm for the environment, as well as through changes to peoples' behaviour and diets, and by fostering resource-saving and circular practices. However, this may break established routines and create resistance and anxieties, which need to be understood better.⁶



The innovation gap in the EU in translating research results into the development of innovative circular/bio-based products was seen by a majority of the **open public consultation (OPC)** respondents as a 'highly relevant' and 'relevant' problem. Only few academics and companies, SMEs and citizens consider this issue as less relevant. At the same time, only a small number of respondents across various groups see Intellectual Property Rights (IPR) licencing as 'very relevant' and 'relevant' barriers for exploitation of innovations in the circular bio-based field. Public authorities, citizens and non-governmental organisations (NGOs) are more convinced about that in comparison to academics business associations, SMEs and companies.

From the economic and business model perspective, a bioeconomy that is based on the concepts of circularity and cascading use presents a challenge to making economies work. Circularity implies new ways of designing and manufacturing products, new relationships between economic actors, new ways of recycling components and waste, etc. Different production models in terms of scope and size should be able to co-exist and capture the synergies between them. Furthermore, there is a need for larger investments to grow new

¹ EC (2019a)

² EC (2018d)

³ European Forest Institute (2017)

⁴ EC (2019c)

⁵ EC (2019a)

⁶ SCAR (2015)

value chains and new businesses in this area.⁷ This includes key facilities e.g. large-scale bio-refineries, which require cross-border and cross-sector collaboration and larger investors' inputs, as well as technologies and facilities of medium and smaller scales that can be of help to SMEs and biomass suppliers in, for example, remote regions.



Dominant majority of the **respondents to the OPC** see 'Lack of public investment' as a 'relevant' or 'very relevant' challenge faced by R&I efforts of EU in fostering a circular bio-based economy. Public authorities seem to be the most concerned, followed by EU citizens, business associations, academics, large companies, NGOs and SMEs. Public authorities seem to be the most concerned, followed by other groups all showing a high level of agreement. A high majority of respondents consider 'Lack of private investment' as 'relevant' or 'very relevant' challenges. The strongest agreement came from academics, followed by business associations, SMEs, large companies, public, public authorities and citizens.

According to the most of the **interviewees** from all groups, there is extensive potential to use agricultural and food wastes as feedstock, but there are challenges such as the scarcity and small-scale nature of these feedstock sources, lack of awareness by farmers of opportunities in new value chains and lack of capabilities to engage in these value chains.

Furthermore, uncertainties around feedstock sustainability, quality and costs of bio-based products and nutrients are important issues, especially if one wants to ensure that biomass supplies do not increase environmental pressure, biodiversity loss or intensive agriculture both within and outside the EU.⁸

The multi-sectorial nature of new bio-based industries requires building linkages and trust among economic actors from various sectors (e.g. farmers that would be upstream of the bio-based value chains are not linked with the chemical sector or with manufacturers downstream). Structural fragmentation in primary production and a high prevalence of microenterprises and SMEs are hurdles to a quick take-up of new opportunities in the area.⁹

Low awareness of many consumers, as well as insufficient clarity on the added value and benefits of new bio-based products translate into low demand.^{10 11} Not having an overall definition of sustainability has resulted in a moving target for the bioeconomy, meaning that farmers are not provided with predictability with regard to where to invest.¹² Consideration of circularity and circular economy goals most certainly will add even further complexities to the concepts to be worked with.



A majority of the **respondents to the OPC** see 'Lack of understanding of the circular and bio-based economy' as a 'relevant' or 'very relevant' challenge. Public authorities most strongly agree with that, followed by EU citizens, academics, SMEs, business associations, large companies and NGOs.

Regarding 'Lack of consumer acceptance or understanding', the majority of respondents see it as a 'relevant/very relevant' challenge. The highest agreement is shown by SMEs, and the lowest by NGOs.

⁷ European Forest Institute (2017)

⁸ OECD (2019)

⁹ BBI JU (2019)

¹⁰ BIOVOICES (2018)

¹¹ OPC shows that over 60% of respondents see lack of consumer acceptance or understanding (both business and individual) as problem in fostering circular bio-based economy.

¹² BBI JU (2019)

In terms of policy challenges, the fragmented policy landscape is slowing down the development of bio-based solutions by not addressing uncertainties, a lack of strategic direction and a lack of motivation from economic actors. Despite the launch of the EU bioeconomy strategy that seeks alignment across policy domains, what is being incentivised through one regulation is being penalised, or not facilitated, through another regulation. National and regional Bioeconomy policies do not show strategic coordination either, therefore impeding a boost to the benefit of all countries/regions.¹³

Finally, lessons from the past have shown the significant risks and trade-offs related to a large-scale increase in biomass utilisation, and increased competition between the demands of food and non-food biomass production. The growing use of agricultural and forest waste streams could have negative effects on the level of organic matter in soil and soil biodiversity, as well as on soil fertility and productivity. The need to increase crop productivity could lead to even more use of fertilisers and pesticides, causing more water and soil pollution. The bioeconomy could also aggravate water scarcity in some areas by adding pressure on water demand.¹⁴



In the **Inception Impact Assessment consultation (IIA)**, as well as in **interviews** stakeholders from academia, NGOs and EC, highlighted the importance to consider environmental impact of creating new demand for biomass (e.g. food security, impact on ecosystems, resource conflicts outside EU), and ensure maintenance or improvement of biodiversity.

Table 1: Overview of the challenges emerging in the area of circular bio-based industries

| | |
|------------------------------------|---|
| Social | <p>Consumption and production culture and patterns have been increasingly based on wasteful practices. Solutions will have to break established routines, which might create resistance and anxieties.</p> <p>Insufficient clarity of benefits and sustainability of the bio-based products translate into low demand.</p> <p>Weak linkages and trust among economic actors from various sectors.</p> |
| Technical and technological | <p>Growing need in closing the material loops in new bio-based products and biowaste valorisation value chains that substitute fossil-based products and value chains.</p> <p>Need for closing the innovation gap and supporting technologies and facilities (like bio-refineries) of both small and large-scale to unlock the bio-based business potential, especially in rural areas.</p> |
| Economic | <p>Concepts of circularity and cascading use presents a particular challenge to making economies work.</p> <p>Problems with mobilisation of investment for large and small-scale for bio-based projects, value chains and infrastructure.</p> <p>Uncertainty around availability and sustainability of biomass feedstock (e.g. side/secondary streams).</p> |
| Environmental | <p>Climate change, land and eco-system degradation, high ecological footprint and bio-capacity deficit.</p> <p>Significant risks related to an increase in biomass utilisation: increased competition between food and non-food biomass production, greater demand for land, more use of fertilisers and pesticides leading to water</p> |

¹³ ibid

¹⁴ OECD (2019)

| | |
|---|---|
| | and soil pollution, higher pressure on water demand, negative effects on the fertility of soils. |
| Political, policy and regulatory framework | <p>The fragmented policy landscape is slowing down the development of bio-based industry by not addressing uncertainties, controversies, lack of strategic direction and motivation from industries.</p> <p>Bioeconomy policies developed at national and regional levels do not show strategic coordination that could boost the benefits for all countries/regions.</p> |

Source: Technopolis Group, based on literature review

1.2 EU relative positioning

1.2.1 Competitive positioning of Europe in the field

An international assessment¹⁵ demonstrates that Member States, notably the United Kingdom and Germany, have developed the most advanced sustainable bioeconomy strategies. The European Union's role as an active partner in fostering bioeconomy transformation is plainly reflected in these results. However, even with the most advanced strategies, a considerable governance gap still exists between promoting and regulating bioeconomies.

The socio-economic effects of the bioeconomy are still to be estimated; however, many studies showed its positive contributions in value added generation and job creation in the EU when comparing material use of biomass against energy use.¹⁶ Between 2008 and 2016, the **turnover in the EU bioeconomy** has increased from below EUR 2 trillion to about EUR 2.3 trillion.¹⁷ After excluding food, beverages and tobacco sectors, turnover amounted to EUR 1.14 trillion. Among these, **the bio-based industries' turnover** grew from EUR 600 billion in 2008 about EUR 700 billion in 2016.

In contrast to the above, overall **employment in the EU bioeconomy** is declining. However, this reduction is mainly due to the decline of the agricultural sector¹⁸ while the other sectors have been stable or even increased their employment. In 2016, the EU bioeconomy had 18.6 million jobs, including 3.6 million in the 'bio-based sectors', which saw growth since 2008. It is important to note that the strategic expectation for the bio-based economy is that it builds on innovations while addressing societal objectives, such as contributing to high-skill job creation in rural settings, rather than maintaining an obsolete employment structure in agriculture.

Little information is available about **investments** in the bioeconomy. The report by Lux Research indicated a total of USD 9.2 billion attracted globally by bio-based chemicals and materials industries in 2010-2015.¹⁹ Nova-Institute suggests that investments in Europe and the USA cover mostly R&D and pilot facilities, while in Asia and South America they focus on commercial production plants.

The **analysis of the technological and scientific excellence of the EU bio-based sector** that is summarised below is based on trends in scientific publications and inventive

¹⁵ Dietz et al (2018),

¹⁶ Dammer et al (2017)

¹⁷ Piotrowski et al. (2019)

¹⁸ it is likely due to the increasing efficiency of agricultural production and emerging varied employment options for the rural population.

¹⁹ Dammer et al (2017)

activities measured by patenting in the area of bio-based products and processes. The **patenting** statistics^{20 21} show that all leading countries are largely challenged by China. Once producing patents at the same level as the EU, China's inventive performance grew from less than 3 000 patents in 2001 to over 55 000 patents in 2016, while the EU as well as other economies (except South Korea) saw a slight decline in patenting activity. Within the EU, over the years the leadership in patenting has been with Germany and France, while Poland and Finland have also performed well. The BBI JU-supported projects had applied for three patents by 2019.²² When it comes to the production of **scientific publications** in the bio-based area (search based on the term 'biorefineries')²³, the cumulative statistics for the EU countries show the EU leadership at the global level followed by the USA and China. Among the EU Member States, Spain has performed well, following China in the global ranking. Other EU leaders are the UK, Italy, Germany and Sweden. In terms of leading organisations (most prolific in publishing), we find a strong presence of EU universities and research institutes, with the Technical University of Denmark and the Dutch Wageningen University and Research Centre being the two leading ones. Also, Swedish, French and Finnish organisations are among the top 10. Two Brazilian organisations also rank high, showing that the topic is of key interest in that country¹⁰.

No official statistics are available **R&D expenditures** related to bio-based products and services. An EC-led study estimated the R&D expenditures in the biotechnology in the EU to be around EUR 2.5 billion in 2012, while the annual average growth rate in R&D expenditures over 2005-2012 was 4.6 %.^{24 25} The study also highlighted the declining patenting trends against increasing R&I investment in the area during the period 2005-2012, not only in the EU but also in the USA.

1.2.2 Support for the field in the previous Framework Programme

Under the Horizon 2020 programme, Societal Challenge 2: 'Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy' was allocated EUR 3.851 billion for the period 2014-2020.²⁶ Within this budget, the area relating to the bioeconomy and bio-based solutions was addressed under the call 'Innovative, sustainable and inclusive bioeconomy' with annual budgets of EUR 44.5 million and EUR 42 million in 2014 and 2015, respectively, and the call 'Bio-based innovation for sustainable goods and services – Supporting the development of a European bioeconomy' with annual budgets of EUR 12 million and EUR 26.47 million, respectively, in 2016 and 2017. In addition, selected topics of calls under 'Sustainable Food Security' and 'Blue Growth' contributed to coverage of relevant areas.

The current partnership initiative Bio-based Industries Joint Undertaking (BBI JU) has been allocated EUR **975 million** from Horizon 2020, while this sum is planned to be matched by EUR 2.73 billion from industries engaged in the partnership (Bio-based Industries Consortium or BIC).²⁷ The BBI JU was initiated in 2014 with the aims to attract consistent private investment, promote R&I along whole value chains, avoid fragmentation and duplication, and improve coordination in the innovation activities of bio-based industries.

²⁰The patent counting methodology is based on Rassenfosse et al (2013) ,

²¹ Detailed list of the IPC classes selected to the patent analysis is presented in Appendix F

²² as recorded in DG RTD internal databases. They come from two projects, EnzOx2 and PULP2VALUE.

²³ Details on the methodology for the bibliometric analysis are provided in Appendix G.

²⁴ Frietsch (2017)

²⁵ Despite the study being published in 2017, the years covered in the analysis only went up to 2012.

²⁶ <https://ec.europa.eu/programmes/horizon2020/node/113>

²⁷ BBI JU (2018)

The Institutionalised Partnership policy option was selected. Details of the BBI JU activities and achievements, and its stakeholder analysis, are presented in Appendix E.

The lessons learned from the implementation of the BBI JU

The BBI JU 2017 interim evaluation analysis²⁸, its annual activity reports²⁹, the 2019 study on the participation of the agricultural sector in the BBI JU³⁰ and the European Court of Auditors' report³¹ offer insights on the persisting problems and challenges, which are to be taken into consideration in building the new partnership model. On an operational level, these reports have identified various challenges in the programme setting, orientation, and monitoring, as well as emerging needs to strengthen specific aspects of the programme. These challenges are summarised below and offer lessons and considerations that are important for the design of the future initiative (note: BBI JU is aware of these and setting dedicated actions):

Insufficient level of contributions secured from industry partners compared to what was initially committed. The auditors see a high risk that the industry members will not achieve the minimum amount of operational financial contributions by the end of the programme. This requires strong attention when setting up a partnership in which the feasibility of commitments and their legal status will need to be discussed and planned carefully;

Methodological challenges in monitoring and reporting on performance indicators. For example, for the indicator on employment creation some ambiguities exist as to how many additional jobs have been created vs existing jobs. Needs stressed to update the key performance indicators (KPIs);

Need for better coordination with other EU initiatives. The focus of BBI JU is closely linked with themes covered under Horizon 2020 SC2 and SC5, with many complementary objectives and activities; therefore, establishing linkages will benefit both parts of the programme, serve society and foster the bioeconomy;

Insufficient participation of EU-13 MS in the BBI JU initiatives and weak outreach to regions with rural or deindustrialised areas. The low success rate of these countries in the BBI JU Calls is a concern;

Emergence of new bio-based value chains and products and the *need for support for market uptake* of these products. The experience of BBI JU has shown a rapid emergence of new value chains and products, which required moving from the biomass 'push'-based approach towards creating a demand for biomass product 'market pull'. Continuous effort and innovative approaches to support market uptake of new products can also include social innovation that balances present consumption patterns with a push for higher resource efficiency and overall environmental sustainability;

Lack of interest and prohibitive barriers to engagement of primary producers in the projects of BBI JU, especially for small-scale agricultural companies. Annual Activity Reports pointed out that only 29 % of all projects contributing to the growth of income for primary producers that are mostly SMEs. The cost of joining BBI JU is still prohibitive to them, and the time and resources required for proposal preparation and project implementation remain an

²⁸ EC (2017a)

²⁹ BBI JU Annual activities reports (AAR) are available on the following hyperlinks: Annual activity report 2018; Annual activity report 2017; Annual activity report 2016; Annual activity report 2015; Annual activity report 2014

³⁰ BBI JU (2019)

³¹ European Court of Auditors (2018)

obstacle. For many understanding of the concepts, new economic opportunities, limited awareness about the initiative, is also an obstacle;

Need to reflect on the emergence of new trends in technologies (e.g. digitisation) or sub-areas (bioinformatics, synthetic biology). In this respect, intra-sectorial collaborations between research and industry are important for the further development of the young sector and the input from scientific partners is needed to generate the most innovative solutions.

1.3 EU policy context beyond 2021

As mentioned in the report on the overarching context to the impact assessment studies, R&I actions focused on the attainment of a more circular and bio-based economy will be funded under the Horizon Europe Pillar II Cluster 6 (Food, bioeconomy, natural resources, agriculture and environment). These R&I actions address multiple SDGs, including: SDG 2: Zero hunger; SDG 6: Clean water and sanitation; SDG 7: Affordable and clean energy; SDG 11: Sustainable cities and communities; SDG 12: Responsible consumption and production; SDG 13: Climate action; SDG 14: Life below water; and SDG 15: Life on land.

The R&I actions in this cluster aim at contributing to the EU *European Green Deal* priorities.³² As part of the Green Deal, the proposed initiative is expected to especially contribute to a toxic-free environment, a clean and circular economy, preserving and restoring the ecosystem and biodiversity, and also to the priority of a just transition. The R&I actions in this cluster are also expected to be instrumental to the announced climate change actions in light of the *Clean Planet Communication*³³ and several EU policy initiatives that are driven by the Paris Agreement. They will benefit from the minimum 35 % of all Horizon Europe (HEU) expenditure that will be dedicated to climate action. Policy initiatives related to the proposed initiative include the 2018 *European Bioeconomy Strategy*,³⁴ the *Biodiversity strategy*,³⁵ and sectoral policies like the new *common agricultural policy*,³⁶ which has high climate and environmental ambitions and a strategic focus on increasing the participation of farmers in the bioeconomy.

The R&I actions in this cluster aim at contributing to the EU '*European Green Deal*' priorities.³⁷ As part of the Green Deal, the proposed initiative is expected to especially contribute to a toxic-free environment, a clean and circular economy, preserving and restoring the ecosystem and biodiversity, and also to the priority of a just transition. The R&I actions in this cluster are also expected to be instrumental to the announced climate change actions in light of the *Clean Planet Communication*³⁸ and several EU policy initiatives that are driven by the Paris Agreement. They will benefit from the minimum 35 % of all Horizon Europe (HEU) expenditure that will be dedicated to climate action. Policy initiatives related to the proposed initiative include the following:

The 2018 *European Bioeconomy Strategy*³⁹ is a cross-cutting policy framework that outlines the transition to a sustainable circular bioeconomy. It aims to strengthen and

³² EC (2019c)

³³ EC (2018f)

³⁴ EC (2018d)

³⁵ EC (2011) EU

³⁶ https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy_en

³⁷ EC (2019c)

³⁸ EC (2018f)

³⁹ EC (2018d)

scale-up the bio-based sectors, unlock investments and markets, deploy rapid bioeconomies across Europe and understand the ecological boundaries of the bioeconomy. For this purpose, it brings together various EC Directorate Generals, sectors and stakeholders to put forward coordinated actions (in R&I but also in investment and skills actions).

The current *EU Biodiversity Strategy 2011-2020*,⁴⁰ introduced six key targets, amongst which is to 'Achieve more sustainable agriculture and forestry'. This includes preserving wilderness areas and protecting genetic diversity that are crucial in the discussions on ecosystem services in the bioeconomy (including carbon sinks), and assessing trade-offs and alternative uses of feedstock. The new Biodiversity Strategy 2030 (expected in 2020) will frame actions for the bioeconomy, inform the new EU forest strategy, and developments in the agricultural and blue bioeconomy sector.

The *common agricultural policy (CAP)*,⁴¹ has a huge potential to further support the deployment of the bioeconomy in rural areas, as well the effective integration of primary producers into the value chains of the bioeconomy. The European Agricultural Guarantee Fund gives farmers the flexibility to produce the biomass according to the market demand. The European Agricultural Fund for Rural Development allows farmers to address needs in establishing integrated value chains via awareness-raising, training support, small-scale investment support, etc.

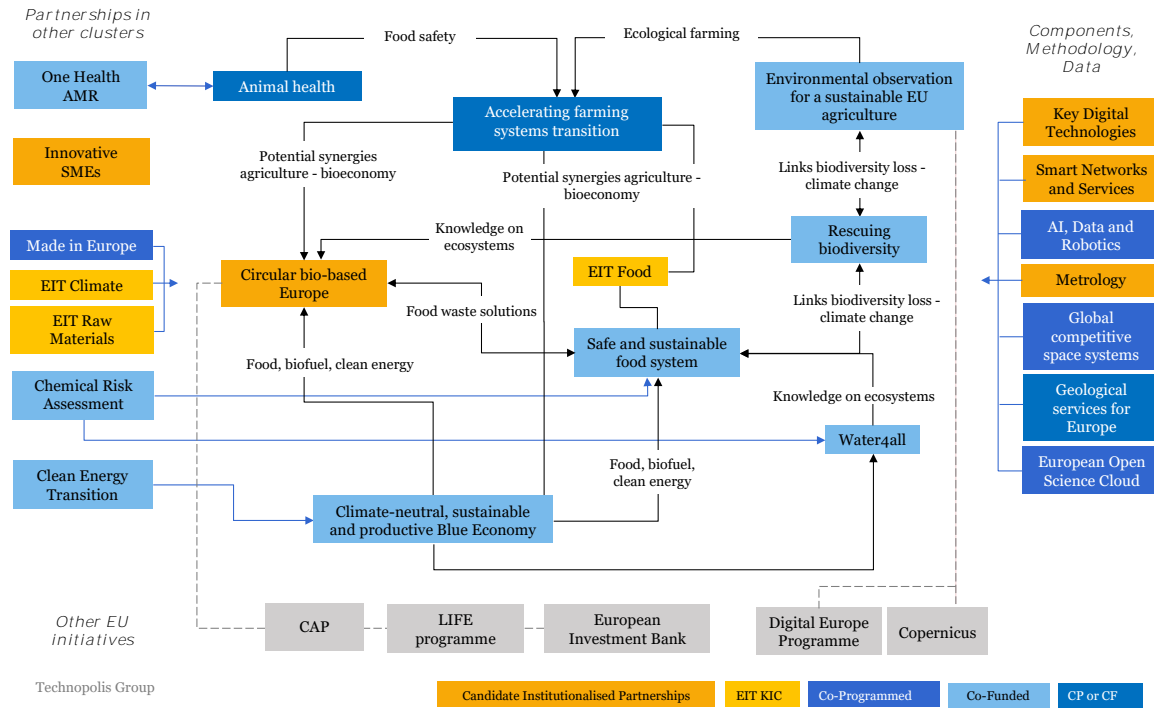
Figure 1 below maps out the landscape of the European Partnerships that are currently envisaged for funding under Cluster 6, amongst which is the candidate Institutionalised Partnership for a Circular Bio-based Europe in the context of the European Partnership Area 'Sustainable, inclusive and circular, bio-based solutions'. Due to the close intertwining of the challenges addressed, strong and multiple interlinkages exist between the envisaged partnerships. Since the food system both uses agricultural and fishery products and produces raw materials for the bioeconomy, the partnership for safe and sustainable food systems is linked with most of the other partnerships. Considering the overall objectives of both the cluster and the EU policy, strong linkages must also be ensured between the partnership for rescuing biodiversity, and all those connected to food production and exploitation of natural resources. Finally, the currently proposed cluster portfolio of partnerships aims at change in production and consumption habits for the emergence of new systems, which will be more environmentally, economically and societally sustainable. It will therefore contribute to both the overarching EU objectives of a European Green Deal and a people-centred economy.

⁴⁰ EC (2011) EU

⁴¹ https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy_en

Figure 1: Interconnections between the envisaged partnerships in Cluster 6

European Partnerships in the Food, Bioeconomy, Natural Resources, Agriculture and Environment cluster



The cluster should exploit synergies with R&I activities and envisaged partnerships in other clusters. For instance, the European Open Science Cloud and Innovative SMEs partnerships may provide valuable 'horizontal' support to the candidate European Partnership in Cluster 6. Both aim to facilitate research and innovation collaboration. The European Open Science Cloud may help the integration of technologies developed in other research and innovation projects into new solutions, such as the use of digital technologies in agriculture and fishery. Similarly, the share of data will be key to ensure smooth cross-sectoral collaboration and foster the development of circular economy. The Innovative SMEs, through the support to cross-border research and innovation projects of SMEs, may accelerate the deployment of solutions across Europe and potentially beyond.

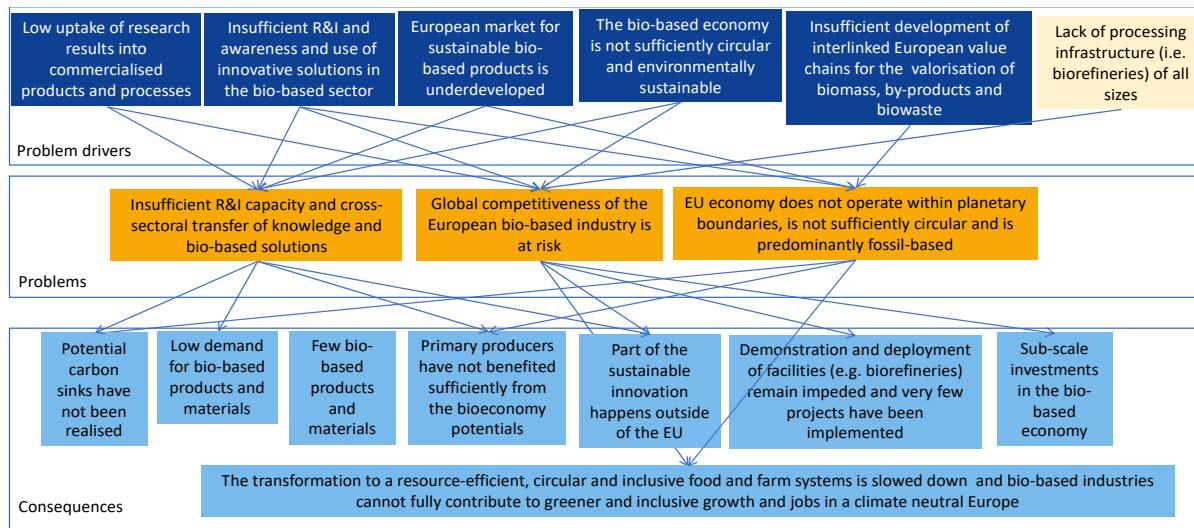
The envisaged Circular Bio-based Europe initiative may also find support for its activities in the CAP mentioned above and the LIFE Programme for environmental and climate actions, which provides grants for pilot and demonstration projects for the environment and resource efficiency, as well as climate change mitigation and adaptation. The European Investment Bank (EIB) and the Circular Bioeconomy Thematic Investment Platform, which is part of the 2018 Bioeconomy Strategy action plan may support bringing bio-based innovations closer to the market and de-risking private investments in sustainable solutions.

2 Problem definition

This section provides a discussion of the problems to be addressed in relation to the emerging challenges presented in Section 1.1, drawing on evidence from desk research and the findings of the stakeholder consultation undertaken as part of this study.

The problem tree presented in Figure 2 below portrays related problems, their drivers in the scientific, technological/economic and societal spheres, and their consequences. They are further described in detail in the following sections. This diagram will further feed the objective tree and the intervention logic presented in the following sections of the report, addressing the need for EU R&I action.

Figure 2: Problem tree for the initiative on Circular Bio-based Europe



Source: Technopolis Group

2.1 What are the problems?

This section describes the key problems for Europe to address, especially through research and innovation investments, taking account of current and future challenges in the field of the bio-based industries.

2.1.1 The EU economy does not operate within planetary boundaries, is not sufficiently circular and is predominantly fossil-based

Despite the take-up of environmental and circular economy agendas in the EU, the European economy and consumption patterns are still to a large extent based on fossil-based products. This results in a high ecological footprint produced by European citizens which is more than double the bio-capacity.⁴²

As the scale of the problem is significant, the efforts needed for the transition are huge and involve all sectors of the economy. For example, the Circularity Gap Report has stated that only 9 % of the global economy is circular.⁴³ While being a lost opportunity, this also represents a huge potential. Therefore, there is a need for the EU to act, and in recent years policies have addressed the need for a more radical and holistic change. For example, the EU currently has a goal of 40 % emission reductions by 2030.⁴⁴ The new Industrial Policy Strategy⁴⁵ foresees actions on circular economy and 'measures to convert biological resources into bio-based products'. The recently published EU Green Deal proposes new ambitious targets such as European climate neutrality by 2050 and 50 % emissions reduction by 2030. It also reiterates the ambition for the EU to become a world leader in the circular economy. By March 2020, the EC will launch a European Climate Pact, 'bringing together regions, local communities, civil society, industry and schools'. A new Biodiversity Strategy will be proposed as part of the Green Deal call for curtailing biodiversity loss,

⁴² <https://www.eea.europa.eu/data-and-maps/indicators/ecological-footprint-of-european-countries-1/assessment>

⁴³ Circle Economy (2019)

⁴⁴ EC (2014)

⁴⁵ EC (2017d)

ecosystem restoration and a decent living for farmers.⁴⁶ The bioeconomy and sustainable forestry are among the nine objectives of the post-2020 CAP.

Given the significant scale of the problem, and in order to achieve these high ambitions, and because of the complexity and the systemic nature of many of the solutions, the EU is pledging to invest significant amounts of money into R&I.⁴⁷ All these new policy developments and targets lead to the conclusion relevant to our impact assessment: despite successes and improvements, the European economy as a whole is not sufficiently circular and sustainable, and needs to step up action to ensure planetary boundaries are respected. Therefore, the EU needs to act on all big leverages such as the bio-based economy to move closer to the goal of a highly sustainable and circular economy. Its vocation is to reduce dependency on non-renewable resources and changing the nature of European consumption. Additional R&I is strongly needed for that, as well as to ensure that this transition has no negative impact on biodiversity and ecosystem services. By using biological waste, it will help to increase circularity of the multiple relevant systems leading to a reduced ecological footprint overall.



A high majority of business associations respondents to the **OPC**, followed by a smaller majority of businesses and EU citizens think that future European Partnerships under Horizon Europe need to be responsive towards EU policy objectives. They are followed by NGOs, academics, SMEs and public authorities.

An even bigger number of respondents from each category think that the European Partnerships need to be responsive to societal needs as well. An overall majority under each stakeholder category think that future European Partnerships under Horizon Europe need to significantly contribute to achieving the UN's SDGs.

According to all **interviewees**, the future initiative for a circular bio-based Europe might be contributing to the EU policy objectives by promoting and raising awareness about the bio-based industry, promoting existing standards or labels but also by de-risking investment and filling the funding gap in the industry. In that regard, it has been stipulated that the future initiative needs to accompany the industry and producers in promoting bio-based products.

2.1.2 Insufficient R&I capacity and cross-sectoral transfer of knowledge and bio-based solutions

R&I capacity in the bio-based sector is not sufficient, despite the fact that a significant amount of EU funding has already gone to the bioeconomy and more specifically to the bio-based economy through BBI JU, H2020 Coordination and Support Actions (CSAs); European Structural and Investment Funds (ESIF) including the European Regional Development Fund (ERDF), EAFRD, European Maritime and Fisheries Fund (EMFF); and the LIFE Programme. This is evidenced in the declining number of patents and is due to the huge diversity of the sectors and applications involved. It should also be mentioned that the level of R&I investments in the fossil-based economy significantly exceeds the R&I investments in the bioeconomy. At the same time, as pointed out in the 2018 updated EU Bioeconomy Strategy, in the context of rising markets in the developing world and given the many societal challenges, the EU bioeconomy sectors 'need to innovate and further diversify'.

The challenges facing the bio-based economy are significant and R&I is expected to resolve a number of different problematic issues, such as competing uses of feedstock; the need

⁴⁶ Political Guidelines for the next European Commission 2019-2024

⁴⁷ Ibid

for larger quantities of feedstock supply if the bio-based economy is to grow; the need to increase yield productivity, etc.

One of the reasons for the insufficient competitiveness of the European bio-based industry has been the relatively slow cross-sectoral transfer of knowledge and bio-based solutions, and a slow uptake of research by the industry.⁴⁸



An overall majority of **respondents to OPC** across various stakeholder groups believe that there is a lack of economic and regulatory incentives for bio-based products and producers. SMEs and business associations had the highest share of concerned respondents, followed by academics, NGOs, public authorities, citizens and large companies.

A large part of the respondents across every category of stakeholders, except for businesses and NGOs who collected less engagement, think that it is relevant/very relevant for R&I efforts at EU level to address the problem of R&I – Lack of understanding of the circular and bio-based economy. A high majority therefore think that it is relevant or very relevant for R&I efforts at EU level to address the problem of R&I – Innovation gap and to address the problem of Structure and resources – Limited public-private collaboration.

A majority of respondents across categories think that the future European Partnerships under HEU need to be responsive towards priorities in national/regional R&I strategies.

According to the **interviews** of the European industrial stakeholder **category**, they have the impression that many European patents have been used and commercialised in countries outside the EU.⁴⁹ The reasons for this trend are complex. One of them is that the bio-based industry is highly risky, hence there are serious difficulties in mobilising high-risk capital for its development in Europe.⁵⁰ The bio-based economy has a multi-sectoral nature, and actors from different sectors do not communicate sufficiently and often operate in sectoral silos. This also means that there is a lack of common understanding of the issues and priorities encountered by other stakeholders and sectors.

2.1.3 The global competitiveness of the European bio-based industry is at risk

The Political Guidelines for the next European Commission 2019-2024 underline that 'A sustainable Europe is one that opens up opportunities, innovates, creates jobs and offers a competitive edge to its industries. The circular economy is key for developing Europe's future economic model'. Therefore, given the importance of the bio-based economy and industry for the circularity of the entire European economy, enhancing the competitive edge of European bio-based industry is of utmost importance.

The wider bioeconomy and the bio-based sector have been growing in recent years with almost EUR 700 billions of turnover and 3.6 million employees in the EU-28 in 2015. An untapped potential in certain industries could be illustrated by the following figures: while there was a slight increase in the overall bio-based share of the chemical industry from 5.5 % in 2008 to 6.8 % in 2015, only 50 % of the raw materials for the chemical industry are organic. With regards to the bio-based share of organic raw materials, it has grown from 11 % in 2008 to 14 % in 2015.⁵¹

⁴⁸ EC (2018d)

⁴⁹ interviews with representatives of industry. While the insights of the consulted stakeholders are important and should be paid attention to because of the stakeholders' knowledge of the market we cannot back up these statements with any concrete figures.

⁵⁰ *ibid.*

⁵¹ Piotrowski et al (2019)

This growth has partly been driven by the policy developments (discussed in Section 2.1.1) related to the circular and bio-based economy. Even though there has been growth in the sector, European industry has not been able to fully use the potential presented by the bio-based economy. At the same time, as the global market for bio-based products is growing, the European industries need to speed up the shift in order to be able to benefit from this growth. According to the EU Bioeconomy Strategy, the biggest growth is expected in sustainable primary production, food processing and industrial biotechnology and bio-refineries.⁵² This strategy also points out that, in the context of growing markets in the developing world and given the many societal challenges, the EU bioeconomy sectors 'need to innovate and further diversify'.⁵³



In the **OPC**, A clear agreement was found about the relevance for R&I efforts at EU level to address the uptake of innovations – Lack of competitiveness.

Except for academic respondents who gathered less engagement, the majority of respondents think that future European Partnerships under Horizon Europe need to make a significant contribution to EU global competitiveness.

It has been reiterated a number of times in the **interviews**, especially by representatives of industry on the basis of their industrial intelligence, countries outside Europe have been investing massively in deployment of infrastructure necessary for the development of the bio-based industry. As a consequence, part of the sustainable innovation and deployment in the bio-based sector occurs outside Europe and undermines the competitiveness of the European bio-based industry, possibly putting it at risk with regards to the future development of the bio-based economy and the opportunities it offers. Developments which might take place in Europe would potentially take place elsewhere.

2.2 What are the problem drivers?

The key problem drivers affecting R&I performance in the Circular Bio-based Economy in Europe are discussed in more detail in the following paragraphs.

2.2.1 Insufficient development of interlinked value chains for the valorisation of European biomass, by-products and biowaste

The level of development of the value chains for the valorisation of biomass, by-products and biowaste is insufficient. On the one hand, sustainable feedstock availability remains too uncertain, partly due to the lack of integration of primary producers in business models.⁵⁴ On the other hand, there are very few processes and technological solutions for turning biomass into industrial products due to unexploited research and patent issues.⁵⁵



Agreement was found in the **OPC**, about the relevance for R&I efforts at EU level to address the problem of Innovation gap and to address the mobilisations of resources – Limited via public-private collaboration.

According to some **interviewees** from academia and public authorities, one reason for the insufficient development of the biomass and biowaste valorisation value chains is the fact that different sectors of the bio-based economy do not communicate sufficiently with one another. As a result, the potential for development of new biomass and biowaste utilisation value chains has been underutilised. Ultimately, this leads to fewer recycled nutrients – a situation that means an untapped potential for carbon sinks and a

⁵² EC (2018d)

⁵³ ibid

⁵⁴ (2018d)

⁵⁵ EC (2018d)

low circularity of systems. The lack of integration of small agricultural producers results in less feedstock availability in cases where larger producers are either too few, unreliable or too costly for bio-economy processing companies. Most biomass processing companies are having feedstock issues because of seasonality, biomass quality or logistical issues in all EU Member States, although some Member States are more affected than others. This problem does not affect all bio-based products. It mostly affects those with a cost that is higher than their traditional alternatives. The scale of the problem has been somewhat decreasing with the recognition of the bio-based products as more sustainable alternatives, and with some customers ready to pay more for sustainable options.

2.2.2 European market for sustainable bio-based products is underdeveloped

Despite the increase in their number there are still relatively few bio-based products on the market. This leads to limited choice for consumers and is insufficient to alter their consumption habits and patterns. The situation creates a vicious circle, leading to a low demand for bio-based products.

Despite the introduction of new obligations and targets for the near future, there remains a fragmented policy landscape, which complicates the start of new facilities or processes/products and hampers the constitution of a functioning European market.⁵⁶ This is an obstacle to providing a sufficient supply of diverse bio-based products and has been confirmed by responses to the OPC.

Additionally, the potentials of the green public procurement have been underutilised. Countries and regions do not have strong incentives and knowledge to include specific criteria in their procurement.

Besides the low availability of bio-based products, one main reason for the low demand of such products is the limited awareness of consumers with regards to their environmental and nutritional benefits. What further slows down the change in consumer behaviour is the fact that biomass use has sometimes been associated with concerns such as posing threats to food security. Addressing these and communicating this to the public can contribute to an increase in demand for bio-based products.



Except for the EU citizens who are less convinced, the majority of **respondents of OPC** think that the future European Partnerships under Horizon Europe need to be responsive towards Market failures. Agreement has been found on the relevance for research and innovation efforts at EU level to address the problem of Lack of consumer acceptance or understanding as well as to address the problem of Lack of economic and regulatory incentives for bio-based products/ producers.

When providing further detailed in open questions, respondents of all kind mentioned the need for strong communication flows and inclusiveness to increase awareness and societal change.

According to the **interviewees** from all groups, despite the success of BBI JU, European policy had not provided sufficient push for creating new markets for sustainable bio-based products. Consulted stakeholders reiterated that there has been a lack of economic and regulatory incentives for bio-based products and producers. This can change with the adoption of targeted legislation, such as the EU Plastics Strategy⁵⁷ and the Directive on Single Use Plastics⁵⁸, which open up significant markets for the bioplastics industry.

⁵⁶ EC (2018d)

⁵⁷ EC (2018c)

⁵⁸ European Parliament (2019)

2.2.3 The bio-based economy is not sufficiently circular and environmentally sustainable

The bioeconomy is not intrinsically sustainable. It requires economic, social and environmental trade-offs and contains inherent risk.⁵⁹ Enhanced biomass mobilisation can be linked with air and water pollution; therefore the question on how much biomass can be supplied sustainably for a growing EU bio-based industry is key.⁶⁰ Policy-makers need to carefully determine the most cost-efficient use of biological and other resources to meet food, feed, fuel and fibre needs.⁶¹ Making the bio-based economy increasingly circular has huge potential for bringing the overall European economy closer to a more circular and sustainable model of development.

The bio-based economy includes large sectors such as chemicals and plastics, pharmaceuticals, paper and paper products, forest-based industries, textiles, biofuels and bioenergy. They need to make enormous gains in their environmental sustainability and circularity by increasing the share of raw materials coming from sustainably sourced biomass.

The potential to grow the bio-based share of industry is significant, although it remains to be researched what would be the optimal level.



A majority of respondents to the OPC think that it is relevant or very relevant for research and innovation efforts at EU level to address the problem of Lack of understanding of the circular and bio-based economy. An even higher majority think that the future European Partnerships under Horizon Europe need to Focus more on bringing about transformative change towards sustainability.

According to some **interviewees** from industry, academia and public sectors, the growth of the bio-base industry will require the involvement of actors such as primary producers, leading to serious implications for the agricultural sector. The same holds true for the forestry sector. To use this potential, additional research is equally needed for the creation of new bio-based building blocks to be used by the chemical industry. In the European bio-based sector, technological and innovation challenges are also present in the development of new bio-based building blocks and biowaste valorisation value chains. This necessitates significant investments in R&I, both at national and EU level.

All interviewees agree that the systemic challenges in the bio-based sector are also rooted in the multi-sectoral nature of the industry where there is still a low level of collaboration between sectors. This has prevented sufficient cross-sectoral fertilisation and creation of new cross-sectoral value chains. Overcoming the collaboration gap requires a strong structuring and organising effort.

2.2.4 Insufficient R&I, awareness and use of innovative solutions in the bio-based sector

As mentioned earlier, despite support from various EU and national programmes the patenting in the bio-based sector is slowly declining. A good benchmark for the desired levels of R&I funding in the bio-based sector would be the funding in the fossil-based sector, which is significantly higher.

⁵⁹ OECD (2019)

⁶⁰ Camia et.al (2018)

⁶¹ EC (2018d)

While insufficient R&I has been identified as one of the problems in the sector, driving this problem is also the insufficient awareness within different industrial sectors of both the available research and the cross-sectoral opportunities.^{62 63}



A majority of **respondents to the OPC** think that it is relevant or very relevant for research and innovation efforts at EU level to address the problem of Lack of consumer acceptance or understanding and that it is relevant for research and innovation efforts at EU level to address the problem of Lack of consideration of user needs.

It has been indicated by the **interviewed** stakeholders involved in BBI JU-funded projects that participating in consortia with research organisations provides a much better access to innovative research. Cooperation with other sectors – which would not have happened without the current BBI JU – has opened up company horizons and has stimulated cross-sectoral innovation. Interviewees have reported that new business collaborations have followed the EU-funded projects.

2.2.5 Low uptake of research results into commercialised products and processes

It has been pointed out in the EU Bioeconomy Strategy that ‘research and application of research are often disconnected’. Different stakeholders have validated this. This occurs because of ‘an information and knowledge gap’ and because of insufficient collaboration and interaction between researchers, innovators, producers, end-users, policy-makers and the civil society. Research results with high potential also remain unexploited because of legislative issues and patenting.⁶⁴ This has also been confirmed in interviews with different stakeholder groups and in the OPC.

An Organisation for Economic Cooperation and Development (OECD) foresight report also recommends the promotion and integration of biotechnology research across commercial applications. The report underlines the importance of knowledge exchange between different research disciplines and commercial applications.⁶⁵



According to the **respondents to the OPC**, it is relevant or very relevant for research and innovation efforts at EU level to address the problem of Innovation gap, the problem of limited public-private collaboration as well as the problem of lack of economic and regulatory incentives for bio-based products/producers.

Interviewees, especially from the business see that the market uptake of novel products and bio-based solutions face challenges that could be addressed by a diverse set policy instruments addressing both, demand and supply sides.

2.2.6 Lack of processing infrastructure (i.e. biorefineries), both small and large

The Bioeconomy Strategy recognises that ‘a sustainable bioeconomy requires more research, rural, marine and industrial infrastructures...’.⁶⁶ The Strategy mentions the need to support integrated and diversified biorefineries, as well as small-scale local plants.

One of the reasons for the limited deployment of demonstration and flagship facilities is their cost and the level of risk they bring. The OPC respondents have pointed to the high

⁶² Interviews

⁶³ BBI JU (2019)

⁶⁴ EC (2018d)

⁶⁵ OECD (2009)

⁶⁶ EC (2018d)

cost of transition to the use of bio-based materials. As a result, there are few examples to inspire others and a risk that sustainable innovations will happen outside the EU.

Biorefineries face logistical challenges, as they need to be located close to sources of biomass because of high transportation costs.⁶⁷ There is also an insufficient number of commercially available small-scale industrial solutions, which can be applied by SMEs or primary producers, including in a symbiosis with larger biorefineries. This further impedes the scaling-up of solutions as large industrial solutions are not always applicable.

The growth in sustainable primary production, food processing, and industrial biotechnology and biorefineries would lead to the creation of new bio-based industries and the transformation of those already in existence. It will also create new markets for bio-based products.⁶⁸



Agreement was found among the respondent to the OPC on the relevance for research and innovation efforts at EU level to address the problem of Lack of private investment and the lack of public investment.

A high majority of respondents, except for EU citizens who were less engaged, think that the future European Partnerships under Horizon Europe need to focus more on the development and effective deployment of technology. The need to focus on high TRL was reinstated in open answers regarding “other needs” to be addressed, especially by companies.

Views collected during the **interviews** (especially industries) depict that due to the lack of competitiveness and because flagship projects are not bankable, potential investors and entrepreneurs are reluctant to enter the market.

2.3 How will the problem(s) evolve?

The population in Europe is expected to continue to grow and the demands for products will increase. At the same time, the need to reduce the European ecological footprint and to reach the ambitious policy objectives of climate neutrality by 2050 will require replacing many of the fossil-based products with bio-based ones. Therefore, the need for continuing research on new bio-based building blocks will grow, as well as the need to create the necessary processes to turn them into concrete products. The R&I action on bio-based products and processes will become even more pressing with the adoption of the new EU legislation and the rising ambitions for circularity and carbon-neutrality.



Many interviewed stakeholders from all groups consider that, because of its huge potential, the sector would develop even without EU intervention. However, it would take longer for research to reach the necessary results and chances are that research will not be well-aligned with societal needs and realistic industrial capacities.

Additionally, the sustainable European bio-based sector will risk undermining its competitiveness in a context of a growing global market for bio-based products. Given the high reported interest of countries like China, the USA, Canada, South Korea and others in developing the bio-based sector, it could be expected that international competition will only grow.

The growth in the bio-based sector will require much higher biomass mobilisation levels. Naturally, this will pose significant problems with regards to ensuring the sustainability and

⁶⁷ OECD (2019):

⁶⁸ EC (2018d)

optimal levels of biomass production and minimisation of negative environmental impacts associated with it.



Overall, there is an agreement in the **interviewees** from all groups that R&I in the bio-based sector is hugely inferior to R&I in the fossil-based sector. Therefore, there is a need to try and match R&I in the bio-based sector with R&I in the fossil industry. European action will be needed while this discrepancy persists.

The benefits of EU-supported R&I spending will be much higher if these investments take place in close collaboration with the industry and are aligned with public interests and societal needs.



As shared by some **interviewees** from public authorities and industries, many of the European research results and patents are being deployed and implemented in countries outside the EU, undermining the competitiveness of the European bio-based industry.

If the shortage of European funds for demonstration and flagship projects continues to be the case, this trend risks being aggravated, which will further decrease the chances of European industries having an increasing share of the growing market of bio-based products.

The OECD in its forward-looking study *Bioeconomy 2030* foresees that the focus of both private and public research investments in the bioeconomy will shift from health applications to primary production and industrial applications (from 6 % in the early 2000s to 75 % in 2030).⁶⁹

3 Why should the EU act?

3.1 Subsidiarity: Necessity of EU action

The bio-based industries have been growing at an average of 2 % annually and their turnover reached about EUR 700 billion in 2016, up from about EUR 600 billion in 2008.⁷⁰ However, extensive investments are needed, in addition to holistic policy support, including on consumer perception, to ensure sustainable growth and avoid the loss of jobs. A coherent EU-wide approach is also necessary to ensure that the right balance is found between growth and sustainability.⁷¹

Firstly, the bio-based industries can be a key structuring element for a circular economy by enabling the reuse of biomass waste and the creation of non-fossil-based products and materials. However, it might increase pressure on global ecosystems and food supply, and eventually result in an overall rise in greenhouse gases (GHG).⁷² Avoiding negative environmental externalities is not straightforward, especially as both policy and research development are tightly intertwined in the sector where a great deal of uncertainties persist.⁷³ Coordination at EU-level would ensure both a holistic approach and knowledge sharing between EU countries and regions for local implementation.

Rapid technological changes in the bio-based industries and the ongoing massive investments in skills and production capacity in competitive countries require a rapid and

⁶⁹ OECD (2009) *Bioeconomy 2030: Designing and Policy Agenda*

⁷⁰ Piotrowski et al (2019)

⁷¹ Philippidis, G. et al (2018)

⁷² Diakosavvas, D. and C. Frezal (2019).

⁷³ SCAR (2015)

coordinated response in order for the EU to remain competitive. While investments in science are still needed, dissemination and take-up of research results into commercialised products and processes is too slow. Ensuring EU-wide dissemination is necessary to avoid missed opportunities and duplication.

Moreover, bio-based industries, by creating high-value products and processes, offer opportunities for feedstock providers, and can play a major role in the revitalisation of rural regions in Europe. Nonetheless, any growth in this sector would have to be carefully planned so as not to excessively disrupt current rural economies based on food production, multifunctional ecosystems and tourism.⁷⁴ As job growth potential remains limited, it should be carefully integrated with other economic activities.⁷⁵

Finally, the EU needs to create the right market conditions for the sector to reach its economic and environmental potentials: awareness needs to be raised to create demand and recycling infrastructures need to be completed to ensure cascading use. The EU could act as a first mover in creating an economic system at Single Market level, fit for addressing environmental problems, giving it a competitive advantage in a global context increasingly turned toward addressing these issues (notably the climate and biodiversity crises). This will require strong coordination between and within all Member States, which can only be ensured with the support of EU-level mechanisms. This will also ensure that the regulatory framework for the bio-based industries, as part of the bioeconomy, is well harmonised, an essential condition for its success.⁷⁶



During **the OPC**, respondents were asked to provide their view on the relevance of research and innovation efforts at EU level to address the following problems in relation to the circular bio-based field, specifically on three types of problems: problems in uptake of circular bio-based innovations, structural and resource problems and research and innovations problems. While there are various answers regarding each specific problem, overall, a majority of respondents saw EU level action as relevant or very relevant. Only issues of intellectual property rights did not gather such an approval.

During interviews, a vast majority of respondents from all stakeholder groups mentioned that action at EU level was needed in general to develop a circular bio-based economy.

3.2 Subsidiarity: Added value of EU action

The research agenda must be coordinated at the EU level, notably to ensure its cohesion with related policy areas (e.g. EU environmental policy, CAP, and cohesion policy) for bio-based industries to contribute to a sustainable circular economy in the EU. There is also a need to ensure the alignment of national and regional policies across the EU to create a coherent regulatory landscape. The continuing needs for research and innovation also call for a pooling of resources at EU level, notably in sharing research infrastructures and promoting researchers' mobility. This will ensure both an efficient use of research funding, avoiding duplication, and the dissemination of research results, which is key to the uptake of innovation, especially when reaching the commercialisation stage. Investments in research, but also in market deployment, must match those of other countries (especially China and South Korea) to ensure EU competitiveness in the long term. The effective deployment of biorefineries throughout Europe will be difficult to achieve if funded only at the national level and there is a risk of excluding the less innovative Member States, leading to a fragmented economic landscape. A European coordinated action would

⁷⁴ Ibid.

⁷⁵ Philippidis, G. et al (2018)

⁷⁶ Diakosavvas, D. and C. Frezal (2019)

furthermore ensure the realisation of economies of scale in the development of a circular recycling infrastructure for the sector at the continental level, creating conditions for a single market for the cascading use of bio-based products.



During **the OPC**, a large panel of the respondents considered that the geographical scope and coverage proposed for this candidate Institutionalised European Partnership is right, based on its inception impact assessment.

Interviewees from all groups insisted on the role of the EU in ensuring de-risking investment, bridging the gap between research and market application, and ensuring EU competitiveness.

4 Objectives: What is to be achieved?

Based upon the problems and problem drivers presented above, this section defines the objectives of the initiative and effects needed in order to address the problems – taking account of the Horizon Europe priorities and objectives.

4.1 General objectives

In order to tackle the problems identified in Section 2, it is important to clarify the objectives of EU action in the field of research and innovation. We have identified three general objectives corresponding to the main problems discussed in Section 2.1.

Contribute to a sustainable circular economy and climate neutrality in the EU

The ultimate goal of the initiative should be to improve the environmental sustainability and circularity of the EU economy by boosting the bio-based sector together with improving its sustainability and circularity. This general objective is fully aligned with the HEU's specific objectives. The transformation to a sustainable and circular economy in the EU, and ultimately reaching the objective of climate neutrality in 2050, requires the generation of new knowledge. The transition is in line with EU policy developments. By intensifying R&I in the circular bio-based economy, Europe will eventually move closer to the implementation of these policies. This transition is also linked with the uptake of innovative solutions, including in the bio-based sector. It contributes to the achievement of societal goals such as the fight against climate change. This general objective is linked closely with a number of SDGs, including SDG 8: Decent work and economic growth (because of job creation and regional development potential); SDG 9: Industry, innovation and infrastructure (because of the necessary innovations and the improved competitiveness of industry); SDG 12: Responsible consumption and production (because of substituting fossil-based products with bio-based ones); SDG 13: Climate actions (because of GHG emissions reduction) and SDG 17 (because of the extensive partnerships needed to reach this objective) (see also Section 2.3).



A great majority of business associations **respondents to the OPC**, and a lower percentage for the other stakeholder categories think that future European Partnerships under Horizon Europe need to be responsive towards EU policy objectives.

A high number of respondents also think that the European Partnerships need to be responsive to societal needs as well and need to make a significant contribution to achieving the UN's SDGs.

All **interviewees** recognise importance of the EU to pursue the transition to circular bioeconomy that also contribute to the climate change goals

Almost half of the stakeholders who participated in the **IIA consultation** and representing businesses, business associations, academia, NGO and public authorities welcomed the

integration of circular economy objective and highlighting the high relevance of the circular economy topic in the context of bio-based industries

Ensure the circularity and environmental sustainability of bio-based industries

The achievement of this objective will improve the circularity and environmental sustainability of the European bio-based economy through European funding for R&I. This means addressing concrete aspects, leverages and problem drivers within the sector. This would entail working on the environmental sustainability of raw materials by engaging with the primary producers as well as contributing to improving the productivity of the agricultural sector in order to be able to supply the quantities necessary for the further uptake of the sector. Improving the sustainability of the bio-based sector would entail work with individual sectors to address its upstream suppliers (raw materials) and downstream suppliers (waste processing), as well as enabling these sectors to work together, improve the circularity of the system, and ensure that biomass mobilisation has no negative impact on biodiversity. The circularity of the bio-based industry will also improve as it increasingly moves to higher end valorisation of biomass and biowaste.



A great majority of business associations **respondents to the OPC**, and a lower percentage for the other stakeholder categories think that future European Partnerships under Horizon Europe need to be responsive towards EU policy objectives and need to be responsive to societal needs as well.

Higher engagement was found among business associations about the relevance for research and innovation efforts at EU level to address the problem of Favourable bio-based products do not fulfil some commonly used product specifications compared to the other categories of stakeholders.

The **interviews** show an overall endorsement by all types of stakeholders of the new initiative to be focused on promoting circular economy principles in the bio-based industries.

Secure the long-lasting competitiveness of the European bio-based industry

This general objective corresponds to the problem of the global competitiveness of the European bio-based industry being at risk. One of the ways ahead is to keep as much as possible of the innovation and new demonstration and flagship infrastructure within Europe. Research results should be able to find their way smoothly to practical industrial applications. Therefore, there is a need to bridge the information gap between researchers, innovators, primary producers and industries, and to create opportunities for cross-fertilisation and synergies. Investments into applied R&I are key to that. Direct funding and leveraging additional funding for new demonstration and flagship facilities is also a core element. European R&I funding has the vocation to de-risk risky projects and leverage the much-needed additional financing. This general objective is in line with HEU objectives on facilitating technological development, demonstration and knowledge as well as with the objective of strengthening the deployment and exploitation of innovative solutions (see also Section 2.3). It also addresses the implementation of SDGs 8, 9 and 13.



A very high agreement was found across categories of stakeholders about the relevance for research and innovation efforts at EU level to address the problem of uptake of innovations that is risking EU competitiveness in the bio-based industries segment.

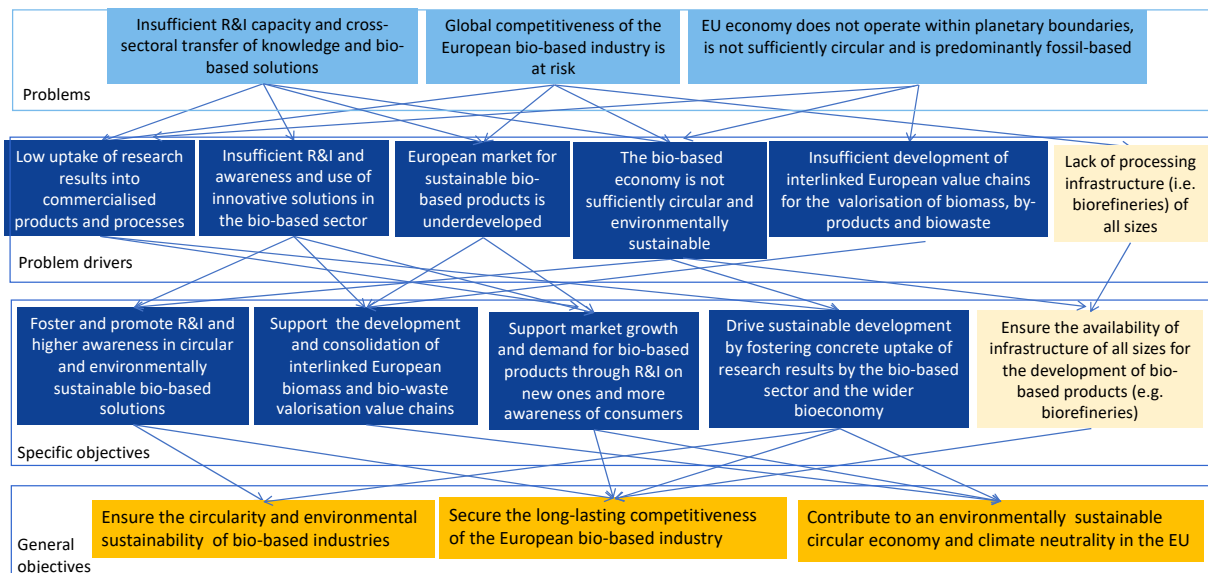
Lower engagement from academic respondents compared to the other categories of stakeholders was found about the need to make a significant contribution to EU global competitiveness.

4.2 Specific objectives

In order to achieve the general objectives, we defined five specific objectives. These specific objectives respond to each of the problem drivers discussed in Section 2.2. The relationship between the general and specific objectives is shown in Figure 3.

The diagram below presents the objectives tree for the initiative on Circular Bio-based Economy, providing an overview of the linkages between problems, problem drivers, specific objectives and general objectives, which can also inform how the latter will contribute to the Horizon Europe general objectives.

Figure 3: Objectives tree for the initiative on Circular Bio-based Economy



Source: Technopolis Group

Foster and promote R&I and higher awareness in circular and environmentally sustainable bio-based solutions (Specific objective 1)

This specific objective addresses several problem drivers, including the low uptake of research results into commercialised products, but also insufficient awareness on innovative solutions, as well as the insufficient circularity of the bio-based industry and the impact of its activities on the environment. Achieving this specific objective means bridging the information gap between research and industry, which hampers the transfer of research to industrial applications. It also requires adaptation of the research to the needs of the industry and the market in line with societal needs and public interests. It will also be necessary to remove obstacles related to legal and patenting issues.

This specific objective supports the achievement of the general objective on improving the circularity of the European economy and reaching climate neutrality when circular solutions and value chains are implemented. Successful implementation should lead to replication across Europe. The achievement of this specific objective will also improve the competitiveness of the European economy. Instead of applying European research outside Europe, this would occur in European companies and facilities.



Majority of **respondents to the OPC**, except for businesses who generate less engagement, find that it is very relevant for research and innovation efforts at EU level to address the problem of lack of understanding of the circular and bio-based economy.

The same situation accounts for the relevance for research and innovation efforts at EU level to address the problem of lack of consumer acceptance or understanding.

During the **interviews**, several informants from public authorities, academics and industry highlighted a need for building awareness among primary producers about novel bio-based value chains and opportunities locked up for them in this area. Several interviewees also mentioned that the consumer needs to get more clear and trustworthy information about recyclability and environmental impact of bio-based products.

Support the development and consolidation of interlinked European biomass and bio-waste valorisation value chains (Specific objective 2)

This strategic objective will address the problem driver on insufficient development of value chains for the valorisation of biomass, by-products and biowaste. The initiative should contribute to the structuring of value chains by bringing all their parts closer together. Significant attention should be given to securing feedstock for the bio-based industry that is sufficient, environmentally sustainable and available at a competitive price. This will bring benefits to agricultural producers, including small farmers, and will also provide the necessary raw material for bio-based processes. Intensive cooperation with primary producers will be required.

It is necessary to facilitate more intensive and extended collaboration and communication between different parts of the value chain, such as primary producers, logistics and processing. End-users should also be involved in order to complete the value chain and trigger higher awareness and the associated increase in demand for bio-based products.

By structuring and supporting biomass, by-product and waste valorisation value chains, the initiative will contribute to the achievement of the general objectives. Valorised waste leads to emission reductions and to the substitution of fossil-based raw materials. In this way it contributes to the general objective on improved circularity of the European economy. Strengthening waste valorisation value chains leads to higher revenues for different actors along the value chains and to higher competitiveness of the European bio-based economy. Without the necessary structuring and support, non-European actors could replace each of the parts of these value chains.



There was a high level of engagement among **respondents to the OPC** across categories of stakeholders about the relevance for research and innovation efforts at EU level to address the problems of innovation gap and limited public-private collaboration.

The **interviews** showed overall consensus among all types of stakeholders that the new initiative should more actively promote the valorisation of by-products of agriculture and forestry sectors, as well as of the municipal waste of organic origin.

IIA consultation, while showing a wide endorsement of the circular economy emphasis of the new initiatives, also brought requests from varied groups of stakeholders about inclusion of topics such as bioenergy, plant based proteins, wastewater and waste gases valorisation,

Drive sustainable development by fostering concrete uptake of research results by the bio-based sector and the wider bioeconomy (Specific objective 3)

This specific objective addresses the problem driver of low uptake of R&I into commercialised products. At the same time, it also tackles the problem driver of an insufficiently circular bio-based economy. The development of biomass and biowaste valorisation value chains produces a positive effect for the environment by reducing CO₂ emissions. It also helps avoid CO₂ emissions by substituting fossil-based products and processes with bio-based ones. Additionally, R&I may also address the problems of land use, cascading use of feedstock, etc. These are all complex problems that will continue to require additional R&I. In order to achieve this specific objective, intensive collaboration is needed between research institutions and different industries. The achievement of this

strategic objective will contribute to the achievement of the three general objectives. A significant part of the possible gains and advancements for the circular economy in Europe is to be implemented through bringing innovative R&I to practical implementation.



A high level of engagement among **respondents to the OPC** across categories of stakeholders was seen about the relevance for research and innovation efforts at EU level to address the problem of R&I – Innovation gap and to address the problem of Structure and resources – Limited public-private collaboration.

Ensure the availability of infrastructure of all sizes for the development of bio-based products (e.g. biorefineries) (Specific objective 4)

This specific objective addresses the problem driver regarding the lack of processing infrastructure, both small and large. This means acting on the obstacles for infrastructure deployment, namely the availability of capital and removal of policy barriers. Besides financing R&I in the bio-based sector, the initiative needs to support the practical application of European research by funding demonstration and flagship infrastructure. The objective would be linked to the deployment of both large and small installations. While large installations are necessary, but harder to finance, because of the size of the projects and the need for extensive quantities of sustainable feedstock, it would be easier to deploy and also replicate successful technological solutions in smaller installations.

Infrastructure is needed for demonstration purposes and for the testing of new research and new building blocks and processes. Flagship infrastructure is needed for the commercial deployment of already tested products and processes. The concern of various stakeholders is that if the deployment of infrastructure does not occur with the necessary speed, much of the European research will be commercialised outside of Europe, undermining the competitive edge of the European bio-based sector and missing out on opportunities for increasing the circular character of the European economy as a whole. Hence, the achievement of this specific objective will contribute to the achievement of the general objective on securing the competitiveness of the European bio-based industry.



A majority of **respondents to the OPC, except businesses who were less agreeing**, think that it is relevant and very relevant for research and innovation efforts at EU level to address the problem of lack of private investment in the uptake of innovations. On the other hand, the whole majority this time, think that it is relevant and very relevant for research and innovation efforts at EU level to address the problem of Lack of public investment.

Most of the respondents, except EU citizens who were less convinced, think that future European Partnerships under Horizon Europe need to focus more on the development and effective deployment of technology.

A number of **interviews** with national and EU public authorities, industries and academics highlighted that the new initiative should focus on supporting the opening of smaller scale biorefineries in a wider set of locations, including remote regions, in contrast to the established practice in BBI JU where large scale facilities where the focus.

Support market growth and demand for bio-based products through R&I and more awareness of consumers (Specific objective 5)

The assumption behind this specific objective is that the larger the market is for bio-based products, the higher the share of the fossil-based market that will be substituted. The assumption is also that the growth of the market needs to be based on sustainable feedstock and should not have a negative impact on the environment. The uptake of the bio-based economy cannot occur without increased demand for bio-based products which is linked to a wider choice and variety of consumer products. It is also a consequence of

greater awareness of consumers of the better performance of bio-based products in terms of environmental and health impacts. It also goes hand in hand with labelling and certification efforts. The rising uptake of the bio-based sector will also lead to job creation in remote, rural areas. Higher demand for bio-based products would lead to increased revenues for European bio-based sector industries (including many SMEs), which will allow even larger investments in R&I and an even higher rate of substitution of fossil-based products.



A majority of **respondents to the OPC**, except for businesses who generate less engagement, find that it is relevant or very relevant for research and innovation efforts at EU level to address the problem of R&I – Lack of understanding of the circular and bio-based economy. The same situation accounts for the relevance for research and innovation efforts at EU level to address the problem of lack of consumer acceptance or understanding.

A number of **interviewees** from industries, EC, and NGOs suggested a higher role for brand owners in the future actions of the new initiative, as this can speed up the needed shift to bio-based inputs for products and increase market uptake of bio-based products.

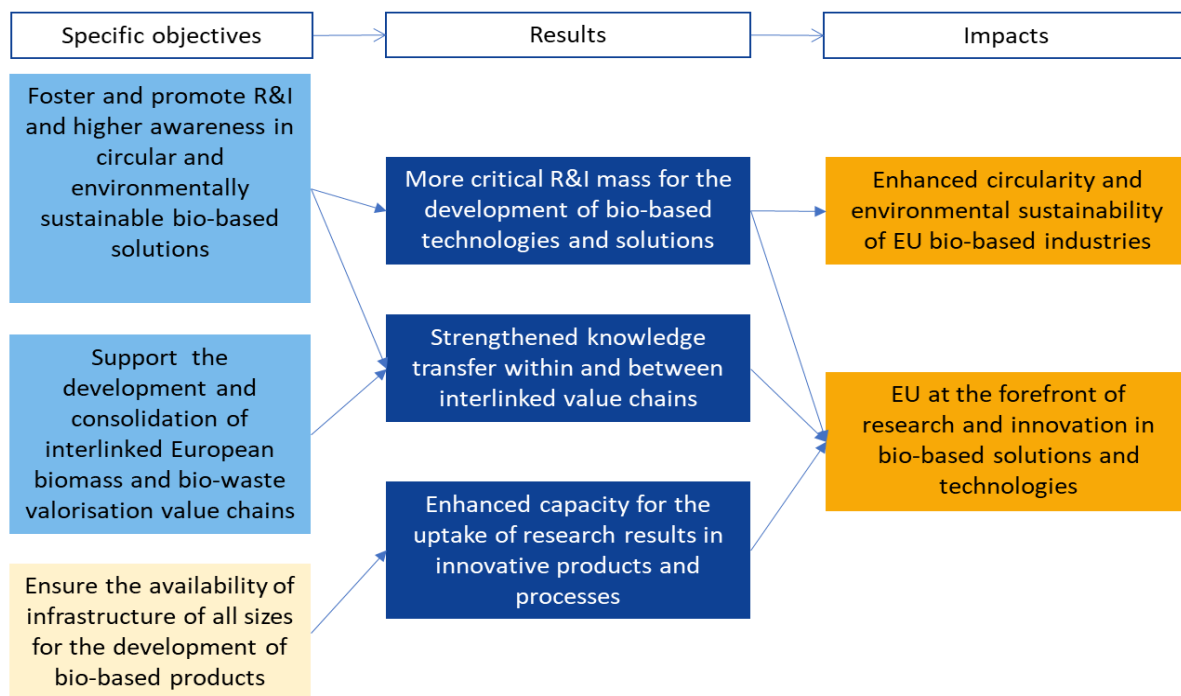
4.3 Intervention logic and targeted impacts of the initiative

4.3.1 Likely scientific impacts

The initiative is likely to lead to two key scientific impacts, as illustrated in the figure below and further described underneath.

Figure 4: Impact pathway leading to scientific impacts

Scientific impact



Source: Technopolis Group

The initiative is expected to be fully aligned with HEU objectives and hence to deliver a strong scientific impact.⁷⁷ Specific objective 4 aims to foster and promote R&I in circular and environmentally sustainable bio-based solutions. Through collaborative research actions and demonstration and piloting activities, it seeks to ensure availability of new bio-based building blocks and materials⁷⁸ and to improve and validate technologies to deal with bio-based waste in a circular manner. This will result in a more critical mass for the development of bio-based technologies and solutions. It will also focus on bridging the information gap between research and industry ensuring that research is adapted to the needs of the industry and the market. Stakeholders mentioned this as crucial to strengthen knowledge transfer within and between interlinked value chains.

Knowledge transfer should also be reinforced by the work done under specific objective 1, which aims to support the consolidation of interlinked European biomass and bio-waste valorisation value chains. Activities will especially contribute to inter-sectoral collaboration at the European level, but also to a more territorial approach by fostering bio-based value chains in the regions, enhancing their capacity to benefit from local research and innovation results.

All sectors of the bio-based industries are expected to benefit from these results, including primary producers, especially when moving to higher TRLs.⁷⁹ More specifically, research communities and industrial players should benefit from more exchanges and increasing availability of bio-based materials and technologies. Regions as well as SMEs should benefit from dedicated actions. Interviewees from all stakeholder groups pointed to the importance of involving a wide variety of actors already in research activities to set the right priorities and maximise benefits.

By increasing the critical mass for the development of bio-based technologies the likely long-term impacts include: more efficient use of bio-resources, less pollution, assurance that biodiversity is not endangered and even enhanced, more biowastes are recycled through the industry. Finally, all three results would put the EU at the forefront of R&I which, together with technological development, will increase trade and investments flows in this way strengthening EU competitiveness. The scientific impacts of the initiative should contribute to SDG 9: Industry, innovation and infrastructure; SDG 12: Responsible Consumption and Production and SDG 13: Climate actions.



The majority of **respondents to the OPC** think that it is relevant or very relevant for research and innovation efforts at EU level to address the problem of R&I – Innovation gap.

Less engagement from EU citizens and NGOs compared to the other categories of stakeholders was found about the need for the future European Partnerships under Horizon Europe to be responsive towards priorities in national and regional R&I strategies.

4.3.2 Likely economic/technological impacts

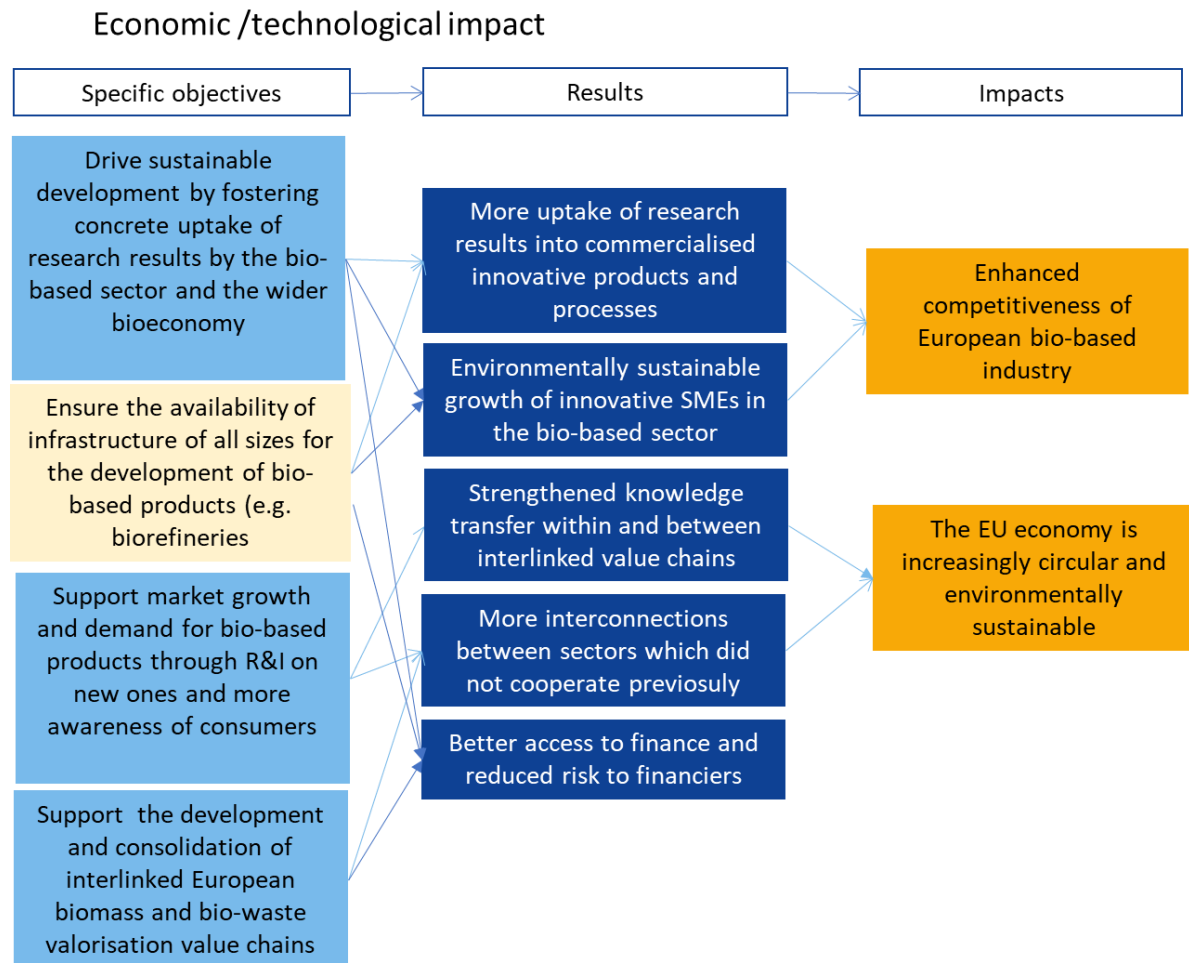
The initiative is expected to provide significant economic and technological results and impacts. The likely key economic/technological impacts of the initiative are mapped in the figure below:

⁷⁷ EC (2019a)

⁷⁸ For reference, projects funded under the BBI-JU are expected to result by 2020 in 46 new biochemical building blocks and 106 new bio-based materials. See European Union (2017), Interim Evaluation of the Bio-based Industries Joint Undertaking (2014-2016)

⁷⁹ BBI JU (2019).

Figure 5: Impact pathway leading to economic/technological impacts



Source: Technopolis Group

Fostering the uptake of research results in the bio-based economy and the wider bioeconomy in practice means that the building blocks developed during research activities need to be tested in demonstration facilities and commercialised in flagship activities. The initiative can also be instrumental in scaling up and replicating successful examples in other regions. The concrete uptake will potentially occur through efforts to structure a value chain that extends from the primary producers of feedstock to logistics and processing companies. The impacts on the local economy and on the financial results of the companies including SMEs will be tangible. The economic benefits will be of even higher importance to primary producers, who have benefitted little from the growth in the bio-based sector.

The uptake of research results into commercialised products is closely linked to the availability of processing infrastructure of all sizes. The deployment of small infrastructure is equally important as it is more flexible and requires smaller investments and feedstock.

The uptake of research results into concrete bio-based products will have significant technological implications and it will usually be linked with innovation and development of a new technology. This process will also have a significant economic impact on the region where the (majority of the) value chain is located. Benefits will include diversification of the economic structure and the creation of high-quality jobs.

The support for market growth in various ways will represent a strong incentive to the sector and will fuel further cross-sectoral collaboration allowing for the valorisation of biomass, waste and biowaste. The support of interlinked value chains as well as improved

availability of infrastructure will lead to lower financial risks and hence better availability of co-financing for existing projects or fresh finance for new projects. These results will lead to two envisaged impacts. The first one will be enhanced competitiveness of the European industry through new bio-based product delivery and commercialisation subsequently contributing to a higher share of the market for bio-based products going to the European bio-based industry. The results and impacts to be achieved through the implementation of the initiative are related to SDG 8: Decent work and economic growth (new jobs and growth of all parts of different value chains); SDG 12: Responsible Consumption and Production (increased demand for bio-based products substituting fossil-based ones); SDG 9: Industry, Innovation and Infrastructure and SDG 13: Climate Action (emissions reduction).



A high majority of **respondents to the OPC**, especially businesses, NGOs and EU citizens think that it is relevant or very relevant to address the problem of Lack of competitiveness. The stakeholders, except for academics who are less convinced, also agree about the need for the future European Partnerships to make a significant contribution to EU global competitiveness.

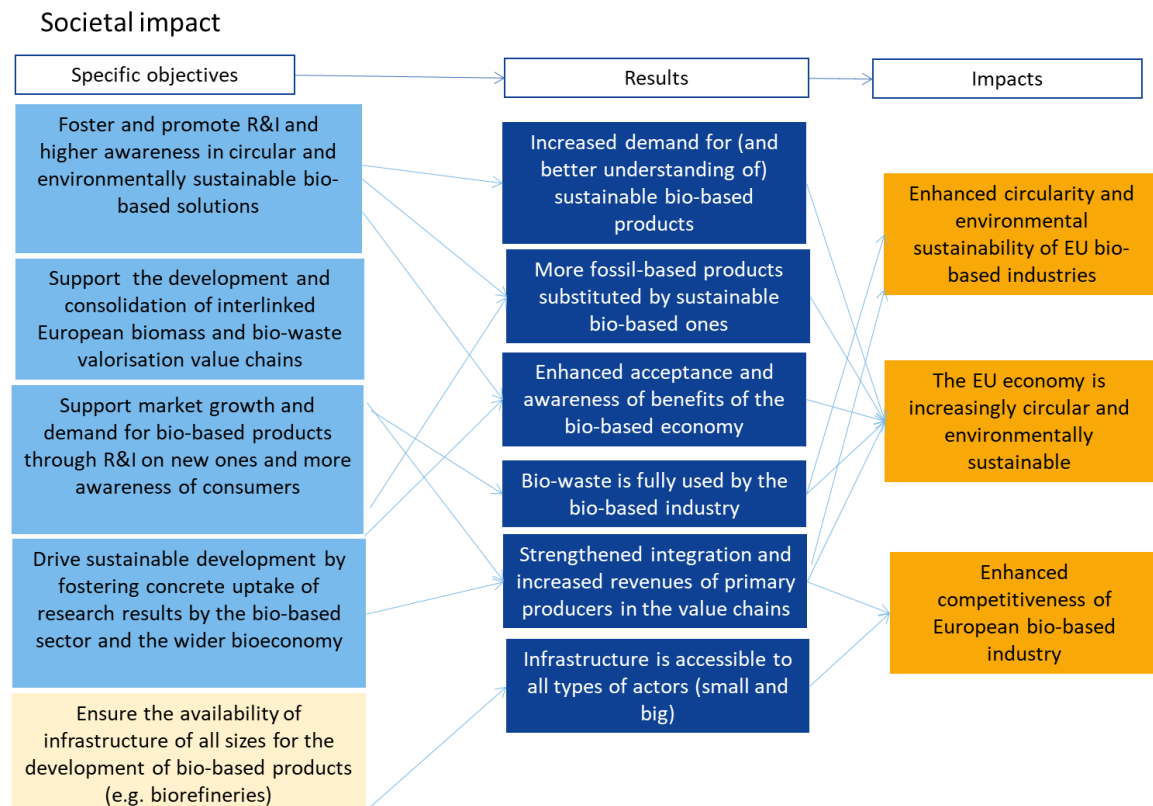
The overall majority of respondents, with almost a full agreement from NGOs and business associations, think that the future European Partnerships under Horizon Europe need to focus more on the development and effective deployment of technology.

According to most of **interviewees** from all groups, the uptake of the research results into commercialised products is closely linked to the availability of processing infrastructure of all sizes. Stakeholders insisted that the deployment of small infrastructure is equally important as it is more flexible and requires smaller investments and feedstock.

4.3.3 Likely societal impacts

The scientific and economic/technological impacts discussed above will also support the attainment of societal impacts as shown in the figure below.

Figure 6: Impact pathway leading to societal impacts



Source: Technopolis Group

Likely environmental impacts

The initiative will likely produce significant environmental and climate impacts and tangible social impacts.⁸⁰ Fostering and promoting research and innovation in bio-based products and processes will likely lead to the discovery and patenting of new building blocks. These are expected to be converted into concrete commercialised products through ensuring availability of infrastructure of all types. Results will come mainly through increased demand for bio-based products, which will further speed up the substitution of fossil-based products with bio-based products. This substitution has both an environmental impact (i.e. through reduced pollution from plastics) and also a climate impact.

With the increasing availability of bio-based products and through some possible additional activities like stimulating GPP, the acceptance of the bio-based products and the awareness of their positive environmental and health impacts will grow. The increased attention to bio-based products and the knowledge among different stakeholders will also increase the sensitivity towards potential negative environmental impacts. These impacts are theoretically possible, although the bioeconomy, as described earlier in the report, is not inherently sustainable; thus the sustainability and the positive environmental and climate impact need to be demonstrated for every bio-based product.



The interviewed environmental NGOs and some researchers highlighting possible risks associated with too strong push for bio-based economy and suggested to consider lessons from the experience with re-bounce effect observed in promoting biofuels.

In the **IIA consultation** two stakeholders (from academia and NGO), highlighted the importance to consider environmental impact of creating new demand for biomass (e.g. food security, impact on ecosystems, resource conflicts outside EU), and ensure maintenance or improvement of biodiversity.

The support and development of interlinked waste valorisation value chains will also lead to a situation where biomass, bio-products and bio-waste are fully utilised. This would lead to a positive climate effect through reduced emissions, through both higher value use and the substitution of fossil-based products. This will also lead to increased circularity of the overall system and achievement of a number of EU policy objectives.

Likely social impacts

The social impact of the initiative will mostly come through the utilisation at the local level of opportunities,⁸¹ which have always existed, but which have not been exploited because of information and knowledge gaps. The benefits involve diversifying the revenue sources of small primary producers in often poor and remote areas. Activating, incentivising and integrating primary producers into the bio-based value chains will also lead to enhanced security of feedstock supply.

SMEs will also benefit from being a part of different value chains - as processing companies, logistics companies, suppliers of technology and raw materials, etc. The structuring of regional value chains will have significant impact on local and regional levels in terms of strengthening the cohesion and connectedness of the local and regional economy and creating new, previously untapped opportunities.

All these results will lead to the achievement of three envisaged impacts: enhanced circularity and environmental sustainability of the EU bio-based industries (through newly

⁸⁰ EC (2019a)

⁸¹ *ibid.*

valorised streams); increased circularity and environmental sustainability of the EU economy as a whole and enhanced competitiveness of the EU bio-based sector (through capturing a larger part of the increasing global market for sustainable bio-based products).

These results and impacts will contribute to the achievement of several SDGs: SDG 8: Decent work and economic growth (new jobs and growth of all parts of different value chains); SDG 12: Responsible Consumption and Production (through increased demand for bio-based products substituting fossil-based ones); SDG 13: Climate Action (through emissions reduction).



An even bigger number of **respondents to the OPC** think that the European Partnerships needs to be responsive to societal needs as well, needs to make a significant contribution to achieving the UN's SDGs and needs to Focus more on bringing about transformative change towards sustainability.

Several **interviewees** from business and academia suggested that if the small farms are a part of the bio-based sector value chains, they will be less likely to sell their biomass for energy production. This will trigger an additional change of mindset favouring the cascading use of biomass.

4.3.4 Likely impacts on simplification and/or administrative burden

Impacts on simplification and/or administrative burden are not expected.

4.3.5 Likely impacts on fundamental rights

Impacts on fundamental rights are not expected.

4.4 Functionalities of the initiative

This section outlines the functionalities that need to be considered when assessing the policy options in Section 6, reflecting the selection criteria for European Partnerships defined in the Commission proposal for the Horizon Europe Regulation.⁸² In the following paragraphs, we discuss the implications of the criteria relating to the type and composition of the actors involved, the range of activities to be undertaken and the directionality required if the initiative is to deliver the objectives discussed above. We also consider the complementarities and synergies with other, related initiatives under Horizon Europe and beyond.

4.4.1 Internal factors

Type and composition of the actors involved

This functionality relates to the criterion 'Involvement of partners and stakeholders from across the entire value chain, from different sectors, backgrounds and disciplines, including international ones when relevant and not interfering with European competitiveness'.

To ensure a balanced promotion of sustainability, economic and social objectives put forward by the Bioeconomy Strategy, as well as other EU policies and maximise the impact of EU R&I initiatives, there is a need to rely on the collaboration, contribution, co-design and co-creation of a wider set of stakeholders from entire value chains and across territories.⁸³ In this context, the CBE initiative will benefit from cooperation among a broad set of actors in a flexible setting.⁸⁴

⁸² EC (2018e)

⁸³ EC (2018d)

⁸⁴ OPC shows that 86% of respondents see "broad group" and 75% "flexibility in composition" as "very relevant"; or "relevant" for CBE

Industries:⁸⁵ The past few years of experience of BBI JU have shown that the bio-based value chains have grown to be more cross-sectoral by linking a greater range of industries. The community involving biotechnology, chemicals, food and feed, fuel/energy, materials and plastics industries is now complemented by agriculture, aquaculture, waste processing and recycling. Retail and brand owners are increasingly seen as important facilitators of the commercialisation and diffusion of bio-based products as well as a source of demand for new bio-based innovations.

Smaller economic actors, such as farmers and SMEs are identified as important players in the bio-based value chains. Their active involvement in the bio-based economy contributes to local economic development, creation of jobs, and more dynamism in the regions.⁸⁶ In the current partnership, SMEs have already increased their participation in projects, but there is still ample room for further outreach and mobilisation of SMEs, especially in the rural, coastal and less advanced regions. Many primary biomass suppliers are SMEs and they have already been identified as a special group that needs to play a larger and more specific role in the bioeconomy and bio-based value chains.⁸⁷

Research actors:⁸⁸ Research organisations have been actively contributing to the entire research spectrum from basic research to pilot initiatives and commercialisation. Knowledge capital and research facilities are the important resources that these stakeholders can contribute in order to develop new bio-based solutions. The input from scientific partners is needed to generate the most innovative solutions.⁸⁹

Public bodies:⁹⁰ Ensuring promotion of societal and strategic objectives for the countries, regions and the EU can be done by public bodies. In addition to the *European Commission*, this important stakeholder group should include *national* and increasingly the *regional governments*, which would also allow better coherence and synergies between the EU and local level strategies.⁹¹ Contribution of national and local co-funding could be another role envisaged for these actors.

Civil society organisations⁹²: By being involved in discussions and holding an active position on circular and bio-based economy promotion, these organisations can support the initiative in ensuring the balance of environmental, social and economic objectives in the agenda.

It is important to ensure **openness toward various stakeholders**, their involvement in defining needs, priorities, setting innovation and research agendas, as well as in innovation activities. However, each stakeholder group has different interests,⁹³ which can make the co-creation and governance systems quite complex. This requires setting a platform/system/governance model that ensures a proper dialogue among them, with an appropriate role for each.

⁸⁵ OPC shows that 97% sees as "very relevant; or "relevant" for CBE

⁸⁶ BBI JU (2010)

⁸⁷ BBI JU (2019)

⁸⁸ OPC shows that around 73% of respondents see this "very relevant; or "relevant" for CBE

⁸⁹ EC (2017b)

⁹⁰ OPC shows that 75% of respondents see it "very relevant; or "relevant" for CBE

⁹¹ EC (2018d)

⁹² OPC shows that 50% of respondent see as "very relevant; or "relevant" for CBE

⁹³ BIOVOICES (2018)

Type and range of activities

This functionality relates to the criterion 'Approaches to ensure flexibility of implementation and to adjust to changing policy, societal and/or market needs, or scientific advances'. It concerns the types of activity that the initiative is intended to encourage, such that it is able to respond effectively to the challenges and problems described in Section 2.

Considering the insufficient global competitiveness of the European bio-based industries (discussed in 1.2.1), there is an urgent need to foster R&I capacity and cross-sectoral transfer of knowledge and bio-based solutions.⁹⁴ Furthermore, in order to ensure that developments in these industries evolve along the circular economy principles, research and innovation must be supported along all segments of the value chains and covering all TRLs.⁹⁵ Ensuring a balance across various TRLs and between Research and Innovation Action (RIA), Impact Assessment (IA) and Coordination and Support Action (CSA) projects is important. This will help to ensure on the one hand a higher engagement of the industries whose interests largely focus on prototyping, testing, demonstrating, piloting, large-scale product validation and market replication (higher TRL projects). On the other hand, it should ensure that strategic research focuses on fostering new knowledge via basic and applied research, technology development and integration, testing and validation on small-scale prototypes in a laboratory or simulated environment (lower TRL projects).

In addition, the insufficiently mature market needs incentives via promotion of demand-side actions,⁹⁶ creation of favourable framework conditions, policies, setting and promotion of standards, labels and Life Cycle Assessment (LCA)/footprint methodologies for products,⁹⁷ increasing consumer awareness and acceptance of new products,⁹⁸ as well as informing agriculture and forestry farmers about economic opportunities in the bio-based market.⁹⁹ Greatly needed are continuous efforts in the structuring of otherwise disconnected sectors, as well as in the facilitation of involvement of regions and countries via networking, coordination, communication and matchmaking activities. All these activities can be promoted via CSAs.

Within a dynamically changing environment, the balance among various types of projects needs to be ensured via a higher level of flexibility in the research agenda setting.

Directionality and additionality required

This functionality relates to the criteria 'Common strategic vision of the purpose of the European Partnership' and 'Creation of qualitative and significant quantitative leverage effects'. The former highlights the importance of ensuring that all participating stakeholders have a common understanding of the purpose of the policy intervention and the direction of the R&I activity it is intended to encourage. The leverage effects relate to the creation of spillover effects of the knowledge gained in the broader community, as well as the crowding-in effects on private investments in R&I – both among participating stakeholders and in the broader community.

⁹⁴ EC (2018d)

⁹⁵ European Forest Institute (2017),

⁹⁶ EC (2017b)

⁹⁷ E.g. impact on land use, biodiversity, impact of primary production, long term impact on marine ecosystems, and others are not sufficiently addressed by LCA. Source: COWI and Utrecht University (2019) Environmental impact assessments of innovative

⁹⁸ BIOVOICES (2018)

⁹⁹ BBI JU (2019)

Ensuring a shared vision in the potential CBE initiative is not easy due to a diverse and still largely fragmented group of targeted stakeholders. Different interests of private and public stakeholders might slow down setting a collaborative environment within the initiative and prevent progress towards the higher-level objectives. Directionalities of the research agenda of industries and of the EC might not match or match only in certain aspects. Insufficient awareness of higher-level challenges, lack of a long-term perspective for their business and inability to see their specific role in a wider bio-based economy or in addressing economic, social and sustainability problems by the smaller actors like farmers and SMEs¹⁰⁰ can be another hindrance. All these factors contribute to what can be characterised as an insufficiently mature community for the partnership, which would require a different approach in working with the various players (e.g. different incentives, more actions on capacity building, awareness raising, etc.) and possibly refining the objectives and potential expectations for the initiative.

In fostering the growth of the bio-based industries, a particular challenge is in connecting fragmented actors from various industries,¹⁰¹ which could benefit from knowledge exchange and technological learning. In this regard, the CBE initiative should generate spillovers beyond the actors that are already well established in the domain (e.g. BIC members) and reach out to, for example, actors in remote regions, less active industries (e.g. agriculture, waste, food, etc.), as well as SMEs.

Finally, it is important that the initiative scales up its impact by securing large private investments and contributions complementing the public investment provided by the Commission.

4.4.2 External factors

The proposed Regulation for Horizon Europe also identifies the need to consider 'Coordination and complementarity with Union, local, regional, national and, where relevant, international initiatives or other partnerships and missions' when assessing the case for a partnership. It concerns the potential for linkages with other relevant R&I initiatives proposed or planned for the forthcoming Framework Programme, at the EU level in the context of the Multiannual Financial Framework (MFF) 2021-2027, and beyond. It is paramount that the proposed initiative looks for synergies, complementarities, coordination, collaboration and, if needed, co-creation with other ongoing initiatives in order to contribute to achieving the sustainability, social and economic goals in a more efficient way. It should anchor firmly on the EU Bioeconomy Strategy, the Circular Economy Action Plan, the European Green Deal and Sustainable Development Goals, and should seek coherence and synergies with (inter alia) the following programmes and initiatives:

- At the EU level: Horizon Europe, the InvestEU instrument, the European Regional Development Fund (ERDF), the European Agricultural Fund for Rural Development (EAFRD), the LIFE programme, the European Maritime and Fisheries Fund (EMFF), the European Innovation Partnership for Agriculture (EIP-Agri), the Circular Bioeconomy Thematic Investment Platform, and the partnerships of the Sustainable Process Industry through Resources and Energy Efficiency (SPIRE), the BioEast initiative, and EU Protein strategy. In R&I support activities, complementarities on thematic and TRL level should be ensured.¹⁰² Blending approaches promoted by InvestEU¹⁰³ could combine, for

¹⁰⁰ DeBoer J., Panwarb R., Kozak R., Cashorec B. (2019)

¹⁰¹ EC (2017a)

¹⁰² EC (2017a)

¹⁰³ https://ec.europa.eu/commission/priorities/jobs-growth-and-investment/investment-plan-europe-juncker-plan/whats-next-investeu-programme-2021-2027_en

example, loans for infrastructure with grants for research from CBE. Joint transdisciplinary projects with other partnerships, e.g. SPIRE.

- At the national and regional levels, it should consider the strategies and plans of Member States and regions in the relevant domains (e.g. Bioeconomy strategies/plans).^{104 105} This can be done by considering the national and regional priority-oriented actions in funding specific projects. Other possibilities are synergies with financing instruments, especially where infrastructure and biorefineries for which regional funds or special loan programmes can be engaged.
- At the international level, many stakeholders suggested that the partnership be kept open to third-country players, especially the technology and research leaders, in order to benefit from collaborations with them and ensure a European leading role in the international development of the bioeconomy (for example, in terms of standardisation).

Furthermore, there is a need to reflect on the *emergence of new trends in technologies* (e.g. digitisation) or sub-areas of such technologies (bioinformatics, synthetic biology). In this respect intra-sectorial collaborations are extremely important for the further development of a young sector; also the input from scientific partners is needed to generate the most innovative solutions.¹⁰⁶

A favourable policy framework is an important factor in supporting the viability of new bio-based value chains and the creation and adoption of new innovations, especially green ones, where the market fails to provide sufficient incentives for take-up. In this respect, the CBE initiative could contribute to the regulatory aspects and provide support in, for example, harmonising standards, developing LCA life-cycle assessment methodologies that could support these standards or products, and project assessment processes. It can provide support in maturing and expanding the market for bio-based products and solutions by promoting public procurement.¹⁰⁷

5 What are the available policy options?

In this chapter, we provide an overview of the key characteristics of the policy options for this initiative. The Horizon Europe regulations put forward three forms of European Partnerships that constitute the policy options for this initiative; standard Horizon Europe (HEU) calls are a fourth option while acting also as a baseline against which the three partnership options will be compared.

To ensure a correct assessment of the different options and their effectiveness, it is crucial to take into consideration both the objectives and the functional requirements outlined in Section 4.4. The descriptions of the options in the sections below therefore focus on the implications of the options' characteristics related to these functionalities. They are based on the options' characteristics specifically related to the functionalities presented in section 4.4. A full description of the options is provided in the report on the overarching context to the impact assessment studies.

This section provides an overview of the key characteristics of the policy options for this initiative. A complete description is provided in the report on the overarching context to the impact assessment studies.

¹⁰⁴ Dietz, et al (2018),

¹⁰⁵ BBI JU (2019)

¹⁰⁶ EC (2017a)

¹⁰⁷ OECD (2019)

5.1 Option 0: Horizon Europe calls (baseline)

Under the baseline option, coordination of R&I would be reliant on mechanisms for managing open calls under the Framework Programme.

Table 2: Key characteristics of Option 0

| | Implications of option |
|--|---|
| Enabling appropriate profile of participation (actors involved) | <ul style="list-style-type: none"> The Commission would need to consult extensively with a wide range of stakeholders to translate the strategic R&I agenda for circular bio-based industries/economy into an annual work programme. As in Horizon 2020, this could take the form of work programme covering 2 consecutive years. A well-defined process would be needed to ensure that the programme committees were properly informed about R&I priorities, including key demonstration programmes. The specification of calls over the period of the Framework Programme could reflect the need for an evolving profile of participation, with different consortia forming at different stages to take different types of activity forward. |
| Supporting implementation of R&I agenda (activities) | <ul style="list-style-type: none"> Implementation would rely on the standard infrastructure underpinning the open calls procedure, drawing on resources of relevant executive agencies and Commission IT systems. Administrative costs for the EC would be same/similar to the costs seen in H2020. Calls for proposals would be published in the work programmes of Horizon Europe. Transparency and open publication of results would ensure their availability to interested parties. |
| Ensuring alignment with R&I agenda (directionality) | <ul style="list-style-type: none"> Strategic programming and the research agenda will be defined by the dedicated expert groups invited by the European Commission, which normally will include representative of diverse sectors and academia, as well as policy experts. Work programmes would need to reflect the requirement for R&I activity across TRLs, with input from representatives of all relevant stakeholders. Commission input into specification and oversight of calls would help to ensure alignment with overarching policy objectives, but full integration with other programmes would require additional coordination. Specification of calls for activity at higher TRLs, particularly demonstration programmes, would need substantial input from industry. R&I activity would focus on the short to medium-term needs of the industry, although it would also include research. |
| Securing leveraging effects (additionality) | <ul style="list-style-type: none"> No pooling and leveraging of resources on a programme level will be facilitated. In-kind contribution requirements can be applied at the project level, and requirements for those will not be high. Progress of R&I effort would depend largely on EU funding, with no expectation of significant leveraging of industry support. |

| | Implications of option |
|--|--|
| | <ul style="list-style-type: none"> • Demonstration programmes would require significant in-kind support and collaboration from industry, but there are some unknowns as to whether critical mass could be reached. • Given more limited funding than in the past, critical R&I priorities would need to be identified at the outset. |

5.2 Option 1: Co-programmed European Partnership

A co-programmed partnership (CPP) would provide for focused input from partners into the determination of the R&I agenda and clear aspirations for leveraged funding of activity while continuing to rely on the Commission and/or executive agencies for administration. At the same time, while it would allow for flexibility in the profile of stakeholder participation, progress in the delivery of the R&I programme would depend on the willingness of stakeholders to support individual projects rather than on legally binding commitments.

Table 3: Key characteristics of Option 1

| | Implications of option |
|--|---|
| Enabling appropriate profile of participation (actors involved) | <ul style="list-style-type: none"> • Partners can include <i>bio-based industries</i>, relevant <i>industry network organisations</i> (e.g. BIC) and the <i>European commission</i>. Possible to include research organisations, Member States, national and regional public bodies and other type of actors, e.g. NGOs, cluster organisations, etc. • The partnership would enable participation by all key stakeholders potentially contributing to the specification and delivery of the strategic R&I agenda. • It would need to consult with a wide range of stakeholders to ensure that the R&I agenda, and ultimately the work programme, was aligned with industry and market needs. • At the same time, it would offer the flexibility to change the profile of participation over time, with new partners joining to support new areas of activity in response to emerging results and changing priorities. |
| Supporting implementation of R&I agenda (activities) | <ul style="list-style-type: none"> • Implementation would rely on the standard administrative infrastructure underpinning the open calls procedure, drawing on resources of relevant executive agencies and Commission IT systems. • Administrative cost of the EC would be higher because of needed programming process • Calls for proposals would be published in the work programmes of Horizon Europe. • Transparency and open publication of results would ensure their availability to interested parties. • Private partners would be responsible of implementing its part of the research agenda |
| Ensuring alignment with R&I agenda (directionality) | <ul style="list-style-type: none"> • Work programmes would need to reflect the requirement for R&I activity across TRLs, with input from the various partners to achieve an appropriate balance of activity directed towards different markets. |

| | Implications of option |
|---|--|
| | <ul style="list-style-type: none"> • The partnership would be responsible for ensuring that priorities for calls were specified in line with R&I priorities, including demonstration programmes. • R&I activity would be likely to focus on the medium-term needs of the industry. • The governing board of the CPP would ensure alignment with overarching policy objectives and coordination with related programmes. |
| Securing leveraging effects (<i>additionality</i>) | <ul style="list-style-type: none"> • Industry commitments would not be legally binding. • Expected in-kind contributions from the private sector would be identified in the work programme. • Given more limited funding than in the past, critical R&I priorities would need to be identified at the outset. |

5.3 Option 2: Co-funded European Partnership

The Co-funded Partnership is based on a *Grant Agreement* between the Commission and the consortium of partners, resulting from a call for a proposal for a programme co-funded action implementing the European Partnerships in the Horizon Europe Work Programme.

Table 4: Key characteristics of Option 2

| | Implications of option |
|---|---|
| Enabling appropriate profile of participation (<i>actors involved</i>) | <ul style="list-style-type: none"> • Partners can include <i>any national funding body or governmental research organisation</i>, Possible to include also <i>other type of actors</i>, including foundations. • It is not possible to have industry associations (e.g. BIC) as partners. • Requires substantial national R&I programmes (competitive or institutional) in the field and therefore limited the participation to few Member States (MS) with existing national bio-based industries/bioeconomy programmes. • Usually only legal entities from countries that are part of the consortia can apply to calls launched by the partnership, under national rules. |
| Supporting implementation of R&I agenda (<i>activities</i>) | <ul style="list-style-type: none"> • Activities may range from R&I, pilot and deployment actions to training and mobility, dissemination and exploitation, but according to national programmes and rules. • The decision and implementation are responsibility of the partners through institutional funding programmes, or by 'third parties' receiving financial support, following calls for proposals launched by the consortium. • The scale and scope of the initiative is limited and depends on the participating programmes. The resulting funded R&I actions are typically smaller in scale than FP projects. |
| Ensuring alignment with R&I agenda (<i>directionality</i>) | <ul style="list-style-type: none"> • The strategic R&I agenda/roadmap is agreed between the MS and EC without the participation of industry. • The annual work programme drafted by partners, approved by the EC. • Objectives and commitments are set in the Grant Agreement. • The coherence of the partnership with other actions can be ensured by partners and the EC. |

| | Implications of option |
|---|--|
| | <ul style="list-style-type: none"> • There are strong synergies with national/regional programmes and activities; these can be ensured by the MS. • Synergies with other European programmes or industrial strategies are limited. |
| Securing leveraging effects (<i>additionality</i>) | <ul style="list-style-type: none"> • Low possibilities for leverage of industry contribution as industry does not participate in the decision-making. |

5.4 Option 3: Institutionalised European Partnership

Based on the options standard description put forward in the report on the overarching context to the impact assessment studies, this section elaborates on the details of the possible implementation of the Institutional Partnership (IP) models based on Articles 185 and 187 of the TFEU.

5.4.1 Institutionalised Partnerships under Art 185 TFEU

Article 185 of the TFEU is a complex and high-effort arrangement. It is based on a Decision by the European Parliament and Council and implemented by dedicated structures created for that purpose. It allows the Union to participate in programmes jointly undertaken by MS and Associated Countries.

Table 5: Key characteristics of Option 3: Institutionalised Partnership Article 185

| | Implications of option |
|---|--|
| Enabling appropriate profile of participation (<i>actors involved</i>) | <ul style="list-style-type: none"> • Partners can include MS and Associated Countries. • Non-associated third countries can only be included as partners if foreseen in the basic act and subjected to conclusion of dedicated international agreements. • Good geographical coverage is required with participation of at least 40 % of Member States. • The existence of substantial national R&I programmes (competitive or institutional) in the field is required. • While by default the FP rules apply for eligibility for funding/participation, in practice (subject to derogation) often only legal entities from countries that are Participating States can apply to calls launched by the partnership, under national rules. |
| Supporting implementation of R&I agenda (<i>activities</i>) | <ul style="list-style-type: none"> • HEU standard actions apply allowing a broad range of coordinated activities from R&I to be taken up. • In case of implementation based on national rules (subject to derogation) the activities follow the national programmes and rules. • Integration of national funding and Union funding into the joint funding of projects. |
| Ensuring alignment with R&I agenda (<i>directionality</i>) | <ul style="list-style-type: none"> • The strategic R&I agenda/roadmap is agreed between partners and the EC. • The objectives and commitments are set in the legal base. • The annual work programme is drafted by partners and approved by the EC. • The commitments include the obligation for financial contributions (e.g. to administrative costs, from national R&I programmes). |

**Securing leveraging effects
(*additionality*)**

- No expectation on leverage from industries as they are not active stakeholders in this model of partnership

5.4.2 Institutionalised Partnerships under Art. 187 TFEU

Article 187 TFEU is a complex arrangement based on a Council Regulation and implemented by dedicated structures created for that purpose. An Institutional Partnership would provide a structured framework for bringing together the capabilities of all stakeholders potentially contributing to bio-based R&I under Horizon Europe. This would include dedicated administrative resources to support the development of the strategic R&I agenda for the whole of the Framework Programme and legally binding funding arrangements.

Table 6: Key characteristics of Option 3: Institutionalised Partnership Article 187

| | Implications of option |
|---|--|
| Enabling appropriate profile of participation (<i>actors involved</i>) | <ul style="list-style-type: none"> • The partnership would enable participation by all key stakeholders potentially contributing to the specification and delivery of the strategic R&I agenda through a clearly defined membership structure. • It would provide a forum for consulting stakeholders on R&I priorities and the work programme, ensuring that they were aligned with industry and market needs. • Participation would be less flexible than under other options, but it might nevertheless be possible to change the profile of participation over time, with new partners joining to support new areas of activity in response to emerging results and changing priorities. |
| Supporting implementation of R&I agenda (<i>activities</i>) | <ul style="list-style-type: none"> • A dedicated administrative structure would be established to coordinate the specification of R&I activity, manage implementation and report on the results (with administrative expenditure limited to 4 % of the budget and subject to 50:50 allocation between the Commission and private partners). |
| Ensuring alignment with R&I agenda (<i>directionality</i>) | <ul style="list-style-type: none"> • The partnership would be responsible for specifying a work programme fully in line with the R&I priorities identified by the industry to fulfil European policy needs, combining activities across low and high TRLs and in different areas. • The work programme would reflect the medium to long-term needs of the industry, drawing on the perspectives of different stakeholders. • The work programme would build on, but not be constrained by, the current BBI JU to ensure continuity where appropriate. • Commission participation in the partnership governance arrangements and approval of the work programme would help to ensure alignment with overarching policy objectives and enable integration with other programmes. |
| Securing leveraging effects (<i>additionality</i>) | <ul style="list-style-type: none"> • Formal commitments and funding requirements would be clearly defined at the outset, with private sector partners expected to provide between 50 % and up to 75 % of partnership resources through in-kind and/or financial commitments. |

| | Implications of option |
|--|---|
| | <ul style="list-style-type: none"> Given more limited funding than in the past, critical R&I priorities would need to be identified at the outset. |

5.5 Options discarded at an early stage

The Co-Funded partnership and an Institutionalised Partnership created under Article 185 of the TFEU are not considered relevant for the impact assessment of the candidate Institutionalised Partnership for a Circular Bio-based Europe. These two options are discarded due to the reasons detailed below.

Both partnership models exclude industries in the partnership agreement, which does not create any basis for involving them in the agenda setting, motivating them to commit to the policy objectives and to programme success. In achieving the key objectives of securing long-lasting competitiveness for the European bio-based industries and ensuring their circularity and sustainability, it is necessary to have the involvement and commitment of the industries. These two options will fail to achieve the necessary directionality between the objectives of industries and state policies. Furthermore, the lack of mechanisms or structures to connect various sectors will not allow delivering the structuring effect that is needed to support the growth of the EU bio-based industry and the development of new value chains.

These conclusions are also in line with the Inception Impact Assessment for the CBE partnership,¹⁰⁸ which suggested that Article 185 TFEU and the co-funded partnership are not considered suitable because the prospective initiative mostly targets industry.

6 Comparative assessment of the policy options

6.1 Assessment of effectiveness

The initiative aims to deliver scientific, economic/technological and societal impacts through a set of pathways (Section 4.3), which require a number of critical factors in place for the impacts to be achieved in the best possible way (Section 4.4).

This section assesses the extent to which each retained policy option has the potential to allow for the attainment of the likely impacts in the scientific, economic/technological and societal sphere, based upon its characteristics (Section 5). At the end of each section we summarise the outcomes of the assessment by assigning a non-numerical score to each option for each impact desired. The assessments in this section set the basis for the comprehensive *comparative* assessment of all retained options against all dimensions in Section 5.4. The table below lists the desired impacts.

Table 7: Likely impacts of the initiative

| Impact area | Likely impacts |
|-------------------|--|
| Scientific impact | EU at the forefront of research and innovation in bio-based solutions and technologies |
| | Strengthened knowledge transfer within and between interlinked value chains |
| | Enhanced capacity for the uptake of research results in products and processes |
| | Enhanced competitiveness of European bio-based industry |

¹⁰⁸ EC (2019a)

| Impact area | Likely impacts |
|--|--|
| Economic / technological impact | Introduced innovative sustainable technologies and processes |
| | More uptake of research results into commercialised products and processes |
| | Sustainable growth of innovative SMEs in the bio-based sector |
| | Strengthened knowledge transfer within and between interlinked value chains and more opportunities for innovative business development |
| | More cross-sectoral interconnections allowing for the valorisation of European biomass, by-products and biowaste |
| Societal impact | The environmental sustainability, social cohesion and circularity at the core of the EU policies in the area |
| | Remote, rural areas diversify their economy |
| | Higher environmental sustainability through substitution of more fossil-based products by bio-based ones |
| | Enhanced acceptance and awareness of benefits of the bio-based economy and shift in the consumers' mindset |
| | Strengthened integration of primary producers in the value chains and higher diversified revenues in poor and rural areas |

Source: Technopolis Group

6.1.1 Scientific impacts

Option 0: Horizon Europe calls (baseline)

Under the baseline option it would be possible to deliver to a large extent on the specific objective on fostering and promoting R&I in bio-based products. Good representation of projects from all TRLs and CSA projects will allow for contribution to long-term scientific progress by investing in novel exploratory research leading to the patenting of new building blocks. This option is likely to result in a higher number of scientific publications.¹⁰⁹ The enhancement of capacities to translate research into products will take place only through (limited) commercialisation actions. The bio-based products and processes that are discovered in RIA projects risk being less aligned with the needs of the market.

In terms of *openness*, due to the intensity of the call process, the calls under this option would largely attract actors that are already active in public R&I support programmes but will not sufficiently foster competitive European-wide bio-based industries.



The **interviewees** from all groups are convinced that many relevant agricultural organisations, waste recyclers, as well as many SMEs would face challenges to access funding under this option. Lack of capacity, administrative burdens and the absence of 'support' structures, for example from a Joint Undertaking (JU) team facilitating outreach would constitute a barrier, according to them.

Due to a limited outreach, the baseline scenario is likely to have limited impact on supporting the development and consolidation of European biomass and bio-waste valorisation value chains. While consortia for HEU calls can have suitable participants, the

¹⁰⁹ One has to note here that neither evidences from the current H2020 and BBI JU projects, nor open stakeholder consultation indicated high relevance of patenting

totality of the value chains can hardly be involved in the projects. Because of its flexibility and openness, this option could be helpful in engaging new players. However, this advantage is unlikely to be sufficient to compensate the shortcomings in terms of type and composition of actors involved. It therefore receives a score of 1.

Option 1: Co-programmed

A CPP option can deliver more (in comparison to Option 0) on the specific objective on fostering and promoting R&I in bio-based products and processes. This is due to a higher amount of resources to be pooled in the programme via the contributions of partners. As there is a higher *flexibility* as to the types of activities that can be funded, it is likely that raising the awareness of different actors involved in circular and environmentally sustainable bio-based solutions is also likely to be achieved.

Due to the possible involvement of research and industry partners, intensive cooperation between them would be possible, both in terms of defining the R&I agenda and for the implementation of research results in products and processes. Hence, the achievement of more critical mass of bio-based technologies and sustainable solutions could be achieved to a degree higher than the baseline scenario.



Public and academic stakeholders in the **interviews** argued that higher roles assured for the scientific actors along with the industries in the agenda setting will ensure a balanced spectrum of calls related to various low and high TRL projects, including demonstration programmes, as well as opportunities for CSA projects.

The CPP option, by following a strategy focused on industry structuring (as part of the SIRA), is likely to achieve consolidation of interlinked European biomass and bio-waste valorisation value chains better than the baseline scenario. Various categories of important actors, such as regions, agriculture and waste industries, and SMEs, are more likely to be involved through facilitation of an open governance model and recruitment to the CPP network. Consequently, the knowledge transfer between and within new interlinked European value chains will be better than Option 0.

Option 3: Institutionalised Art 187

The existence of a Scientific Committee (members from academia) and a State Representative Group (1 per MS + associate members) ensures a high degree of necessary buy-in. The commitment would likely be similar to the CPP, provided Member States and scientists are involved to the same degree.

The IP would be in a strong position to ensure the close collaboration of research and industry in terms of setting the R&I agenda. The close collaboration would shift to a natural one achieving a critical mass for the development of bio-based technologies and solutions, as well as enhancing the capacity of many participating actors for the uptake of R&I results in products and processes.



A number of **interviewees** from public sector stressed that compared to the CPP, in the IP model the EC would not manage to have a high weight in selecting research priorities and call topics. They are afraid that might result in less attention paid to areas that are strategically important for EU topics, and more interest in the topics with quick commercial prospects.

An IP with high industry involvement will be better in aligning research with the realities of the industry and the market. There doesn't seem to be a difference with the CPP in this regard. However, there is a likelihood that low TRL research will receive less attention due to the higher interest of industries in demonstration and piloting projects. A stronger involvement of the public and research actors in the agenda setting can mitigate this trend,

pointing to the high importance of setting a well-balanced governance model from the very beginning of the initiative.



The **interviews** demonstrated a somewhat diverging view on the TRL focus of the future initiative: while most of the industries, some national public authorities, some academics think that larger focus on high TRL projects will help to keep the interest of industries, as well as sooner bring new sustainable solution to the market, other public actors and academics think that strategically it is risky for the EU to miss out in investing in low TRL projects in potentially important areas.

The success of the BBI JU in fostering a structuring effect is likely to be taken over and further developed by the new IP. This would promote the transfer of knowledge to new members' value chains. This impact is very likely to be higher than in Option 0, however can be rather comparable with the one expected in Option 1, as both options will have to facilitate dedicated networking, matchmaking and engagement through specific activities on a programme level.



Most stakeholders from industries and some MS who were **interviewed** were convinced that only an IP could deliver industry structuring (and therefore the knowledge transfer) better.

However, there are evidence that existing CPPs are also delivering the structuring

An IP would be better than the baseline option in further exploring and immediately integrating in practice the understanding of bioproducts and biodegradability. Making sure that the bio-based economy is better from a sustainability perspective is key for the success of the sector. Therefore, the IP and the CPP would need to excel in incorporating environmental sustainability concerns in the research agenda and the calls. In fact, all options can secure a focus on environmental sustainability, but some stakeholders tend to believe that the prevalence of the industries interest in the thematic orientation (that is more likely in IP) might result in the most modest level of sustainability objectives.



Most of the stakeholders **responding to the OPC** indicated that a legal structure would be more relevant in bringing scientific outcomes to the market. For example, a majority of respondents in various stakeholder groups agree that a legal structure will help in linking the R&I agenda of the initiative to the practitioner on the ground, where academics, business associations and NGOs are especially positive. Furthermore, the stakeholders, especially business associations, see that the legal structure will be useful in facilitating work on harmonised standards.

Summary

Table 8 below, lists the scores we assigned for each of the policy options, based upon the assessments above, as well as taking into account the points expressed by the different stakeholders.

Table 8: Overview of the options' potential for reaching the scientific impacts

| | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|---|---------------------|---------------|-----------------------|
| EU at the forefront of research and innovation in bio-based solutions and technologies | ++ | ++ | ++ |
| Strengthened knowledge transfer within and between interlinked value chains | ++ | +++ | +++ |
| Enhanced capacity for the uptake of research results in products and processes | ++ | +++ | +++ |

Notes: Score +++: Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential.

6.1.2 Economic/technological impacts

Option 0: Horizon Europe calls (baseline)

Building blocks developed through research activities funded by HEU calls are less likely to be tested in demonstration facilities and then commercialised. Under the baseline option, successful examples are less likely to be scaled up and replicated in other regions due to the limited involvement of regional actors. Hence, the low uptake of research results into commercialised products.



According to many **interviewees** from industries, especially ones representing BIC, as well as some member states, it will be less possible to produce a structuring effect on the value chain from the primary producers of feedstock to logistics and processing companies. Many of these important actors (especially primary producers, less informed SMEs, actors in remoter regions) would have difficulties in participating in HEU calls without specialised outreach activities and a dedicated programme team who would offer a technical support.

Hence, in HEU the impact on industry, including SMEs and primary producers, will not be significant. This also means that there will be limited impact on the local and regional economies. Even though it would be possible to leverage funding for infrastructure from other sources, the required coordination efforts would be too high.

The achievement of the specific objective on supporting market growth and demand for bio-based products will likely be partially achieved. The collaboration between researchers, companies, primary producers, end-users, etc. will probably be limited to projects. The baseline option will not be in a position to support market growth in any other way. A limited market and few demonstration and flagship facilities will mean that high risk for financiers will remain. Ultimately, as significant economic and technological results are less likely to be achieved, the envisaged impacts on the competitiveness of the EU bio-based economy will be limited. Given the fact that industry will not have a sustained and guiding role, the level of directionality of the initiative will not be high.

Option 1: Co-Programmed

A CPP would be likely to foster economic results by the industry because of the possibilities to fund (or leverage funding for) demonstration facilities and potential commercialisation in flagship activities. Scaling up and replication of successful options in other regions would be more likely to happen than within the baseline option but less likely to take place than in the IP because of the lack of a large dedicated expert team.

It should be noted that consulted stakeholders acknowledged the aspect of co-creation of solutions with end-users as highly relevant. The possibility for SMEs to enter the market will be higher than the baseline objective but supposedly not high enough in order to convincingly reach the impacts of enhanced competitiveness of the bio-based industry and of making the EU economy increasingly circular and environmentally sustainable. We can assume that within the CPP much effort will be needed to match the BBI JU's very good performance in terms of working with SMEs.

A certain level of achievement concerning the specific objective on supporting market growth and demand for bio-based products can be achieved as there is a possibility to carry out a certain level of transfer of knowledge within and between value chains.

The collaboration and cooperation between researchers, companies, primary producers, end-users, etc. will likely be achieved. However, this element is extremely important to the sector and the degree of implementation of the objective will be key. The CPP will be in a position to support the market growth through transfer of knowledge between sectors and value chains and also possibly through different kind of prizes, grants and procurement. It could also provide a better coordination with other HEU funding instruments related to the pillar. However, this functionality of the partnership is very labour intensive and it is not certain that the CPP would be able to reach the same clout as the IP.

Ultimately, as economic and technological results in CPP will be achieved better than within the baseline option, the envisaged impacts will also be achieved to a higher degree, including the impact on the competitiveness of the EU bio-based economy.



Many **interviewees** from industries, especially the ones active in BBI JU, as well as some MS representatives think that the CPP will not be likely to produce a significant structuring effect on the value chain from the primary producers of feedstock to logistic companies, processing companies and end-users. This is because of the high level of complexity of the non-traditional value chains and the geographical challenges to different parts of the value chain. This is also because of the high coordination and facilitation efforts needed to organise actors that do not traditionally work together. At the same time a CPP representative, as well as the EC officers interviewed for this consultation assured that the structuring effect is also achieved in the existing CPPs.

Many **interviewees** from industries, do not expect the sustainable growth of innovative SMEs to be achieved to a sufficient extent because of the complexity of the sector and the difficulty of structuring sectors with often diverging interests until now. They also think that CPP can be in a better position to help increase the awareness of the benefits of bio-based products among consumers but it is not certain that it would be able to dedicate as much communication capacities as within the IP.

Option 3: Institutionalised Art 187

Results of **OPC** and **interviews** showed that the perception of majority of consulted and interviewed stakeholders (from industries, academia, national authorities) is that the availability of a specific legal structure is very relevant with regards to the effectiveness of

the activities carried out; the possibility to respond faster to changes in the market or policy framework; facilitation of synergies with other EU programmes, etc.

We acknowledge that these views might be biased to the extent to which they are based on the positive interaction with BBI JU, working with its highly professional and specialised staff and a lack of experience of working with the CPP. This, of course, does not mean that the CPP would not be in a position to deliver these impacts effectively. However, in order to be able to do so, the CPP needs to possess the same features as the IP, such as a large, dedicated and specialised team with a high industry experience.

As emphasised in interviews and OPC, an IP Art 187 would have a competitive edge in structuring fragmented actors across different geographies in a context of a shifting policy landscape. An IP would also be effective in achieving a mobilising effect in countries that are already performing well in contributing to reaching a critical mass of involvement in bio-based value chains. Such a policy option would be in a good position to reach out, negotiate and accompany all these new sectors in cross-fertilisation and project implementation. These activities could lead to more cross-sectoral interconnections and knowledge transfer, allowing for the valorisation of biowaste.

The possibility to fund flagship projects (and/or leverage other EU funding) is of significant importance for the future partnership, as venture capital would not support them as they are not bankable. This would lead to more uptake of research results into commercialised products and processes and ultimately enhance the competitiveness of European bio-based industry.

An IP Art 187 would be in a strong position to work with handpicked non-European companies to invest and open factories in Europe. Having a separate body as a counterpart would greatly facilitate the process. This certainly could happen within a CPP as well, provided that a robust dedicated coordination and implementation team is in place.

Judging by the past performance of BBI JU, an IP Art 187 is likely to deliver better in terms of SME participation as the programme aligns with the interests of the technology owners. SMEs will increasingly be able to play the role of project leaders for small biorefineries – a need that has been identified by many stakeholders. This would contribute to sustainable growth of innovative SMEs in the bio-based sector.

In the future, the complexity of the bio-based sector would require the active recruitment of 'less traditional' sectors, such as municipal waste management, retailers, aquatic feedstock and regions. The eventual CBE initiative under an IP Art 187 could play in engaging these sectors.



The **OPC** has demonstrated a high degree of agreement among all types of stakeholders on securing economic benefits if a legal structure/funding body is set up for a new initiative. More than half of the participants across the categories agree that the legal structure can ensure higher financial leverage.

Many also agree that the legal structure can reach more buy-in and long-term commitment from parties.

Interviews showed that the perception of majority of consulted and interviewed stakeholders (from industries, academia, national authorities) is that the availability of a specific legal structure is very relevant with regards to the effectiveness of the activities carried out; the possibility to respond faster to changes in the market or policy framework; facilitation of synergies with other EU programmes, etc.

Close half of the **IIA consultation** participant (representing business, business associations, academia and MS authority) commented on model of the potential partnership and all preferences were with IP model. Some stakeholders commented on the commitment issue, and noted that only IP provides the legal means to ensure the private

partner meets a defined minimum level of commitments. Many mentioned positive experience and the proven efficiency of the current Bio-based Industries Joint Undertaking structure.

Summary

Table 9, below, lists the scores we assigned for each of the policy options based upon the assessments above, as well as taking into account the points expressed by the different stakeholders.

Table 9: Overview of the options’ potential for reaching the likely economic/technological impacts

| | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|---|---------------------|---------------|-----------------------|
| Enhanced competitiveness of European bio-based industry | + | ++ | ++ |
| Introduced innovative sustainable technologies and processes | ++ | ++ | ++ |
| More uptake of research results into commercialised products and processes | + | ++ | +++ |
| Sustainable growth of innovative SMEs in the bio-based sector | + | +++ | +++ |
| More cross-sectoral interconnections allowing for the valorisation of European biomass, by-products and biowaste | + | +++ | ++ |

Notes: Score +++: Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential.

6.1.3 Societal impacts

Option 0: Horizon Europe calls (baseline)

The complexity of the circular bio-based industry is high, which means that systemic solutions are needed and there is a need to integrate the interdependency of all stakeholders (namely integrate regions, newcomers like agriculture and waste management actors, etc.) and undertake the most relevant actions taking everything into consideration. The baseline scenario is likely to have some societal and environmental impact that would stem from the HEU projects; however, it is likely to lack the comprehensive strategic approach and integration of the community. Some awareness of the benefits of the bio-based products and industry might be created due to communication and dissemination of novel practices. These will attract some industries and consumers to the bio-based products and processes. Overall, the much awaited and necessary behavioural change and consumption shift is not likely to be significant, but some impact of the projects’ dedicated activity on consumer awareness could be expected as some stakeholders suggest. The project results alone cannot stimulate large enough changes: the substitution of fossil-based products with bio-based ones will hardly happen with the speed necessary to keep up with EU ambitions and global pressures.

As has already been pointed out, without dedicated activities on structuring, primary producers will continue to be insufficiently integrated in biomass and waste valorisation value chains and will likely redirect or continue directing their feedstock supply to energy production. As no infrastructure deployment will be associated with the baseline option,

associated job creation and local economic development results and benefits will be minimal. Limited involvement/lack of special targeting of remote regions under the baseline option signifies potentially missed opportunities for creating jobs and opening new economic activities in those areas.

Primary producers from remote, rural areas will be unlikely to benefit from the research and so diversify their economy. Depending on the diversity and inclusiveness of the HEU consortia, Option 0 might have an impact on enhanced acceptance and awareness of benefits of the bio-based economy and contribute somewhat to a shift in the consumers' mindset.



Only one quarter of the **OPC respondents** agree that the traditional call would be highly relevant in achieving EU policy objectives, societal needs, R&I priorities, SDGs, climate goals. The highest engagement is found in NGOs followed by SMEs, EU citizens and academics, public authorities and finally a few percentage of large companies are positive about this, while none of the business associations support this view.

The **interviews** showed a very few opinions (from the EC and academia) arguing on the superiority of the HEU in delivering societal impact through ensuring a wider consultation process in selecting programme topics.

Option 1: Co-Programmed

A Co-programmed partnership will have better strategic vision and approach addressing the complexity of the industry, targeting systemic solutions, integrating all stakeholders and reaching out to remote regions. More examples of demonstrated, piloted and commercialised products through the initiative's projects will be likely to increase demand. The awareness of the benefits of the bio-based industry will likely increase as well. These impacts are expected to be somewhat higher than in the Option 0.

Primary producers are likely to be more integrated in biomass and waste valorisation value chains, providing some positive social results and impacts related to job creation and local economic development. Limited consumer behaviour changes are likely to take place, thanks to the communication and dissemination activities of projects, and possibly of the programme itself.

Through products and solutions brought to the market, a CPP is likely have higher impacts on emissions reduction, climate neutrality, building the circular economy and making it more aligned with other EU policies. The perception is, especially among EC representatives, that interests of high public order, such as the environment and climate, will be better protected by the CPP in comparison with the baseline option and the IP. Naturally a strong environmental and climate conditionality could be incorporated in the IP to compensate for strong commercial interests.

With regards to openness and engagement of various actors, a CPP would perform sufficiently well. The overwhelming opinion from interviewed stakeholders was that the initiative needs to be fully open. Industry partners, including SMEs, will be motivated by the opportunity for more active participation especially given the flexibility and relatively low administrative barriers.

It is likely that the participants in a CPP will develop a joint Strategic Research Agenda, and a certain level of directionality is expected too. But there are serious challenges in achieving the envisaged social and environmental objectives: on the one hand, addressing these goals will be well ensured by a higher presence of the public sector, civil society and academic actors in the agenda setting; on the other hand, the objectives set by the partnership might not be fully aligned with the objectives of the leading industries, and therefore the commitment by the industries to implementation of the agenda is not

guaranteed. One of the big challenges to the initiative would be to strike the right balance in this respect.



Only a minority of the **OPC respondents** agree that a co-programmed partnership model is effective in achieving EU policy objectives, societal needs, R&I priorities, SDGs and climate goals. None of the NGOs support this view and business associations, large companies and public authorities have around the same low engagement, while EU citizens generate the highest but still low engagement, followed by academics and SMEs.

The views of the majority of the **interviewed** representatives of the EU institutions differed from the rest of the consulted stakeholders by showing preference for CPP (over IP) model which in their views carries better opportunities in achieving societal and environmental objectives.

Option 3: Institutionalised Art 187

The perception is that an Institutionalised Partnership Article 187 (IP A 187) will have a more strategic approach and vision, which together with its specialised staff and resources will be well placed to promote a transition to sustainability. An IP would perform effectively in achieving a systemic transformation whereby bio-waste is fully used by the bio-based industry and more fossil-based products are substituted by bio-based ones.

An IP Art 187 is able to capitalise to a higher extent on the good practices generated within the projects through active dissemination. This will lead to an increased public awareness and acceptance of the benefits of sustainable bio-based products and increase the demand for these products.

At the same time, many stakeholders suggest that due to a stronger influence of industries in the agenda setting, the IP would probably be less effective than CPP in terms of maximising the integration of social and environmental ambitions, actions within the EU circularity agenda (e.g. ensure alignment with a new type of cascading approach that puts food and food security first). However, an IP with a strong industry and equally strong EC participation would be able to align the policy objectives for maximised action and increased directionality.

Some stakeholders argue that an enhanced contribution of each project towards the EU environmental sustainability agenda is necessary, and that an IP Art 187 would be better positioned to provide an intensive personalised support to each individual project in order to integrate the sustainability dimension in a better way.

Dedicated actions promoting outreach toward rural and poor areas under IP Art 187 can increase the positive social impact by fostering opportunities for businesses, new value chains, creating jobs and revenues. While this can be done also in a CPP, the scale is likely to be more prominent in an IP.



In the **OPC**, respondents were asked to indicate how the societal needs, such as achieving EU policy objectives, societal needs, R&I priorities, SDGs and climate goals, could be addressed through HEU intervention. More than a majority of respondents indicated that an IP was the best fitting approach to address these needs. The highest agreement on this came from business associations, followed by large companies, public authorities, and SMEs. Half of the NGOs and nearly half of academics are also positive about an IP model. Citizens indicated less often that IP were the best option.

The **interviews** as well as the **IIA consultation** showed that all industries, representatives of initiatives, most of the academic stakeholders and some national public authorities believe that the IP model can deliver on societal and environmental objectives

well. They believe that through securing higher focus on commercialisation of new sustainable technologies, EU can faster move towards reaching climate targets and circular economy objectives.

Summary

The table below lists the scores we assigned for each of the policy options based upon the assessments above, as well as taking into account the points expressed by the different stakeholders.

Table 10: Overview of the options' potential for reaching the likely societal impacts

| | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|--|---------------------|---------------|-----------------------|
| The EU economy and bioeconomy are increasingly circular and environmentally sustainable | ++ | +++ | +++ |
| Remote, rural areas diversify their economy | + | ++ | +++ |
| Higher environmental sustainability through substitution of more fossil-based products by bio-based ones | +++ | +++ | +++ |
| Enhanced acceptance and awareness of benefits of the bio-based economy and shift in the consumers' mindset | + | ++ | +++ |
| Strengthened integration of primary producers in the value chains and higher diversified revenues in poor and rural areas | + | +++ | +++ |

Notes: Score +++: Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential.

6.2 Assessment of coherence

6.2.1 Internal coherence

In this section we assess the extent to which the policy options show the potential of ensuring and maximising coherence and synergies with other programmes and initiatives under Horizon Europe, in particular European Partnerships.

Option 0: Horizon Europe calls (baseline)

Coherence of the research agenda is likely to be achieved; however, complementarities would be limited by the smaller number of higher TRL actions, leading to a loss of knowledge transfer from research and innovation actions to demonstration and deployment activities, which will be reinforced by the lack of continuity in project teams as answers to individual calls usually lead to ad-hoc consortia. There will be a limited scope for synergies between projects, as there is a lack of structuring of the community in the absence of a dedicated body. Synergies and complementarities with the rest of the Framework Programme are likely to be achieved. Links with partnerships could be made but would be ad-hoc. The lack of a dedicated team that could devote time to engage with the partnership could limit the creation of links and might result in duplication or misalignment of work.

Option 1: Co-Programmed

The Memorandum of Understanding would ensure coherence of the research agenda over time, and the flexibility of the governance model would secure the timely involvement of the most relevant actors, ensuring continuity across projects and better internal synergies. As the EC would provide a strong steering role, coherence with the rest of the Framework Programme would be achieved. Both EC staff and the network's secretariat would theoretically have the means to create synergies and complementarities with other partnerships, but this will depend on the availability and expertise of the staff, and good coordination between different initiatives.

Option 3: Institutionalised Art 187

An Institutionalised Partnership Article 187 (IP A187) provides for the creation of a dedicated secretariat with specialised staff that have a full understanding of bio-based issues and would have the means to fully exploit the potential for synergies and complementarities of all actors, provided that the partnership can open its ranks to all of them. It will also act as a single contact point for interested parties. An IP A187 would also benefit from a stronger contribution from industrial partners, secured through a legal agreement, which would benefit project partners and ensure a strong structuring effect. The research agenda would have to be fully in line with Horizon Europe objectives and as such, it is expected that coherence with the rest of the Framework Programme will be ensured. With the resources to engage with other European partnerships' staff, an Institutionalised Partnership would be able to exploit synergies and complementarities within Horizon Europe.



As part of the **OPC**, several categories of actors saw relevance/ high relevance in setting up a specific legal structure (funding body) for the candidate European partnership to achieve: research organisations and business associations insisted on better links to practitioners on the ground; a majority of research organisations, business associations, companies (all sizes), public authorities, and NGOs insisted on better links to regulators. Finally a large majority of business associations and large companies saw relevance in more buy-in and long-term commitment from other partners.

Several **interviewees** mentioned that the IP A187 is the option with the highest visibility and strongest position to engage with other parties. This was especially mentioned by Member States, and supported by some other respondents (from the EC, BBI-JU related stakeholders, companies not BBI-related, and a research organisation). However, some interviewees from the European Commission and a Member state consider that a CPP would have the same engagement and visibility as an IP A187.

Several **interviewees** mostly from public authorities, and one MS government voicing at **IIA consultation** highlighted an importance of assuring an appropriate governance model in the IP model. They suggest that it is aligned with the public interest, industry needs and the needs of other key stakeholders such as primary producers and end users. They also suggest that the role of the MS (and possibly of regions) in the governance is strengthened, and asked for more open process in themes selection in the agenda setting and for better information sharing.

6.2.2 External coherence

In this section we assess the extent to which the policy options show the potential of ensuring and maximising coherence with EU-level programmes and initiatives beyond the Framework Programme and/or national and international programmes and initiatives.

Option 0: Horizon Europe calls (baseline)

Links can theoretically be made with other programmes under the MFF 2021-2027 (beyond Horizon Europe), but only on an ad-hoc basis. There would be no dedicated team that could devote time to engage with other programmes and develop structured, long-lasting synergies. Nonetheless, activities that are unlikely to be conducted through Horizon calls (especially deployment actions) could be funded under other programmes (e.g. InvestEU). Horizon Europe calls are unlikely to contribute to the constitution of European infrastructures, and projects would have to rely on infrastructures provided by other funders. The absence of Horizon Europe funding for biorefineries would have an impact on the capacity to conduct research, as other funders are unlikely to match the missing element, leading to a loss of complementarity (as other funders currently benefit from Horizon 2020 investments in infrastructures). No work on regulation is to be expected under Horizon Europe calls, and their capacity to contribute to the regulatory debate through CSAs would be limited. In particular the impact of CSAs in this domain and the overall directionality and engagement of the community might be impeded by the lack of a community-structuring effect, the scattering of actors with highly diverse opinions and no clear identification of overall needs.

Option 1: Co-Programmed

The administration of the partnership by an EC executive agency would ensure that staff would have the means to continuously engage with other programmes beyond Horizon Europe in order to develop synergies and complementarities. The network's secretariat could also take part in these networking efforts. A wider range of actors involved in the network would create conditions for stronger synergies with other public bodies at European, national and regional levels. It should ensure a continued (and perhaps stronger) alignment with national and regional strategies, as realised under the BBI-JU.¹¹⁰ However, in a co-programmed partnership the industry might be less engaged. It would therefore not benefit from strong complementarities with purely private initiatives and might attract less attention from brand owners.

Option 3: Institutionalised Art 187

A strong involvement of the European Commission will be needed to ensure that an IP A187 engages with other MFF programmes. However, the need to look for complementarities, especially regarding access to finance when demonstration and deployment activities end, should create a strong incentive for the secretariat of the partnership to engage with these programmes (e.g. the EIB's European Circular Bioeconomy Fund, InvestEU) and it would have the resources to then support project holders in their transition.

The involvement of a wide range of actors within the network, benefitting from the structuring effect of an Institutionalised Partnership, would create the conditions for synergies with other public bodies at European, national and local levels. The high level of involvement required of the industries would also encourage them to join forces and develop the links that are necessary to create and strengthen bio-based value chains in an integrated manner. The structuring effect of an Institutionalised Partnership will also provide for the constitution of common understandings regarding needs, especially in terms of regulation, infrastructure or human capital.

¹¹⁰EC (2017b)



As part of the **OPC**, several categories of actors (approximately same engagement across categories) saw relevance / high relevance in setting up a specific legal structure (funding body) for the candidate European partnership to achieve: facilitated synergies with EU/national programmes; and facilitated collaboration with other partnerships.

The **interviews** showed that several interviewees (namely companies, but also one research organisation) mentioned that a CPP might result in the industry being less engaged than in an IP A187.

Close to half of participants to the **IIA consultation** representing business and business associations, MS government and academia, welcomed the Institutional Partnership model. Among their arguments were that this model represents the deepest level of integration and engagement. At the same time there was a suggestion that the synergies with national programmes should be promoted along with better involvement of the MS in the governance process

Summary

The table below lists the scores we assigned for each of the policy options based upon the assessments above, as well as taking into account the points expressed by the different stakeholders.

Table 11: Overview of the options' potential for ensuring and maximising coherence

| | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|---------------------------|---------------------|---------------|-----------------------|
| Internal coherence | + | +++ | +++ |
| External coherence | + | ++ | +++ |

Notes: Score +++: Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential.

6.3 Comparative assessment of efficiency

In order to compare the policy options under common standards, we developed a standard cost model for all 13 candidate Institutionalised Partnership studies. The model and the underlying assumptions and analyses are set out in the report on the overarching context to the impact assessment studies.

Table 12 below, shows the intensity of additional costs against specific cost items for the various options as compared to the baseline, i.e. Option 0 (Horizon Europe calls). In this table we have taken into account that for Option 3 (Institutionalised Partnership Art 187) there would be moderate additional costs for the set-up of a dedicated implementation structure, seeing that such a structure (BBI JU) is already existing. For Option 1 (Co-programmed), we considered an additional cost for the call and project implementation as MS would not be providing contributions.

Table 12: Intensity of additional costs compared with HEU Calls (for partners, stakeholders, the public and the European Commission)

| Cost items | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|---|------------------------|------------------|--------------------------|
| Preparation and set-up costs | 0 | ++ | +++ |
| Preparation of a partnership proposal (partners and EC) | 0 | ++ | ++ |
| Set-up of a dedicated implementation structure | 0 | 0 | Existing: ++ |
| Preparation of the SIRA / roadmap | 0 | ++ | ++ |
| Ex-ante Impact Assessment for partnership | 0 | 0 | +++ |
| Preparation of EC proposal and negotiation | 0 | 0 | +++ |
| Running costs (Annual cycle of implementation) | 0 | + | ++ |
| Annual Work Programme preparation | 0 | + | + |
| Call and project implementation | 0 | 0 | + |
| Cost to applicants | 0 | 0 | 0 |
| Partners costs not covered by the above | 0 | + | + |
| Additional EC costs (e.g. supervision) | 0 | + | ++ |
| Winding down costs | 0 | + | +++ |
| EC | 0 | 0 | +++ |
| Partners | 0 | + | + |

Notes: 0: no additional costs, as compared with the baseline; +: minor additional costs, as compared with the baseline; ++: high additional costs, as compared with the baseline; +++: very high additional costs, as compared with the baseline.

The scores related to the costs set out above will allow for a 'value for money' analysis (cost-effectiveness) in the final scorecard analysis in Section 6.4. For this purpose, in Table 13 below where we provide the scores for the scorecard analysis, based on our insights and findings and based on the scores above, we assign a score of 1 to the option with the highest costs and a score of 3 to the lowest.

Table 13: Matrix on overall costs and cost-efficiency

| | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|------------------------|------------------------|------------------|-----------------------------|
| Overall cost | 3 | 2 | 1 |
| Cost-efficiency | 3 | 3 | 2 |

Notes: Score of 1 = Substantial additional costs, as compared with the baseline; score of 2 = Medium additional costs, as compared with the baseline; score of 3 = No or minor additional costs, as compared with the baseline.

We considered that while there is a clear gradation in the overall costs of the policy options, the cost differentials are less marked when we take into account **financial leverage (co-financing rates)** and the total budget available for each of the policy options, assuming

a common Union contribution. From this perspective, there are only one or two percentage points that split the most cost-efficient policy options – the baseline Option 0 and the CPP policy options – and the least cost-efficient – the IP option. We have therefore assigned a score of 3 to Option 0 and the CPP options for **cost-efficiency**, and a score of 2 for the IP policy option. It is important to note that while the cost-efficiency in Options 0 and 1 seems very close, Option 1 surely offers a larger scale of impact due to almost twice the amount of envisaged investment for R&I. Investment for R&I in the Institutionalised Partnership is envisaged to be high as well, but still slightly smaller than in a Co-programmed partnership.

6.4 *Comprehensive comparison of the options and identification of the preferred option*

Building upon the outcomes of the previous sections, this section presents a comparison of the options' 'performance' against the three dimensions of effectiveness, efficiency and coherence.

6.4.1 Comparative assessment

Effectiveness

In assessing effectiveness, the policy options 1 and 3 for CPP and IP, respectively, are likely to offer a comparable scientific impact that is higher than the one envisaged in HEU calls. This is due to the expectation that the impact in the facilitated models would go beyond the scientific outputs and create knowledge transfer and spillovers and increased capacity of actors.

In delivering economic and technological impacts, again Options 1 and 3 prevail, due to a strategic approach defined in a SIRA, more targeted innovation activities, better links with the market and more developed cross-sectoral interconnections. Under the Option 0, the lack of coordinated actions/strategy relevant to the community will result in more modest impacts. Also, larger pools of resources for Options 1 and 3 should translate into larger scale impacts from the project activities.

Slightly higher societal impact is envisaged in an IP in comparison to a CPP and both would have a much higher impact than the baseline option. This is because dedicated targeted activities for outreach to the regions and rural areas aimed at integrating primary producers (farmers, SMEs, waste recyclers) in the new value chains would translate into creating jobs and diversifying local economies.

Coherence

Regarding coherence within the proposed initiative, HEU calls allow for only limited complementarities and knowledge transfer, with minimal structuring effects across projects. While synergies with the rest of the Framework Programme can be achieved, there will be no resources to build lasting relationships with partnerships. By contrast, a CPP would ensure both coherence of the research agenda and timely involvement of the right actors and would have resources to engage with all the relevant initiatives within the HEU programme. An IP A187 would perform similarly well but might ensure a stronger involvement of private partners. It is also likely to be in a stronger position to engage with other initiatives; however, the potential of both partnerships for external engagement depends on the resources allocated (time and staff), so can therefore, at this stage, be considered equivalent.

Regarding external coherence, the option 0 would perform poorly, due to the absence of a dedicated team and the low potential for overall directionality and community engagement. Its capacity to deliver the objective will depend on actions performed externally, with no guarantee that other initiatives will contribute. Both CPP and IP A187 partnerships would perform better in this regard, with a team available to build the necessary bridges with

related initiatives (especially regarding environmental sustainability) and other funders (especially regarding access to finance for the highest TRL outputs) that are needed for the innovations to reach the market. Regarding this point, an IP A187 is likely to perform better than a CPP as it would trigger a greater involvement of the industry, both in terms of leverage effects and visible engagement (brand owners' involvement, communication, etc.).

Table 14: Scorecard of the policy options

| | Criteria | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|---------------|---|------------------------|------------------|-----------------------------|
| Effectiveness | Scientific impacts | 2 | 2.7 | 2.7 |
| | EU at the forefront of research and innovation in bio-based solutions | 2 | 2 | 2 |
| | Strengthened knowledge transfer within and between interlinked value chains | 2 | 3 | 3 |
| | Enhanced capacity for the uptake of research results in products & processes | 2 | 3 | 3 |
| | Economic/technological impacts | 1.2 | 2.4 | 2.6 |
| | Enhanced competitiveness of European bio-based industry | 1 | 2 | 2 |
| | Introduced innovative sustainable technologies and processes | 2 | 2 | 2 |
| | More uptake of research results into commercialised products & processes | 1 | 2 | 3 |
| | Sustainable growth of innovative SMEs in the bio-based sector | 1 | 3 | 3 |
| | More cross-sectoral interconnections allowing for the valorisation of European biomass, by-products and biowaste | 1 | 3 | 3 |
| | Societal impacts | 1.6 | 2.6 | 3 |
| | The EU economy and bioeconomy are increasingly circular and environmentally sustainable | 2 | 3 | 3 |
| | Remote, rural areas diversify their economy | 1 | 2 | 3 |
| | Higher environmental sustainability through substitution of more fossil-based products by bio-based ones | 2 | 3 | 3 |
| | Enhanced acceptance and awareness of benefits of the bio-based economy and shift in the consumers' mindset | 2 | 3 | 3 |
| | Strengthened integration of primary producers in the value chains and higher diversified revenues in poor and rural areas | 1 | 2 | 3 |
| Coherence | Internal coherence | 1 | 3 | 3 |
| | External coherence | 1 | 3 | 3 |

| | Criteria | Option 0: HEU calls | Option 1: CPP | Option 3: IP Art. 187 |
|------------|-----------------|------------------------|------------------|-----------------------------|
| Efficiency | Overall cost | 3 | 2 | 1 |
| | Cost-efficiency | 3 | 3 | 2 |

Notes: Scores for effectiveness and coherence: 3 = *substantially higher performance*; 2 = *higher performance*; 1 = *lower performance*. Scores for efficiency: 1 = *substantial additional costs*, as compared with the baseline; 2 = *medium additional costs*, as compared with the baseline; 3 = *No or minor additional costs*, as compared with the baseline.

6.4.2 Identification of the preferred option

The scorecard in Table 14 the scorecard shows that Option 0 has lowest points, while **Options 1 and 3 come close in many criteria**. Nevertheless, **Option 3 still scores a little higher overall** and its slightly advantageous position is delivered through offering marginally higher economic/technological and social impact and higher coherence with external programmes.

All in all, the assessment concludes with a slight preference for Option 3. However, considering the challenges faced in the operation of the current BBI JU, it is strongly advised that the lessons are taken into account while transitioning to the CBE partnership. This should include improving the governance model and process in the partnership by allowing a better representation of other types of stakeholders in agenda setting in order to ensure stronger coverage of non-economic objectives, better synergies with national and regional developments, and more balanced decision-making in which diverse stakeholder voices can be heard and considered in shaping the research agenda.

7 The preferred option

7.1 Description of the preferred option

As discussed above, the likely preferred option would be the Institutionalised Partnership Article 187. This option well addresses the criteria related to the selection of the European Partnerships as listed below. In the table below, we indicate the alignment of the preferred option with the selection criteria for European Partnerships as defined in Annex III of the Horizon Europe Regulation. Seeing that the design process of the candidate Institutionalised Partnerships is not yet concluded and several of the related topics are still under discussion at the time of writing, the criteria of additionality/directionality and long-term commitment are covered in terms of *expectations* rather than *ex-ante demonstration*.¹¹¹

¹¹¹ Appendix J presents other considerations for the selection of the Institutionalised Partnership that have been voiced by the stakeholders.

Table 15: Alignment with the selection criteria for European Partnerships

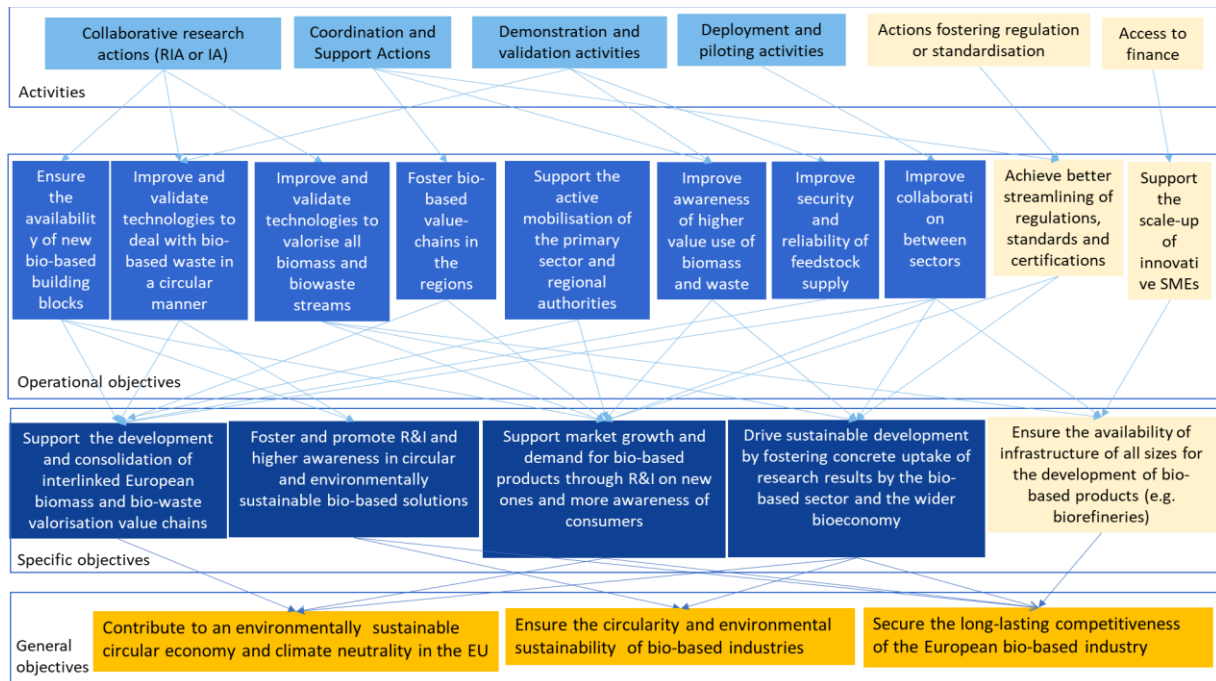
| Criterion | Alignment of the preferred option |
|---|--|
| Higher level of effectiveness | The Institutionalised Partnership is more effective than the Horizon Europe calls in achieving the related objectives of the programme through involvement and commitment of industry partners, as well as engaging other actors (Member States, regions, academia and civil society organisations) through a governance model that needs to be more participative than the one that is currently operated in the BBI JU. |
| Coherence and synergies | Coherence and synergies of the Institutional Partnership within the EU research and innovation landscape will be ensured through the formal agreements between the CBE partnership and other initiatives, as well as through the co-creative process of the agenda setting and dedicated efforts in the course of implementation by the support team. |
| Transparency and openness | The preferred option offers an adequate level of transparency and openness in the selection of priorities and objectives and the involvement of partners and stakeholders from across the entire value chain, from different sectors, backgrounds and disciplines, including international actors (when relevant and not interfering with European competitiveness). Formalised procedures will offer clear modalities for promoting SME participation, as well as for disseminating and exploiting results. |
| Additionality and directionality | It offers high additionality, namely high potential for structuring the bio-base industries and ensures directionality by formalising commitments of partners toward achieving specific targets, eventually feeding the high-level policy objectives. |
| Long-term commitment | In the case of Institutionalised European Partnerships, established in accordance with Article 187 TFEU, the financial and/or in-kind contributions from partners other than the Union will at least be equal to 50 % and may reach up to 75 % of the aggregated European Partnership budgetary commitments. It is expected that most of the commitment will be realised via in-kind and, to a lesser extent, financial contributions within projects, rather than at the programme level. |

7.2 Objectives and corresponding monitoring indicators

7.2.1 Operational objectives

Figure 7 presents the operational objectives of the CBE partnership and how the operational objectives connect to the standard types of activities, as well as additional activities defined for this partnership, and how they can feed the specific and general objectives. It lists a range of actions and activities going beyond the R&I activities that can be implemented under Horizon Europe (highlighted in yellow). This reflects the definition of European Partnerships in the Horizon Europe Regulation as initiatives where the Union and its partners 'commit to jointly support the development and implementation of a programme of research and innovation activities, including those related to market, regulatory or policy uptake'.

Figure 7: Operational objectives of the initiative



Source: Technopolis Group

7.2.2 Monitoring indicators

Table 16 suggests indicators for monitoring the initiative’s progress towards its targeted impacts *in addition to the ones identified for the HEU key impact pathways*. It intends to reflect on the impact pathways set out in Section 4.3 and the operational objectives defined above, as well as partnership-specific indicators. Short-term effects (outputs) relate to the operational objectives, medium-term effects (results) to specific objectives, and long-term impacts to general objectives.

Table 16: Monitoring indicators in addition to the Horizon Europe key impact pathway indicators

| | Short-term (typically, at year 1+) | Medium-term (typically, at year 3+) | Long-term (typically, at year 5+) |
|---------------------------------|---|--|---|
| Scientific impact | No of scientific publications on circular bio-based and waste valorisation technologies from CBE projects | No of patents on circular bio-based and waste valorisation technologies No of projects where circular technologies are demonstrated and piloted | No of technologies and products that are patented, demonstrated or piloted in CBE that reach market/commercialisation Scientific performance of the EU increases in international statistics as per bio-based economy Inter-EU cohesion on R&I in bioeconomy area increased |
| Technological / economic impact | No of new bio-based building blocks identified No of new bio-based products identified | No of new bio-based value-chains (VCs) created No of jobs and value added created as a result of the new VCs, | Economic performance turnover/export/etc. of the EU increases in international statistics on bio-based economy/products |

| | Short-term (typically, at year 1+) | Medium-term (typically, at year 3+) | Long-term (typically, at year 5+) |
|--|--|---|---|
| | <p>No / % of regions where new building blocks identified/ VC/products connected</p> <p>No of new feedstock suppliers engaged in projects or new VCs</p> | <p>technology, product, commercialisation</p> <p>No of locations where necessary infrastructure has been set up</p> <p>No of new cross-sectoral collaborations</p> | <p>Performance of the EU on sustainable biomass and high value added of biomass improved.</p> <p>Economic attractiveness of the EU for bio-based industry investment increased</p> |
| Societal impact | <p>No of feedstock owners reached by information campaigns on opportunities of bio-based and circular economy</p> <p>Activities on streamlining regulations, standards and certifications initiated</p> <p>No of SMEs engaged in projects/innovations</p> | <p>The EU/ national/ regional communities of feedstock suppliers have a good strategic vision and position on participation in bio-based industries.</p> <p>No of regulations, standards, certifications schemes tested and/or launched</p> | <p>Global comparative performance of the EU in creation of high-quality jobs in circular bio-based economy increased (along the whole VC)</p> |
| Incl. Environmental / sustainability impact | <p>Biomass waste valorisation/ diversion from waste or low preferential application introduced</p> <p>New innovations with CO2 emissions avoidance or sunk functions</p> <p>More efficient processes introduced using biomass</p> <p>Sustainable agricultural/forestry practices introduced as part of new value chain</p> | <p>Tonnes of biomass waste valorised / diverted from waste or low preferential application</p> <p>Tonnes of CO2 emissions avoided or sunk</p> <p>Change (%) in efficiency of biomass use per ton of bio-based product</p> <p>Sq. kms of land on which sustainable agricultural/forestry practices are envisaged to be introduced as part of new value chain</p> | <p>Diffusion of sustainable practices on biomass waste valorisation beyond CBE projects</p> <p>National/regional climate neutrality improved</p> <p>Circular economy targets approached</p> <p>Biodiversity enhancement observed as a result of sustainable biomass supply to bio-based value chain</p> <p>Ecosystem services improved/emerged as a result of sustainable biomass supply to bio-based value chain</p> |

Source: Technopolis Group

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Appendix B Synopsis report on the stakeholder consultation – Focus on the candidate European Partnership for Circular Bio-based Europe

Disclaimer: the views expressed in the contributions received are those of the respondents and cannot under any circumstances be regarded as the official position of the Commission or its services.

B.1 Introduction

Following the European Commission's proposal for Horizon Europe in June 2018,¹¹² 12 candidates for institutionalised partnerships within 8 partnership areas have been proposed, based on the political agreement with the European Parliament and Council on Horizon Europe reached in April 2019.¹¹³ Whether these proposed institutionalised partnerships will go ahead in this form under the next research and innovation programme is subject to an impact assessment.

In line with the Better Regulation Guidelines,¹¹⁴ the stakeholders were widely consulted as part of the impact assessment process, including national authorities, the EU research community, industry, EU institutions and bodies, and others. These inputs were collected through different channels:

- A feedback phase on the inception impact assessments of the candidate initiatives in August 2019,¹¹⁵ gathering 350 replies for all 12 initiatives;
- A structured consultation of Member States performed by the EC services over 2019;
- An online public stakeholder consultation administered by the EC, based on a structured questionnaire, open between September and November 2019, gathering 1635 replies for all 12 initiatives;

A total of 608 Interviews performed as part of the thematic studies by the different study teams between August 2019 and January 2020.

This document is the synopsis report for the initiative “Circular Bio-Based Europe”. It provides an overview of the responses to the different consultation activities. A full analysis of the results is included in Appendix B.

¹¹² https://ec.europa.eu/commission/presscorner/detail/en/IP_18_4041

¹¹³ https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_19_2163

¹¹⁴ https://ec.europa.eu/info/files/better-regulation-guidelines-stakeholder-consultation_en

¹¹⁵ The full list of inception impact assessments is available here. They were open for public feedback until 27 August 2019.

B.2 Feedback to the inception impact assessment on candidate initiatives for institutionalised partnerships

Following the publication of the inception impact assessment, a feedback phase of 3 weeks allowed any citizen to provide feedback on the proposed initiatives on the “Have your say” web portal. In total 340 feedbacks were collected for all initiatives.

For the initiative “Circular Bio-Based Europe” 19 individual feedbacks were collected, mainly from businesses (2 responses), business associations (6 responses), academic institutions (5 responses, including 2 anonymous), public authorities (3 responses) and NGOs (3 responses).¹¹⁶ Among the elements mentioned were:

- Eight stakeholders (all businesses, two business associations, three academic institutions, one NGO and two public authorities) welcomed the integration of circular economy objective and highlighting the high relevance of the circular economy topic in the context of biobased industries
- Eight stakeholders (all businesses, some business associations, over half academic institutions, one public authority) commented on the model of the new initiative and welcomed the Option 2 Institutional Partnership model. Comments included that this model represents the deepest level of integration and engagement; that it is the best way forward as it will contribute to longevity and sustainability, through integration, engagement. Some mentioned positive experience and the proven efficiency of the current Bio-based Industries Joint Undertaking structure. Some stakeholders commented on the commitment issue, and noted that only IP provides the legal means to ensure the private partner meets a defined minimum level of commitments.
- One public authority stakeholder while supporting the IP model, commented on importance of assuring an appropriate governance model that is aligned with the public interest, industry needs and the needs of other key stakeholders such as primary producers and end users. They suggest that the role of the MS in the governance is strengthened including via synergies with national programmes, more open process of programme topic generation, information sharing with the MS as in other parts of Horizon, transparency on the real (in-kind and in-cash) contributions actually provided by industry.
- One stakeholder from NGO sector criticized the models of public-private partnerships (ETPs, JTIs, JUs) with industry having an increasing say in determining strategic research agendas and promoting own needs at the expense of EC funds.
- Several stakeholders suggested to ensure that thematic coverage included additional topics as listed below:
 - Three stakeholders commented on importance of inclusion of *bioenergy* sector in the sectorial coverage of the new initiative, commenting that it can also contribute to the circular economy and its synergies with other bio-based sectors.
 - There stakeholders from business, business associations and regional government, stressed the relevance of *wastewater* in the circular bio-based economy as an important source of nutrients and chemicals
 - One association extensively argued about importance of promoting R&I on *plant-based proteins* under the new initiative.
 - One business association suggested to include a focus on *renewable gases* from agricultural waste in the topical scope of the initiatives.

¹¹⁶ Feedback on inception impact assessment to be found on https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2019-4972449/feedback_en?p_id=5722347

- Two stakeholders (from academia and NGO), highlighted the importance to consider environmental impact of creating new demand for biomass (e.g. food security, impact on ecosystems, resource conflicts outside EU), and ensure maintenance or improvement of biodiversity.

B.3 Structured consultation of the member states on European partnerships

A structured consultation of Member States through the Shadow Strategic Configuration of the Programme Committee Horizon Europe in May/ June 2019 provided early input into the preparatory work for the candidate initiatives (in line with the Article 4a of the Specific Programme of Horizon Europe). This resulted in 44 possible candidates for European Partnerships identified as part of the first draft Orientations Document towards the Strategic Plan for Horizon Europe (2021-2024), taking into account the areas for possible institutionalised partnerships defined in the Regulation.

The feedback provided by 30 countries (all Member States, Iceland and Norway) has been analysed and summarised in a report, with critical issues being discussed at the Shadow Strategic Programme Committee meetings.

B.3.1 Key messages overall for all candidate Institutionalised Partnerships are the following:

Overall positive feedback on the proposed portfolio, but thematic coverage could be improved

The results indicate a high level of satisfaction with the overall portfolio, the level of rationalisation achieved, and policy relevance. While delegations are in general satisfied with the thematic coverage, the feedback suggests the coverage could be improved in cluster 2 "Culture, creativity and inclusive society" and cluster 3 "Civil Security for Society".

Large number (25) of additional priorities proposed for partnerships by delegations

Despite high satisfaction with the portfolio and candidates put forward by the Commission, countries put forward a high number of additional priorities to be considered as European Partnerships. A closer examination suggests that these additional proposals are motivated by very different reasons. Whilst some proposals are indeed trying to address gaps in the portfolio and reach a critical mass, then, others are driven by the wish to maintain existing networks, currently not reflected in the Commission proposal (e.g. those based on JPIs, ERA-NETs). In addition, some proposals reflect worries over some topics not being sufficiently covered in the existing proposals, but could be possibly well covered within the scope of existing partnerships, or by traditional calls under the Framework Programme.

Critical view on the high number and openness of Joint Undertakings

Country feedback suggests dissatisfaction with the high number of proposed Article 187 TFEU partnerships. Notably smaller as well as EU-13 countries raise concerns with regards to the potential insufficient transparency and openness of the partnership model. In the feedback, countries either directly support or ask to carefully analyse whether the objectives of this proposal could be reached with the co-programmed model.

For those partnerships that will be set up on the basis of Article 187, the country feedback stresses the need to ensure a clear shift towards openness in the governance, membership policy and allocation of funding of these partnerships. Notably, it is emphasised that the JU rules should not have any limitations or entry barriers to the participation of SMEs and other partners, including from academia.

Although the feedback suggests a general criticism, there are few concrete and broadly supported proposals, including to reduce the number of institutionalised partnerships mergers or by alternative implementation modes.

Lack of cross-modal perspective and systematic approach to mobility

The current proposal foresees 5 partnerships in the area of transport (for rail, air traffic management, aviation, connected and automated driving, zero-emission road transport), and 2 that in closely related technologies for radically reducing carbon emissions (hydrogen, batteries). Several delegations would wish to see a systemic approach to developing mobility and addressing related challenges (optimisation of overall traffic, sustainable mobility solutions for urbanisation), and do not support a mode-dependent view only. This suggests the need to discuss how to ensure greater cooperation between transport modes and cross-modal approaches in establishing partnerships in the area of mobility.

Partnership composition: the role of Member States in industry partnerships

The composition and types of partners is an important element for the success of a partnership, e.g. to ensure the right expertise and take-up of results. Ensuring broad involvement without overly complicating the governance of the partnership remains an important an important challenge in the design of future partnerships.

In the feedback, several Member States express their interest to join as a partner in partnerships that have traditionally been industry-led. However, individual comments suggest there are different views on what their involvement means in practice, with some countries expressing readiness to commit funding, while others support limiting their involvement to alignment of policies and exploiting synergies. This suggests the need to discuss further what the involvement of Member States means in practice (notably in terms of contributions, in the governance), and what would be possible scenarios/options in Horizon Europe. There is special interest in testing and deployment activities, in synergies with Cohesion Funds and CEF priorities and investments.

Although it is too early to determine the interest of industry/ businesses in the topics proposed for partnerships where the main partners are public authorities, their involvement in in public centric partnerships will also be an important question in the design and preparation of future proposals.

Some proposals are more mature than others

The analysis of feedback per partnership candidates suggests that some proposals are more mature, while others would need more time to determine the scope, objectives, partner composition and contribution and appropriate mode of implementation. This relates to in particular to partnerships with no predecessors and those where the main partners are public. It suggests that the proposals would need to be developed at different paces in order to achieve good quality, and thus, not all partnership proposals may be ready for implementation at the start of Horizon Europe.

For the initiative "Circular Bio-Based Europe" the following overall feedback was received from Member States. Delegations identified a number of aspects that could be reinforced in the proposal for the "Circular Bio-based Europe" partnership that would increase its relevance for national priorities. They suggest e.g. to broaden the scope towards forestry, waste and marine bio-resources; to give more emphasis to local production of biomass and to create opportunities for the development of local small-scale technological solutions for rural regions and urban areas. The proposed use of Article 187 is supported by 26%, but also questioned by 26% of the responses, with 48% requiring more information. Overall the results of the Member State consultation confirm strongly the high relevance of the proposed European partnership for a Circular bio-based Europe. While 43% of the countries

are undecided at this stage, 15 have expressed an interest to participate (BE, DE, ES, FI, FR, CR, HU, IE, IT, MT, NL, RO, SE, SK, SI), and only one country has at this stage expressed that there is no national interest to participate (IS). Overall there is a strong agreement (96%) on the use of a partnership approach for a Circular bio-based Europe and a broad agreement (83%) that the partnership is more effective than traditional calls in achieving the objectives and delivering clear impacts for the EU and its citizens. The majority of countries indicate good agreement with the proposed objectives at short, medium and long term and the expected scientific, economic and societal impacts at European level.

B.4 Targeted consultation of stakeholders related to the initiative "Circular Bio-based Europe"

In addition to the consultation exercises coordinated by EC services, the external study thematic teams performed targeted consultations with businesses, research organisations and other partners on different aspects of potential European Partnerships.

B.4.1 Approach to the targeted consultation

The objectives of the interviews in the context of this impact assessment was to collect view of people on the following topics:

- Overall and specific objectives that the potential Circular bio based partnership/initiative could address
- Target groups, membership and openness
- Role and activities of the initiative
- Leverage effect in the potential partnership
- Coordination, structuring and mobilisation needs
- Key Performance Indicators (KPI)
- Costs and benefits of the potential initiative
- Need for a Circular bio-based Europe
- Research needs
- Contribution to EU policies
- Governance / organisation
- Collaborations with other initiatives
- Benefits of EU action

The selection of interviewees was discussed with the steering committee members. The key point was to approach the actors who are well informed about the ongoing partnership work either by being involved in projects, governance board or cooperation activities. A few companies not involved in the current partnership activities have also been approached. Description of the categories of actors interviewed is made in the next section.

The potential interviewees were contacted by email invitations that included the explanation of the context of the assignment, letter of support from the EC and the interview guide with a list of topics and relevant questions to be discussed (See Appendix B). The interview guide (referred as the questionnaire) contained 50 questions divided by sections mentioned above.

The interviewees were given a freedom to use the interview as a guidance for the interview discussions and not forced to address all questions and topics presented here. In many cases the interview was organised by topical sections, in a few cases interviewees structurally followed question by question in providing their answers. Some interviewees preferred to provide written answers to the questionnaire. Finally, the interviewees were guaranteed their anonymity.

B.4.2 Overview of respondents to the targeted consultation

In total, 63 interviews have been conducted. However, that number does not correspond to the actual number of individuals interviewed since group interviews were also conducted with actors belonging from the same stakeholders category.

Moreover, situations were found where actors were belonging to several stakeholders categories, i.e. actors managing a BBI JU Flagship project could also be present in the BBI JU Team and Governing Board category. To avoid duplicate, such situations were resolved by allocating the individuals to their "main" category. That means that from one single interview, multiple visions and experiences could be collected.

In total, 14 stakeholders categories were established as follow:

- The European Commission
- Member States with a bioeconomy strategy
- Member States without a bioeconomy strategy
- Regions
- BBI JU Team and Governing Board
- BBI JU Flagship
- BBI JU Other projects
- Companies BBI JU related
- Companies not BBI JU related
- Other Initiatives
- Business and industry associations
- NGOs and consumer associations
- Research and RTOs

Experts

B.4.3 Key results/messages from the targeted consultation

The main findings of the interviews have been described by sections. Some sections received less input than others since they were more technical and required specific knowledge on the subject, which some actors did not have to provide relevant answers. Some sections received more input, such as the "objectives" section, which proved successful in generating enthusiasm and opinions from the interviewees and did not require technical knowledge.

Objectives

In general, interviewees were agreeing with the objectives of the future initiative, however, many of them stipulated that in the future initiative, the objectives should be more focused, and the scope should be enlarged to be more open to more sectors (e.g. waste

management, food, soil etc.) and cover value chains that have not been covered before, such as for example plant based proteins. More emphasis should also be put on the circularity and on the environmental sustainability aspect of the objectives, as well as on the socio-economic aspect including creation of jobs and growth especially in rural areas and remote and economically vulnerable regions. Some interviewees suggested to link the objectives with the SDGs and to take a more regional perspective in that regard.

Creating a market for the bio-based economy and bringing products to commercialization were objectives often suggested by many stakeholders coming from different categories. In that path, a higher focus on improving the competitiveness of the EU industry was mentioned.

According to the majority of the interviewees such objectives should be set and defined upfront, with a degree of flexibility, by the European Commission and the industry in a collaborative manner. A few stipulated to leave that role for the European Commission only or for the industry only. However, a lot of stakeholders suggested to involve more actors in the process such as primary producers, farmers, universities, member states, public and local authorities, regions, small cooperatives and SMEs. The importance of the role (consultative or full decision-making power) of each actor mentioned depended on the type of stakeholder category interviewed. Nonetheless, a point of agreement was found on having a balance between all actors in order to not have smaller actors eclipsed by the bigger ones. Such a balance was also mentioned when addressing the TRL levels that should be emphasized: some said that the initiative should not exclude any TRL levels and to have a balance of focus, when others said to focus mostly on higher TRL projects as they can bring impact much faster than the lower TRL project. On the other hand, others suggested to focus mostly on lower TRL levels in order to not impede innovation. Another suggestion was made on involving the public and the consumers and informing them better about the bio-based economy and the bio-based products. This consideration was generally linked to creating a market for bio-based products and related objectives.

Arguments regarding the different options varied greatly among the different stakeholder categories and can be exposed as such:

A CPP is considered lighter, more flexible and as giving more influence to the EC. However, as it is less dependent on industry contributions and not requiring legally binding commitment, it also might generate less engagement with stakeholders and make it more difficult to stimulate industry who consider that the EC has too much say. Moreover, some consider that CPP will not allow long-term projections and will not have balanced representation of various TRL in the overall project portfolio of the initiative.

A CFP is depicted as problematic since it does not envisage involvement of the private sector in the initiative. Nonetheless, member states would have more weight which is considered as benefiting for some but creates the drawback of focusing too much on academic topics of research, therefore not sufficiently promoting innovations close to market and reflect industry needs.

An IPP has been described as administratively more regulated and therefore less flexible in governance and other rules, difficult to steer and less inclusive/largely industry driven in the decision making on the content of the work programme. However, it is considered very efficient in structuring very diverse sectors around bio-based value chains and bio-economy, as well as being the best option to cross the valley of death, boost the bio-economy and bring products to the market. The IPP is said to generate a higher engagement and commitment of industry (however many mentioned that the rules about commitments should focus on project level contributions and rather than on the programme level in order to secure industries interest and commitment), allows collaboration with other sectors and serves as a bridge between private actors and the EC. This option has a long-term approach and gives the predictability needed.

Some participants also explained that changing the structure of the potential initiative would create negative impacts and would lose the impetus. A statement often expressed is to have an improved version of the BBI JU, isolated suggestions for a “hybrid model” that will have flexibilities of CPP and a strong back office/secretariat team from the IPP model.

Regarding the definition of the target groups, the panel agreed on having a flexibility on the coverage of the target groups while keeping a degree of stability to ensure the sufficient involvement of actors. However, the interviewees suggested to include more stakeholders of the bio-economy in the future initiative; therefore expressing a need to redefine the target group coverage. Groups that have been the most mentioned were SMEs, regional and local authorities, biomass producers and primary producers, members states, universities, academia, NGOs, citizens and consumers.

The majority of the interviewees expressed interest to have open calls instead of closed calls to ensure innovation and competitiveness. However, suggestions have been made to have more focused calls and have calls only for small size actors such as SMEs, who should also have a special status. Only a few suggested to have a priority in the calls for the members, which implies to have a differentiation between members and non-members. Some stakeholders also expressed the need to have earmarked funding for Eastern and Central Europe countries.

Regarding the engagement on research priorities, different views were expressed. A lot of the interviewees suggested to involve more actors such as SMEs, NGOs, universities and regional and local actors in the advisory board. Some suggested to have academia and industry leading the research priorities, others find it to be the role of the industry with the involvement of member states in order to align on national strategies. Others expressed an interest in including brand owners in the initiative, to get a close-to-market perspective and focus.

Regarding the different options for the future initiative, it has been expressed that CPP would be better suited for members states who would have a bigger influence, on the other hand CPP is depicted as not attractive for non-traditional bio-economy sectors who would not engage. However, IPP has been described as having more capacity to involve and represent more actors.

Roles and activities

An argument that has been expressed by a lot of interviewees was to have a common understanding of the initiative, to have a clear methodology and definitions set beforehand. However, a clear interest has been expressed toward keeping a certain flexibility in the definition of the role and activities of the initiative, while stability was also considered a necessity.

The role and activities were globally approved by the majority of the interviewees, nonetheless, updating the objectives and expanding the scope of the activities was a clearly requested. Activities were suggested to address new technologies in the annual work programme, promote technology transfer and dissemination, establish network and awareness raising activities, create more and more ambitious CSA and involve more in smaller entrepreneurial actions. Moreover, more administrative activities were suggested such as establishing a control mechanism and a follow-up board.

Regarding the different options for the future initiative, CPP has been described to have the potential to allow evolving objectives and activities, while the IPP has been considered as too rigid. However, the IPP generates more visibility and has a dedicated service for activities.

Leverage effect

The subject of the leverage effect has sparked a lot of different opinions and views. Among them an agreement has been found on the difficulties to generate in-cash contributions either from the big industries or from the smaller industries. For the big industries, it has been considered impossible and delusional to get them to contribute to a “common pot” without them knowing in advance what they will get in return for their contribution. It has been described as “paying for the competition”. Same perspective for the smaller actors but even more difficult as they often do not have the financial means. In-cash contributions have therefore been described as difficult. However, some expressed that in-cash was required from industries since the in-kind contribution is a way of circumventing co-financing. Others expressed that both contributions should be requested. Nonetheless, the commitment of industry was considered a necessity.

It has also been mentioned that the EC should be defining the requirements of contributions, and do it in advance. Moreover, some interviewees voiced that the commitment from companies depends on the commitment of the EC: the stronger the commitment of the EC, the stronger the commitment from companies. Another way considered to increase the leverage effect is to focus on high TRL projects, or on mid to later stages projects.

The IPP has been considered better placed to increase the leverage effect as it involves stable partners and has the potential to build momentum.

Coordination, structuring and mobilisation

It has been agreed among the panel that the coordination between across sector is important and required for the bio-based industry. It makes sense to mobilize and coordinate actors such as smaller stakeholders, SMEs, primary producers, regions, local authorities, member states, academia, end users, brand owners etc.

It has been mentioned that the IPP might be the best option to achieve the coordination, structuring and mobilisation objectives as this option is able to inform, mobilize primary sectors, create robustness of value chains and thus, generate cooperation across sectors. However, others stipulated that the coordination with academia should be done by Horizon Europe and not by the initiative. It has also been mentioned that the structuring effect needs cooperation with the policy level to be fostered. Added to that, since structures already exists within the current partnership, a continuation should be envisaged.

KPIs

Regarding the KPIs, a lot of suggestions have been made by the interviewees to include more and broader topics. First of all, it has been suggested to define the KPIs in advance and establish a more thorough definition, as the KPIs are sometimes too abstract and not easily translatable. In addition, clearer method to assess the KPIs has been requested. Then, a qualitative approach instead of a quantitative approach has been described as more suited for the KPIs.

Regarding the subjects in particular, among the suggestions made, one could find to better link the KPIs with the SDGs, to have KPIs related to climate, to sustainability, to regional participation, to jobs, growth etc. It has also been mentioned to link the KPIs with the number of flagships, with the products arriving on the market, with the commercialised technologies, with new value chains etc.

Costs and benefits

Regarding the costs and benefits, the CPP option has been described as cheaper and lighter than the IPP option. However, in the CPP the costs of development are deferred, so it might be that the costs of CPP and IPP will be the same when considering all costs. Moreover, it

appears that CPP is too subjective on contributions, which is not the case in the IPP. Indeed, as the commitment of industry is considered as required and crucial, it should be ensured through legally binding commitment. In addition, IPP appears to give the predictability needed, pairing with the opinion of a lot of interviewees stipulating that long-term funding is required for the initiative. In that regard, an issue pointed out was the lack of continuity, which led some interviewees to stipulate that follow up of investments is more important than financial contribution itself. Thus, a proper monitoring system has been suggested.

On the other hand, it has been advised to reduce bureaucracy, simplify reporting, achieve more with the same amount of contributions and creating a lighter structure of organization.

Need for Circular bio-based Europe

Regarding the timeframe of the EU partnership on Circular bio-based Europe, an agreement has been found among the panel for a long-term period, going from 7 to 10 years to sometimes as long as possible. Others suggested that it should match the financial framework, or to stop the initiative when it is not contributing to EU policy anymore.

A clear need towards the future initiative has been expressed by the majority of the interviewees. Without an initiative, investments in bio-based industry might happen outside the EU, therefore not ensuring EU's competitiveness. Moreover, the development of the industry might be much slower and the cooperation between different actors and sectors might not happen.

According to the panel, an initiative is needed to provide support, to encourage the intersectoral and value chain cooperation, to deliver EC's objectives, to promote social and sustainable ideas and support eco-innovation. In addition, the partnership is considered as having a facilitating role in the bio-based industry.

Research needs

Concerning the research needs and the process for setting priority research topics, different views have been expressed. The first view mentioned that the EC should be the main actor to set the agenda, a second view suggested to have the EC deciding in collaboration with industry. However, the role of the industry in this collaboration varied from a full collaboration to only being heard by the EC. A third view suggested to have the private sector to lead the research agenda and controlled by the university. Others said that there should be a balance between the actors, which led the interviewees to suggest involving more stakeholder in the process of setting up the research priorities such as primary producers, the EU13 countries, to engage more the SRG and the scientific committee.

In addition, the topics of the research priorities have been subject to some improvements to be closer to market, to focus on higher value products and commercialisation and on higher TRL projects. Nonetheless, it has been mentioned that the research agenda should come from the need to achieve environmental targets of the EC and address the societal challenges as well.

Contribution to EU policies

The future initiative might be contributing to the EU policy objectives by promoting and raising awareness about the bio-based industry, promoting existing standards or labels but also by de-risking investment and filling the funding gap in the industry. In that regard, the future initiative needs to accompany the industry and producers in promoting bio-based products. It might also accelerate the market uptake of solutions to contribute to the EU policy objectives by collaborating with and involving smaller stakeholders such as SMEs and consumers.

It has been recognised that policy had to change and that it is benefiting to have projects followed up by policies measures. It has been considered crucial to monitor how the future initiative will be contributing to EU policies objectives.

Regarding the options of the future initiative, an IPP is considered suited to promote and raise awareness, however it is less flexible and it has been mentioned that the EC has minor access to information. CPP has been considered easier by few interviewees.

Governance/organisation

Regarding the governance of the future initiative, a lot of new actors have been suggested to be involved. Member states, as a potential actor, have been sparking the most diverging opinions; some said to involve them, others were opposing their involvement since if they do not speak with one voice it would create confusion, others suggested to communicate with them instead of involving them closely. In addition, universities, academia and research institutes were mentioned to be included, as well as public services who should get a better representation. SMEs are also urged to be given a better representation and participation which might be best guaranteed by the IPP. It has been also advised to look at the possibilities for regions to participate.

Openness and flexibility, according the panel, should be secured for new key actors, member states, partners and target groups. For example, a flexibility for smaller actors in terms of time should be accorded. However, international actors were sometimes refused to get involve in the initiative.

Collaboration with other initiatives

Collaboration with other initiatives has been described as important but sometimes difficult. Collaboration might scale out synergies and might be optimising efforts through synergies, which is considered as important. Collaboration with national and regional levels has been suggested, however collaboration with international level sparked less enthusiasm as it is harder even if considered valuable since it can bring technologies from the outside to the EU.

Collaboration with NGOs, smaller developers, brands, agri business and citizens has been mentioned to have a role to play. Establishing links with other public and private partnership have been suggested to cover potential overlaps and collaboration with initiative like CAP, SPIRE and others have also been described to be beneficial.

Benefits of EU action

According to the panel, an EU initiative is needed for the bio-based industry since the industry is considered too young to develop by itself. In addition, the EU initiative have a structuring effect and is thus needed to drive and coordinates the multiples stakeholders. Among the arguments on the necessity to have an EU initiative could be found; bridging the valley of death, de-risking, advances on R&D, bringing incentives to go to the EU, ensuring EU's competitiveness etc.

In that regard, some have expressed the need for an IPP, while others said that CPP might be too light to ensure the objectives and overcome the potential barriers.

B.5 Open public consultation on the Candidate institutionalised European Partnerships

B.5.1 Approach to the open public consultation

The consultation was open to everyone via the EU Survey online system.¹¹⁷ The survey contained two main parts and an introductory identification section. The two main parts collected responses on general issues related to European partnerships (in Part 1) and specific responses related to 1 or more of the 12 candidate initiatives (as selected by a participant).

The survey contained open and closed questions. Closed questions were either multiple choice questions or matrix questions that offered a single choice per line, on a Likert-scale. Open questions were asked to clarify individual choices.

The survey was open from 11 September till 12 November 2019. The consultation was available in English, German and French. It was advertised widely through the European Commission's online channels as well as via various stakeholder organisations.

The analysis of the responses was conducted by applying descriptive statistic methods to the answers of the closed questions and text analysis techniques to the analysis of the answers of the open questions. The keyword diagrams in this report have been created by applying the following methodology: First, the open answer questions were translated into English. This was followed by cleaning of answers that did not contain relevant information, such as "NA", "None", "no comment", "not applicable", "nothing specific", "cannot think of any", etc. In a third step, common misspellings were corrected, such as "excellence" instead of "excellence", or "partnership" instead of "partnership". Then, then raw open answers were tokenised (i.e. split into words), tagged into parts of speech (i.e. categorised as a noun, adjective, preposition, etc.) and lemmatised (i.e. extraction of the root of each word) with a pre-trained annotation model in the English language. At this point, the second phase of manual data cleaning and correction of the automatic categorisation of words into parts of speech was performed. Finally, the frequency of appearance and co-occurrences of words and phrases were computed across the dataset and the different subsets (e.g. partnerships, stakeholder groups). Data visualisations were created based on that output.

The keyword graphs in the following sections have been built based on the relationships between words in the open responses of the survey participants. It features words that appear in the same answer either one after the other or with a maximum distance of two words between them. Each keyword is represented as a node and each co-occurrence of a pair of words is represented as a link. The size of the nodes and the thickness of the links vary according to the number of times that keywords are mentioned and their co-occurrence, respectively. In order to facilitate the visualisation of the network, the keyword graphs have been filtered to show the 50 most common co-occurrences. Although the keywords do not aim to substitute a qualitative analysis, they assist the identification of the most important topics covered in the answers and their most important connections with other topics, for later inspection in the set of raw qualitative answers.

¹¹⁷ <https://ec.europa.eu/eusurvey/runner/ConsultationPartnershipsHorizonEurope>

B.5.2 Overview of respondents to the open public consultation

Profile of respondents

In total, 1635 respondents filled in the questionnaire of the open public consultation. Among them, 272 respondents (16.64%) were identified to have responded to the consultation as part of a campaign (coordinated responses). Based on the Better Regulation Guidelines, the groups of respondents where at least 10 respondents provided coordinated answers were labelled as 'campaigns', segregated and analysed separately and from other responses. In total 11 campaigns were identified. In addition, 162 respondents in the consultation also display similarities in responses but in groups smaller than 10 respondents. Hence, these respondents were not labelled as campaigns and therefore were not analysed separately from the general analysis.

Among the 1635 respondents, 1178 (72.05%) completed the online consultation in English, 141 (8.62%) in German, 89 (5.44%) in French, 58 (3.55%) in Italian and 47 (2.87%) in Spanish, see Figure 8. Respondents that belong to the 11 campaigns follow the same pattern of language distribution, with English being the dominant language of respondents in that group. Table 17 shows that over 50% of respondents come from 4 Western and Southern European countries – Germany, Italy, France and Spain. Overall, the number of respondents from Eastern and Northern Europe is lower, while among non-EU countries the greater number of respondents come from Switzerland, Norway and Turkey, which are countries associated to the Framework Programme. In the group of respondents labelled as campaigns, most respondents are from Germany (48 respondents or 17.65%), France (39 respondents or 14.34%), Italy (37 respondents or 13.6%), Belgium (23 respondents or 8.46%), the Netherlands (21 respondents or 7.72%) and Spain (17 respondents or 6.25%). Hence, a similar pattern of country of origin is observed in the entire sample of respondents and for the campaigns.

Across all respondents 40.80% indicated to answer to the open public consultation in a public way (non-anonymous) and 20.67% of all respondents indicated their Transparency Register number.

Figure 8: Language of the consultation that selected respondents (N=1635) (non-campaign replies) Aggregation of responses of all candidate initiatives

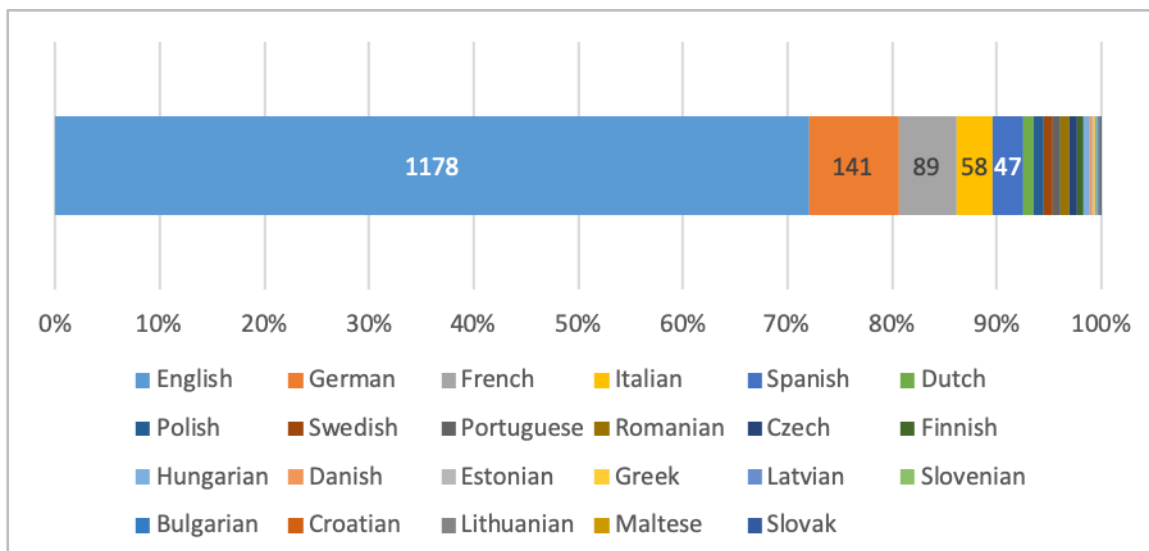


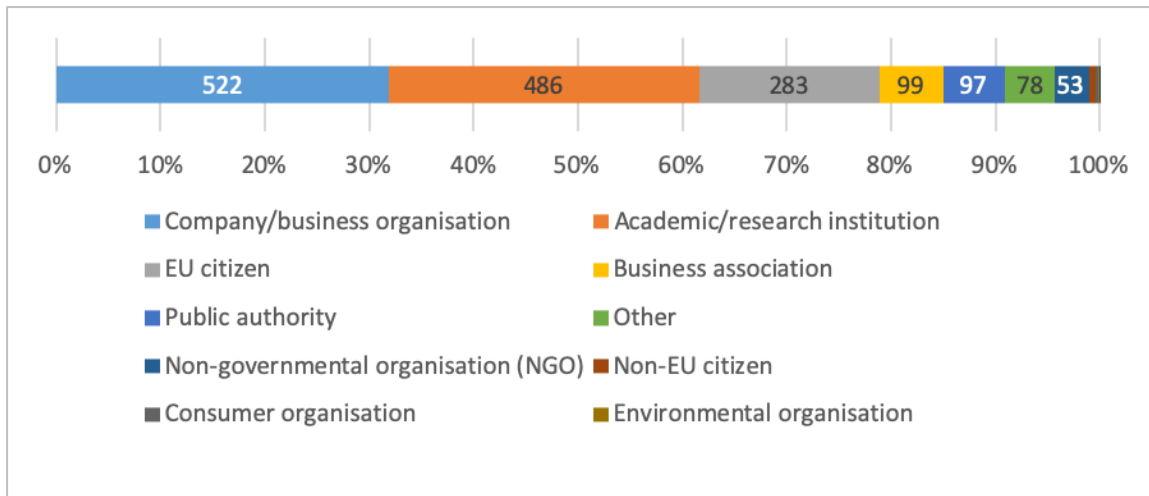
Table 17: Country of origin of respondents (N=1635)

| Country | Number of respondents | Percentage of respondents |
|--|-----------------------|---------------------------|
| Germany | 254 | 15.54% |
| Italy | 221 | 13.52% |
| France | 175 | 10.70% |
| Spain | 173 | 10.58% |
| Belgium | 140 | 8.56% |
| The Netherlands | 86 | 5.26% |
| Austria; United Kingdom | 61 | 3.73% |
| Finland | 49 | 3.00% |
| Sweden | 48 | 2.94% |
| Poland | 45 | 2.75% |
| Portugal | 32 | 1.96% |
| Switzerland | 28 | 1.71% |
| Czechia | 24 | 1.47% |
| Greece | 23 | 1.41% |
| Norway; Romania | 22 | 1.35% |
| Denmark | 20 | 1.22% |
| Turkey | 19 | 1.16% |
| Hungary | 14 | 0.86% |
| Ireland | 12 | 0.73% |
| United States | 11 | 0.67% |
| Estonia; Slovakia; Slovenia | 10 | 0.61% |
| Bulgaria; Latvia | 9 | 0.55% |
| Bosnia and Herzegovina | 7 | 0.43% |
| Lithuania | 4 | 0.24% |
| Canada; Croatia; Israel | 3 | 0.18% |
| China; Ghana; Iceland; Japan; Luxembourg; Morocco | 2 | 0.12% |
| Bhutan; Botswana; Cyprus; Iran; Malta; Mexico; Moldova; Mongolia; Palestine; Russia; Serbia; South Africa; Tunisia; Ukraine; Uruguay | 1 | 0.06% |

According to Figure 9, the three biggest groups of respondents are companies and business organisations (522 respondents or 31.93%), academic and research institutions (486 respondents or 29.72%) and EU citizens (283 respondents or 17.31%). Business associations, representing multiple businesses, were the fourth largest responding group (99 respondents or 6.05%), no other types of associations were presented amongst the selectable options for respondents. Among the group of respondents that are part of

campaigns, most respondents are provided by the same groups of stakeholders, namely companies and business organisations (121 respondents or 44.49%), academic and research institutions (54 respondents or 19.85%) and EU citizens (42 respondents or 15.44%).

Figure 9: Type of respondents (N=1635) (non-campaign replies) Aggregation of responses of all candidate initiatives



Respondents were asked to indicate the organisational size of the companies, organisations and institutions they work for. Based on Table 18, a greater number of respondents work in large companies and business organisations (295 respondents out of 522 or 56.51%) and large academic and research institutions (348 respondents out of 486 or 71.60%). A greater number of respondents that are employed by business associations and NGOs indicated an organisation size of 1 to 9 employees. Among the group of respondents that are marked as campaigns, a greater number of respondents work in large companies and business organisations (82 respondents out of 121 or 67.77%) and academic and research institutions (39 out of 54 respondents or 72.22%).

Table 18: Size of organisations that represent consultation respondents (N=1635)

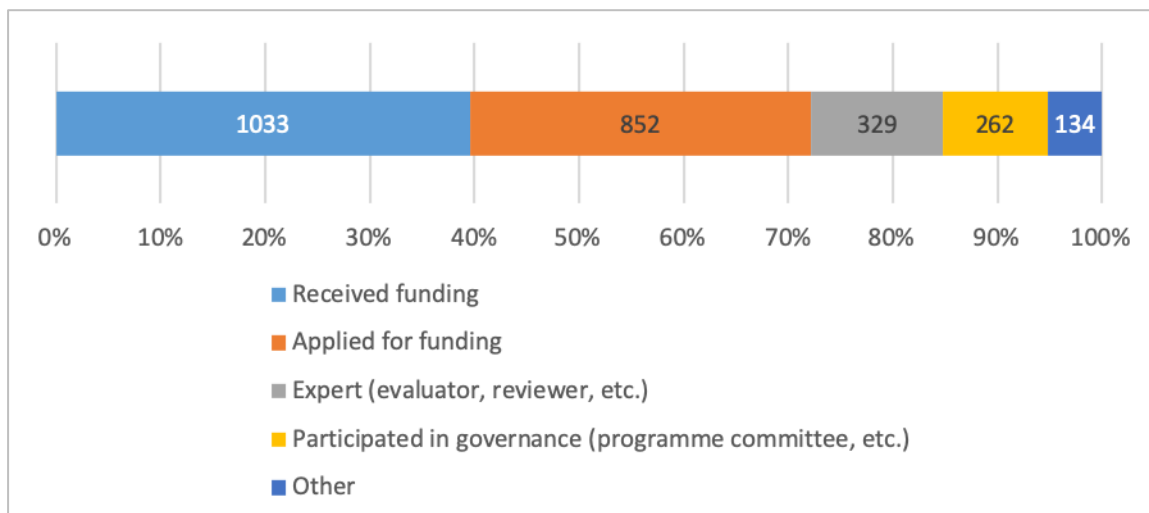
| Type of respondents' organisations | Organisation size | | | |
|-------------------------------------|-------------------------------|------------------------------|----------------------------|--------------------------|
| | Large (250 employees or more) | Medium (50 to 249 employees) | Small (10 to 49 employees) | Micro (1 to 9 employees) |
| Company/business organisation | 295 | 66 | 90 | 71 |
| Academic/research institution | 348 | 95 | 31 | 12 |
| Business association | 15 | 6 | 34 | 44 |
| Public authority | 58 | 33 | 6 | 0 |
| Non-governmental organisation (NGO) | 7 | 9 | 11 | 26 |
| Consumer organisation | 1 | 0 | 2 | 1 |
| Environmental organisation | 0 | 0 | 1 | 0 |
| Trade union | 0 | 0 | 1 | 0 |

| Type of respondents' organisations | Organisation size | | | |
|------------------------------------|-------------------------------|------------------------------|----------------------------|--------------------------|
| | Large (250 employees or more) | Medium (50 to 249 employees) | Small (10 to 49 employees) | Micro (1 to 9 employees) |
| Other | 24 | 16 | 19 | 19 |

Among all consultation respondents, 1303 (79.69%) have been involved in the on-going research and innovation framework programme Horizon 2020 or the preceding Framework Programme 7, while 332 respondents (20.31%) were not. In the group of campaign respondents, the share of those who were involved in these programmes is higher (245 respondents out of 272 or 90.07%) than in the group of non-campaign respondents (1058 out of 1363 or 77.62%). When respondents that participated in the Horizon2020 or in the preceding Framework Programme 7 were asked to indicate in which capacity they were involved in these programmes, the majority stated that they were a beneficiary (1033 respondents or 39.58%) or applicant (852 respondents or 32.64%).

The main stakeholder categories, e.g. companies/business organisation, academic/research institutions, etc., show a similar distribution across the capacities in which they 'have been involved in Horizon 2020 or in the Framework Programme 7' as the overall population of consultation respondents (see distribution in Figure 10). However, a few stakeholder categories have mainly been involved in the capacity of "Received funding" and/or "Applied for funding", this applies to business associations, NGOs and public authorities.

Figure 10: Capacity in which respondents were involved in Horizon 2020 or in the Framework Programme 7 (N=1303)(non-campaign replies) Aggregation of responses of all candidate initiatives, multiple options allowed



Among those who have been involved in the on-going research and innovation framework programme Horizon 2020 or the preceding Framework Programme 7, 1035 respondents (79.43%) are/were involved in a partnership. The share of respondents from campaigns that are/were involved in a partnership is higher than for non-campaign respondents, 89.80% versus 77.03% respectively. The list of partnerships under Horizon 2020 or its predecessor Framework Programme 7 together with the numbers, percentages of participants is presented in Table 19, the table also show the key stakeholder categories for each partnership.

Most consultation respondents participated in the following partnerships: Fuel Cells and Hydrogen 2 (FCH2) Joint Undertaking, Clean Sky 2 Joint Undertaking, European Metrology Programme for Innovation and Research (EMPIR) and in Bio-Based Industries Joint Undertaking. The comparison between the non-campaign and campaign groups of

respondents shows that the overall distribution is quite similar. However, there are some differences. For the campaign group almost a half of respondents is/was involved in the Fuel Cells and Hydrogen 2 (FCH2) Joint Undertaking, a higher share of campaign respondents is/was participating in Clean Sky 2 Joint Undertaking and in Single European Sky Air Traffic Management Research (SESAR) Joint Undertaking.

Table 19: Partnerships in which consultation respondents participated (N=1035)

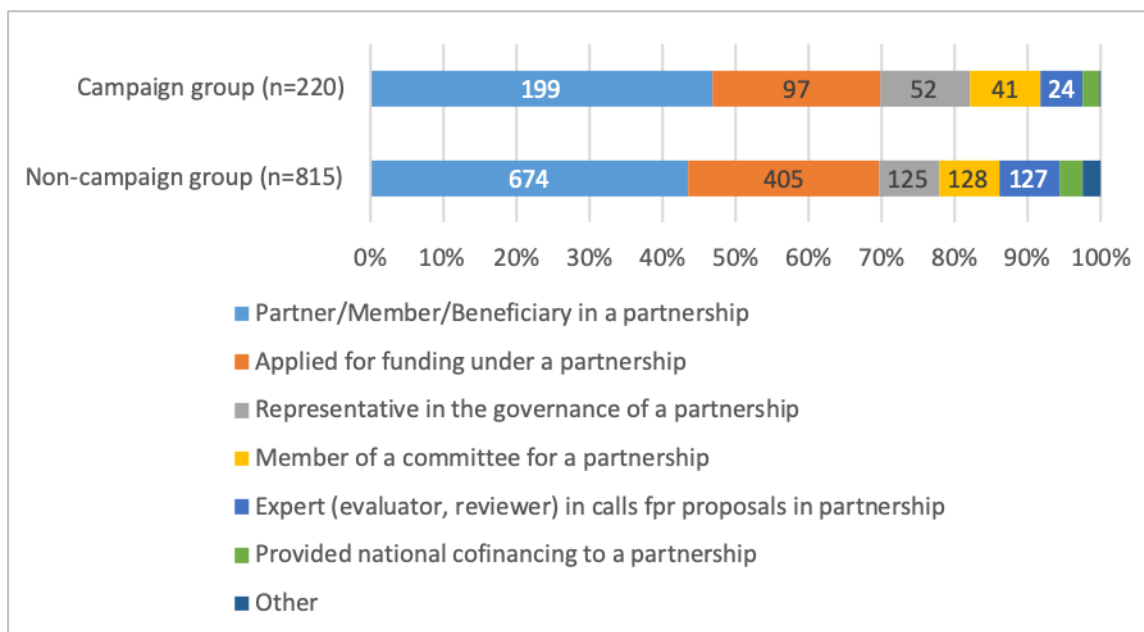
| Name of the partnership | Number and % of respondents from both groups (n=1035) | Number and % of respondents from a non-campaign group (n=815) | Academic/research institutions | Business associations | Company/business organisations | Company/business organisations | EU citizens | NGOs | Public authority |
|---|---|---|--------------------------------|-----------------------|--------------------------------|--------------------------------|-------------|------|------------------|
| Fuel Cells and Hydrogen 2 (FCH2) Joint Undertaking | 354 (33.33%) | 247 (30.31%) | 97 | 9 | 37 | 43 | 41 | 8 | 5 |
| Clean Sky 2 Joint Undertaking | 195 (18.84%) | 145 (17.79%) | 57 | 2 | 10 | 27 | 37 | 1 | 7 |
| European Metrology Programme for Innovation and Research (EMPIR) | 150 (14.49%) | 124 (15.21%) | 64 | 0 | 13 | 9 | 14 | 2 | 19 |
| Bio-Based Industries Joint Undertaking | 142 (13.72%) | 122 (14.97%) | 39 | 8 | 20 | 27 | 14 | 1 | 6 |
| Shift2Rail Joint Undertaking | 124 (11.98%) | 101 (12.40%) | 31 | 7 | 5 | 31 | 14 | 3 | 7 |
| Electronic Components and Systems for European Leadership (ECSEL) Joint Undertaking | 111 (10.72%) | 88 (10.80%) | 42 | 2 | 7 | 20 | 12 | 0 | 5 |
| Single European Sky Air Traffic Management Research (SESAR) Joint Undertaking | 66 (6.38%) | 46 (5.64%) | 10 | 3 | 3 | 20 | 3 | 2 | 3 |
| 5G (5G PPP) | 53 (5.12%) | 47 (5.77%) | 20 | 1 | 6 | 14 | 5 | 0 | 1 |
| Eurostrars-2 (supporting research-performing small and | 44 (4.25%) | 40 (4.91%) | 17 | 0 | 6 | 1 | 7 | 0 | 6 |

| Name of the partnership | Number and % of respondents from both groups (n=1035) | Number and % of respondents from a non-campaign group (n=815) | Academic/research institutions | Business associations | Company/business organisations | Company/business organisations | EU citizens | NGOs | Public authority |
|---|---|---|--------------------------------|-----------------------|--------------------------------|--------------------------------|-------------|------|------------------|
| medium-sized enterprises) | | | | | | | | | |
| Innovative Medicines Initiative 2 (IMI2) Joint Undertaking | 37 (3.57%) | 35 (4.29%) | 18 | 2 | 3 | 3 | 2 | 4 | 3 |
| Partnership for Research and Innovation in the Mediterranean Area (PRIMA) | 28 (2.71%) | 26 (3.19%) | 15 | 0 | 3 | 1 | 2 | 0 | 2 |
| European and Developing Countries Clinical Trials Partnership | 25 (2.42%) | 24 (2.94%) | 12 | 0 | 1 | 2 | 3 | 3 | 2 |
| Ambient Assisted Living (AAL 2) | 22 (2.13%) | 21 (2.58%) | 11 | 2 | 1 | 1 | 3 | 0 | 3 |
| European High-Performance Computing Joint Undertaking (EuroHPC) | 22 (2.13%) | 18 (2.21%) | 6 | 0 | 2 | 3 | 5 | 0 | 2 |

When respondents were asked in which role(s) they participate(d) in a partnership(s), over 40% indicated that they act(ed) as partner/member/beneficiary in a partnership (see, Figure 11). The second largest group of respondents stated that they applied for funding under a partnership. The roles selected by non-campaign and campaign respondents are similar.

The few respondents that selected "Other" as their role were provided with the opportunity to outline their role. A total of 25 people did provide description. The answers provided were very varied and could not be clustered in sub-groups, a few examples are: former communication and stakeholder relationship officer, chair of steering board, system engineer, grant manager, Joint Programming Initiative (JPI), or a role in advocacy of the partnership.

Figure 11: Role of respondents in a partnership (N=1035) (non-campaign replies) Aggregation of responses of all candidate initiatives



In the open public consultation respondents could provide their views on each of the candidate Institutionalised European Partnerships, and each respondent could select multiple partnerships to provide their views on. The table below presents the number and percentage of respondents for each partnership. It is visible that the majority of respondents (31.37%) provided their views on the Clean Hydrogen candidate partnership. More than 45% of respondents from the campaigns selected this partnership. Around 15% of all respondents provided their views for the candidate partnerships European Metrology, Clean Aviation and Circular bio-based Europe. The share of respondents in the campaign group that chose to provide views on the Clean Aviation candidate partnership is of 20%. The smallest number of respondents provided opinions on the candidate initiative 'EU-Africa research partnership on health security to tackle infectious diseases – Global Health'.

Table 20: Future partnerships for which consultation respondents provide responses (N=1613)

| Name of the candidate Institutionalised European partnership | Number and % of respondents from both groups (n=1613) | Number and % of respondents from a non-campaign group (n=1341) | Academic/research institutions | Business associations | Company/business organisations (<250) | Company/business organisations (250+) | EU citizens | NGOs | Public authority |
|--|---|--|--------------------------------|-----------------------|---------------------------------------|---------------------------------------|-------------|------|------------------|
| Clean Hydrogen | 506 (31.37%) | 382 (28.49%) | 123 | 21 | | 55 | 74 | 8 | 13 |
| European Metrology | 265 (16.43%) | 225 (16.78%) | 112 | 3 | 21 | 11 | 34 | 3 | 28 |
| Clean Aviation | 246 (15.25%) | 191 (14.24%) | 57 | 5 | 21 | 34 | 54 | 3 | 8 |
| Circular bio-based Europe: | 242 (15%) | 215 (16.03%) | 63 | 19 | 36 | 35 | 31 | 7 | 13 |

| Name of the candidate Institutionalised European partnership | Number and % of respondents from both groups (n=1613) | Number and % of respondents from a non-campaign group (n=1341) | Academic/research institutions | Business associations | Company/business organisations (<250) | Company/business organisations (250+) | EU citizens | NGOs | Public authority |
|---|---|--|--------------------------------|-----------------------|---------------------------------------|---------------------------------------|-------------|------|------------------|
| sustainable Innovation for new local value from waste and biomass | | | | | | | | | |
| Transforming Europe's rail system | 184 (11.41%) | 151 (11.26%) | 29 | 14 | 23 | 39 | 31 | 2 | 7 |
| Key Digital Technologies | 182 (11.28%) | 162 (12.08%) | 55 | 13 | 20 | 22 | 35 | 5 | 7 |
| Innovative SMEs | 111 (6.88%) | 110 (8.20%) | 19 | 12 | 39 | 4 | 14 | 4 | 10 |
| Innovative Health Initiative | 110 (6.82%) | 108 (8.05%) | 35 | 6 | 9 | 12 | 16 | 16 | 5 |
| Smart Networks and Services | 109 (6.76%) | 107 (7.98%) | 34 | 9 | 12 | 17 | 21 | 2 | 6 |
| Safe and Automated Road Transport | 108 (6.70%) | 102 (7.61%) | 25 | 12 | 11 | 19 | 10 | 3 | 9 |
| Integrated Air Traffic Management | 93 (5.77%) | 66 (4.92%) | 8 | 7 | 4 | 24 | 9 | 2 | 7 |
| EU-Africa research partnership on health security to tackle infectious diseases – Global Health | 49 (3.04%) | 47 (3.50%) | 15 | 2 | 4 | 3 | 12 | 6 | 4 |

Campaigns per candidate Institutionalised European Partnership

As was mentioned above, 11 campaigns were identified, the largest of them includes 57 respondents. The table below presents the campaigns that replied for each candidate partnership. As presented, the candidate Institutionalised Partnership Clean Hydrogen has the highest number of campaigns, namely 5. A few partnerships, such as Innovative SMEs, Smart Networks and Systems, were not targeted by campaigns. Some campaign respondents decided to provide opinions about several partnerships, therefore, campaign #2 and #6 feature in several partnerships.

Table 21: Overview of campaigns across partnerships

| Name of the candidate Institutionalised European partnership | Number of a campaign group (total number of respondents in a campaign) | Number of respondents that provided views about a partnership |
|---|--|---|
| Clean Hydrogen | Campaign #1 (57 respondents) | 57 respondents |
| | Campaign #2 (41 respondents) | 25 respondents |
| | Campaign #7 (18 respondents) | 18 respondents |
| | Campaign #9 (14 respondents) | 13 respondents |
| | Campaign #11 (10 respondents) | 9 respondents |
| Clean Aviation | Campaign #2 (41 respondents) | 17 respondents |
| | Campaign #6 (19 respondents) | 19 respondents |
| | Campaign #8 (14 respondents) | 13 respondents |
| Integrated Air Traffic Management | Campaign #2 (41 respondents) | 10 respondents |
| | Campaign #6 (19 respondents) | 12 respondents |
| European Metrology | Campaign #3 (36 respondents) | 35 respondents |
| Circular bio-based Europe: sustainable Innovation for new local value from waste and biomass | Campaign #5 (20 respondents) | 20 respondents |
| Transforming Europe's rail system | Campaign #4 (31 respondents) | 29 respondents |
| Key Digital Technologies | Campaign #10 (12 respondents) | 12 respondents |
| Innovative SMEs | - | - |
| Innovative Health Initiative | - | - |
| Smart Networks and Services | - | - |
| Safe and Automated Road Transport | - | - |
| EU-Africa research partnership on health security to tackle infectious diseases – Global Health | - | - |

B.5.3 Overall analysis of replies to the open public consultation at programme level

The following section of the report presents the analysis of responses at programme level, meaning all respondents (excluding campaigns) were included, independent of which candidate European Partnerships respondents selected to provide their views on. The results for responses as part of campaigns are presented separately.

Characteristics of future candidate European Partnerships

Respondents were asked to assess what areas, objectives, aspects need to be in the focus of the future European Partnerships under Horizon Europe and to what extent. According to Figure 12, a great number of respondents consider that a significant contribution by the future European Partnerships is 'fully needed' to achieve climate-related goals, to the development and effective deployment of technology and to EU global competitiveness in specific sectors/domains. Overall, respondents' views reflect that many aspects require attention of the Partnerships. The least attention should be paid to responding towards priorities of national, regional R&D strategies, including smart specialisation strategies, according to respondents.

Overall, only minor differences can be found between the main stakeholder categories. Academic/research institutions value the responsiveness towards EU policy objectives and focus on development and effective deployment of technology a little less than other respondents. Business associations, however, find that the future European Partnerships under Horizon Europe should focus a little bit more on the development and effective deployment of technology than other respondents. Furthermore, business associations, large companies as well as SMEs (companies with less than 250 employees) value role of the future European Partnerships for significant contributions to EU global competitiveness in specific sectors domains a little higher than other respondents. Finally, both NGOs and Public authorities put a little more emphasis on the role of the future European Partnerships for significant contributions to achieving the UN SDGs.

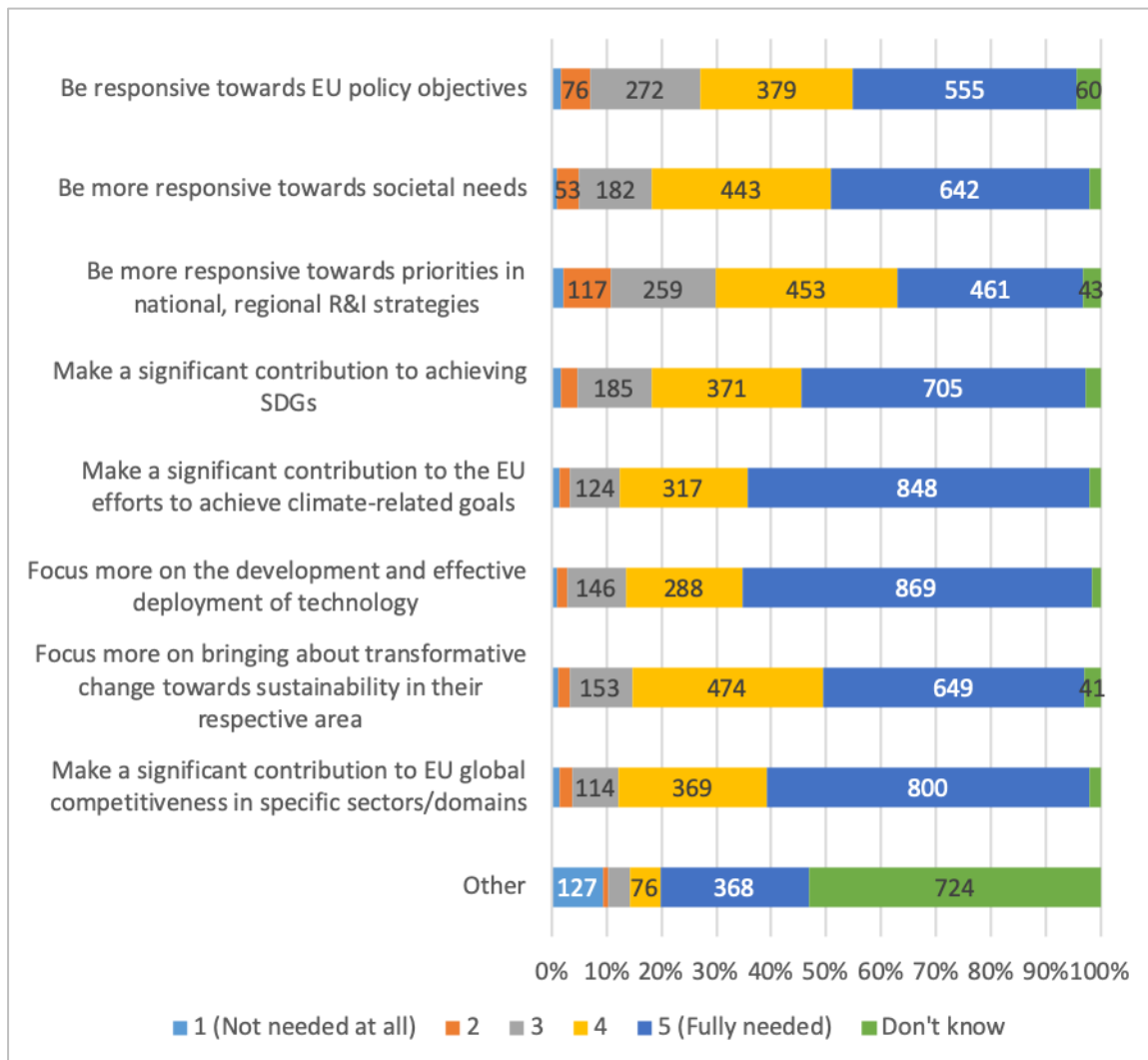
The views of citizens (249, or 18.27%), both EU and non-EU citizens, that participated in the open public consultation do not reflect significant differences with other types of respondents. However, respondents that are/were directly involved in a partnership under Horizon 2020 or its predecessor Framework Programme 7 assign a higher importance of the future European Partnerships to be more responsive towards EU policy objectives and to make a significant contribution to achieving the UN's Sustainable Development Goals.

Among 272 respondents that are classified as **campaigns**, the majority (86.76%) indicated that the future European Partnerships should focus more on the development and effective deployment of technology. Other categories of presented needs that received a high score among many campaign respondents are the need to make a significant contribution to the EU efforts to achieve climate-related goals, Sustainable Development Goals and to EU global competitiveness in specific sectors/domains. The least number of campaign respondents valued the need to be more responsive towards priorities in national, regional R&I strategies (54 respondents gave a score "5 Fully needed", or 19.85%) and to be more responsive towards societal needs (71 respondents gave a score "5 Fully needed", or 26.10%).

Similarly, as for non-campaign respondents, we find only minor differences between the main stakeholder categories amongst campaign respondents. Academic/research institutions indicated that the future European Partnerships need to focus a little less on development and effective deployment of technology than other respondents. On the contrary, large companies find the focus on the development and effective deployment of technology a little more needed than other respondents, as do public authorities. Furthermore, large companies feel responsiveness towards priorities in national, regional R&I strategies is a little less needed than other respondents. Public authorities, however,

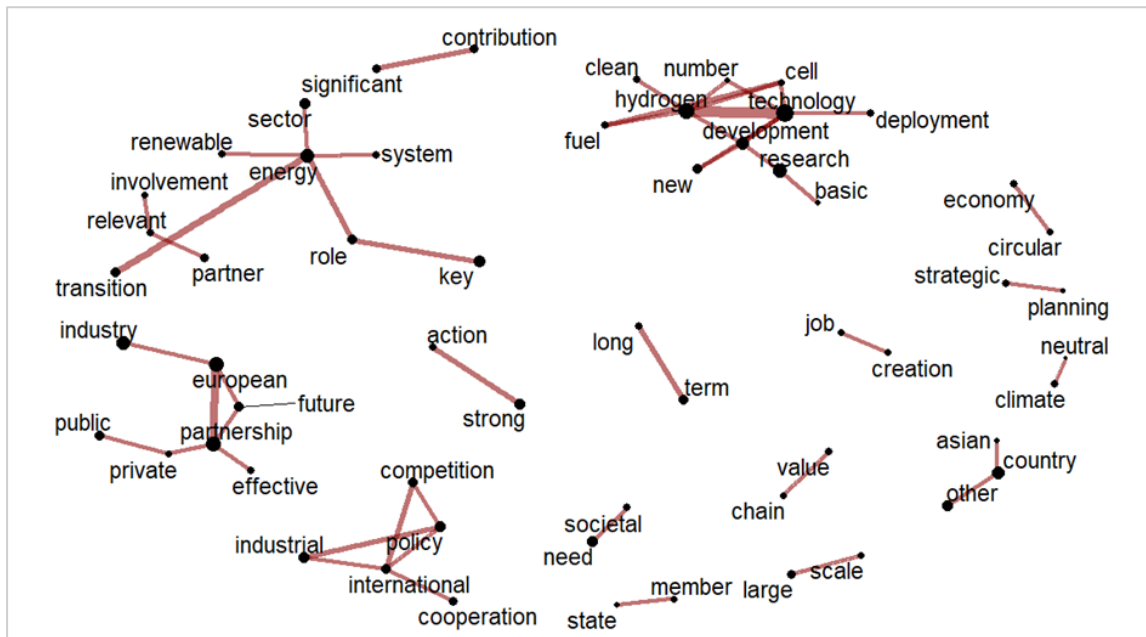
value the responsiveness towards societal needs and priorities in national, regional R&I strategies more than others.

Figure 12: To what extent do you think that the future European Partnerships under Horizon Europe need to (N=1363) (non-campaign replies) Aggregation of responses of all candidate initiatives



The analysis of the open answers provided to explain the “Other” field show that many respondents included the set-up of public-private European partnerships and the link between industrial policy and international competition and cooperation (see Figure 13). This is confirmed through qualitative analysis of answers, many of which mention the importance of collaboration and integration of relevant stakeholders to tackle main societal challenges and to contribute to policy goals. Against this backdrop, fragmentation of funding and research efforts across Europe should be avoided. Additionally, several respondents suggested that faster development and testing of technologies, acceleration of industrial innovation projects, science transfer and market uptake are deemed as priorities. Next to that, many respondents provided answers related to the fields of hydrogen and the energy transition, which corresponds to the high number of respondents that provided answers to the candidate European Partnership specific questions related to these topics.

Figure 13 Assessment of needs, open answers to "Other" field, 50 most common co-occurring keywords (N=734) (non-campaign replies) Aggregation of responses of all candidate initiatives



Many of the respondents that are classified as campaigns took the opportunity of the "Other" field to underline their key messages. The main aspects mentioned were:

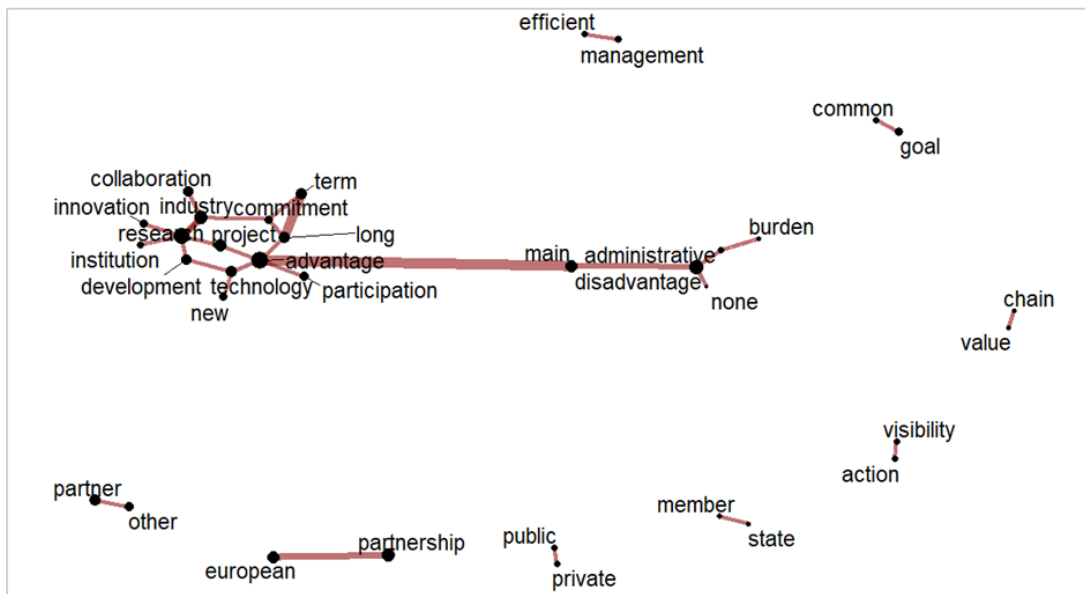
- The global positioning of Europe: outlining the role of global competition (including the role of technology), the importance of autonomy for Europe and the ability of Europe to act as a key player at the global level.
- The balance between policy objectives and private sector interests: Partnerships are regarded as an instrument to secure industry commitments due to the stability required for investments that serve policy goals.
- The importance of the transition between research and innovation (implementing research results in the market).
- The importance of multidisciplinary, and specifically cross-sectoral/cross-partnership collaboration.
- The importance of the long-term commitment of a wide range of relevant stakeholders.

Next to that many respondents as part of campaigns stressed the importance of the energy transition, hydrogen and the environment, which corresponds to the high number of respondents that provided answers to the candidate European Partnership specific questions related to these topics.

Main advantages and disadvantages of Institutionalised European Partnerships

In the next question, respondents were asked to outline the main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe. This was an open question for which a keyword analysis was used (see the main results in Figure 14). As can be observed, the advantages mentioned focus on the development of technology, overall collaboration between industry and research institutions, and the long-term commitment. Disadvantages mentioned are mainly administrative burdens.

Figure 14: What would you see as main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe? (non-campaign replies) Aggregation of responses of all candidate initiatives, 30 most common co-occurring keywords (N=1551)



When asked about the main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe, the following points were mentioned by respondents that are classified as campaigns:

Advantages:

- Long term commitment, stability, and visibility in financial, legal, and strategic terms
- Participation of wide range of relevant stakeholders in an ecosystem (large/small business, academics, researchers, experts, etc.)
- Complementarity with other (policy) initiatives at all levels EU, national, regional
- Efficient and effective coordination and management
- High leverage of (public) funds
- Some innovative field require high levels of international coordination/standardisation (at EU/global level)
- Ability to scale up technology (in terms of TRL) through collaboration
- Networking between members
- Direct communication with EU and national authorities

Disadvantages:

- Slow processes
- System complexity
- Continuous openness to new players should be better supported as new participants often bring in new ideas/technologies that are important for innovation
- Lower funding percentage compared to regular Horizon Europe projects
- Cash contributions
- Administrative burdens

- Potential for IPR constraints

Relevance of EU level efforts to address problems in selected areas of Partnerships

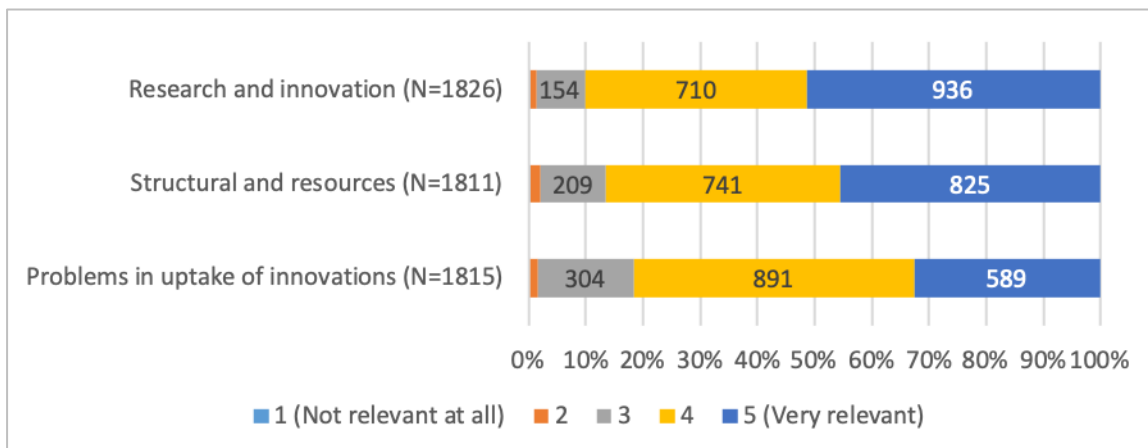
Per candidate European Partnership respondents were asked to rate the relevance of partnership specific problems in three main areas: Research and innovation problems, Structural and resource problems and Problems in the uptake of innovations. To aggregate results the average of the responses on partnership specific problems were calculated.

As presented in Figure 15, research and innovation related problems were rated as most relevant by the respondents across all candidate initiatives, followed by structural and resources problems and problems in the uptake of innovations. Overall, all three areas were deemed (very) relevant across the partnerships, as more than 80% of respondents found these challenges (very) relevant.

Only minor differences were found between the main stakeholder categories of respondents. Research and innovation problems were found slightly more relevant by academic/research institutions, yet slight less relevant by large companies and SMEs. Structural and resource problems were indicated as slightly more relevant by NGOs, but slightly less by academic/research institutions. While both NGOs and public authorities find it slightly more relevant to address problems in uptake of innovation than other respondents.

The views of citizens, both EU and non-EU citizens, are the same as other respondents (no significant differences). Respondents that are/were directly involved in a current/preceding partnership (Horizon 2020 or Framework Programme 7) find, however, the uptake of innovation problems slightly more relevant than other respondents.

Figure 15: To what extent do you think this is relevant for research and innovation efforts at EU level to address the following problems in relation to the candidate partnership in question? (non-campaign replies) Aggregation of responses of all candidate initiatives

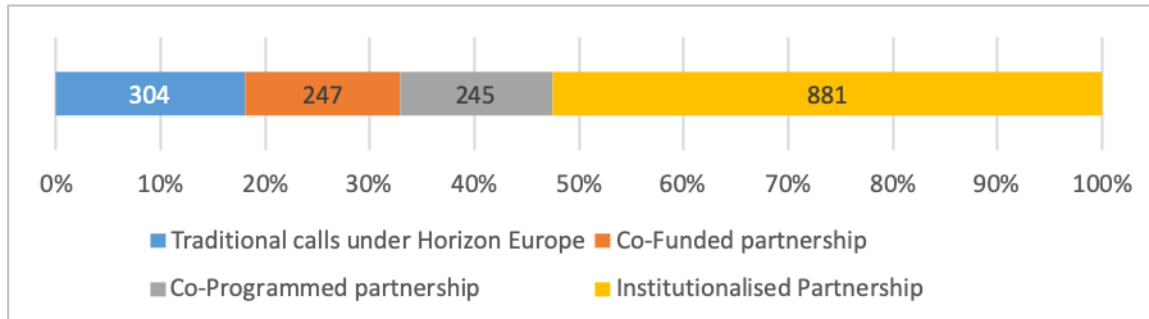


Horizon Europe mode of intervention to address problems

After providing their views on the relevance of problems, respondents were asked to indicate how these challenges could be addressed through Horizon Europe intervention. As shown in Figure 16, just over 50% of all respondents indicated that institutionalised partnerships were the best fitting intervention, however, relatively strong differences between stakeholder categories were found. The intervention of institutionalised partnerships was indicated more by business associations and large companies, but less by academic/research institutions and SMEs. While academic/research institutions valued traditional calls more often, this was not the case for business associations, large companies and public authorities. Public authorities indicated a co-programmed intervention more often than other respondents. Citizens, compared to other respondents,

indicated slightly less often that institutionalised partnerships were the best fitting intervention. Respondents that are/were directly involved in a current/preceding partnership, however, selected the institutionalised partnership intervention in far higher numbers (nearly 70%).

Figure 16: In your view, how should the specific challenges described above be addressed through Horizon Europe intervention? (non-campaign replies) Aggregation of responses of all candidate initiatives



When asked to reflect on their answers, respondents that pointed to the need for using the “institutionalised partnership” intervention mentioned the long-term commitment of collaboration, a common and ambitious R&I strategy as well as the overall collaboration between industry and research institutions. Respondents that referred to possible approaches, sometimes gave examples of good experiences in with other interventions:

- Traditional calls because of their flexibility and integration of a wide range of actors, as long as the evaluation panels do not deviate from the policy premier. This was mentioned by 94 participants, evenly distributed across companies (25 of them), academics (26) and EU citizens (25).
- Co-funded partnership, as a mechanism to ensure that all participants take the effort seriously, while allowing business partnerships to develop. This approach was deemed suitable based on previous experiences with ERANETs. This was raised by 84 participants, 36 of them academic respondents, 18 companies and 16 EU citizens.
- Co-programmed partnerships to tackle the need to promote and engage more intensively with the private sector. This was mentioned by 97 participants, most of them companies (34), followed by academics (22), business associations (15) and EU citizens (11).

Relevance of a set of elements and activities to ensure that the proposed European Partnership would meet its objectives

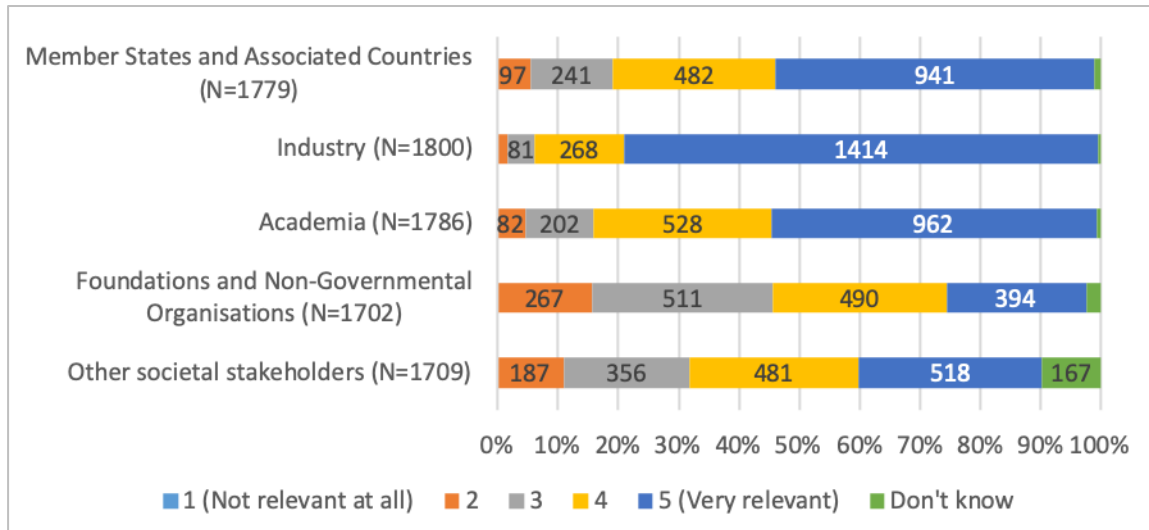
Setting joint long-term agendas

Respondents were asked how relevant it is for the proposed European Partnerships to meet their objectives to have a strong involvement of specific stakeholder groups in setting joint long-term agenda. As presented in Figure 17, collectively all respondents see stakeholders from industry as the most relevant, followed by academia and governments (Member States and Associated Countries). The involvement of foundations and NGOs as well as other societal stakeholders were, however, still found to be (very) relevant by more than 50% of the respondents.

When looking at the differences between the answers of the main stakeholder categories only minor differences could be found. Overall, it could be observed that most respondents indicated the stakeholder group they belong to themselves or that represent them as relevant to involve. Academic/research institutions find it more relevant to involve academia and less relevant to involve industry when compared to other respondents. The other way around large companies, SMEs and business associations find it more relevant to involve industry and less relevant to involve academia, Member States and Associated

Countries and NGOs. The involvement of Member States and Associated Countries was found more relevant by academic/research institutions and public authorities. NGOs also values their own involvement and those of other societal stakeholders more than other respondents. The views of citizens also show a slightly higher relevance for foundations and NGOs. This is less so the case for respondents that are/were directly involved in a current/preceding partnership (most predominantly companies and academia).

Figure 17: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives - Setting joint long-term agenda with strong involvement of: (non-campaign replies)
Aggregation of responses of all candidate initiatives

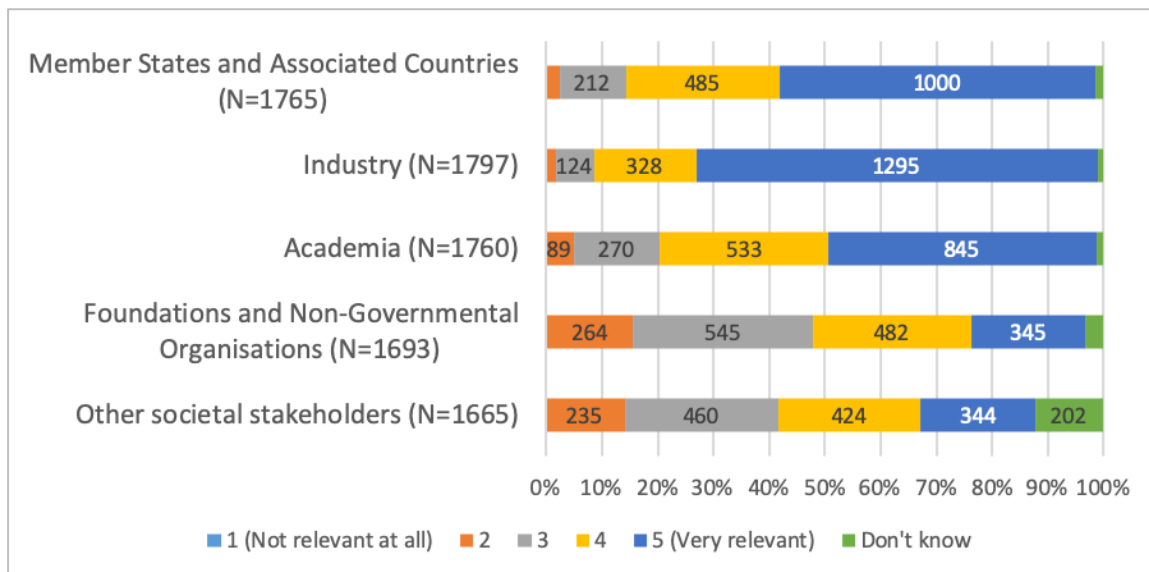


Pooling and leveraging resources through coordination, alignment and integration with stakeholders

Respondents were also asked how relevant it is for the proposed European Partnership to meet its objectives to pool and leverage resources (financial, infrastructure, in-kind expertise, etc.) through coordination, alignment and integration with specific groups of stakeholders. As shown in Figure 18 - similarly as for the previous questions-, respondents also see stakeholders from industry as the most relevant, followed by academia and governments (Member States and Associated Countries). The involvement of foundations and NGOs as well as other societal stakeholders are also still found to be (very) relevant for more than 50% of the respondents.

Similarly as described for the question on setting joint long-term agendas, most stakeholder categories valued their own involvement higher than other respondents – although also here differences between stakeholder categories were minor. As such, academic/research institutions see the relevance of academia higher, while large companies, SMEs and business association indicated a lower relevance of academia than other respondents. Similarly, these private sector stakeholders valued the relevance of industry higher than others while valuing the relevance of NGOs and other societal stakeholders less. NGOs value themselves and other societal stakeholders however higher than other respondents, and also public authorities indicated a higher relevance for Member States and Associated Countries than other respondents. Citizens mainly put more emphasis on the role of NGOs and other societal stakeholders than other respondents.

Figure 18: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Pooling and leveraging resources (financial, infrastructure, in-kind expertise, etc.) through coordination, alignment and integration with: (non-campaign replies) Aggregation of responses of all candidate initiatives

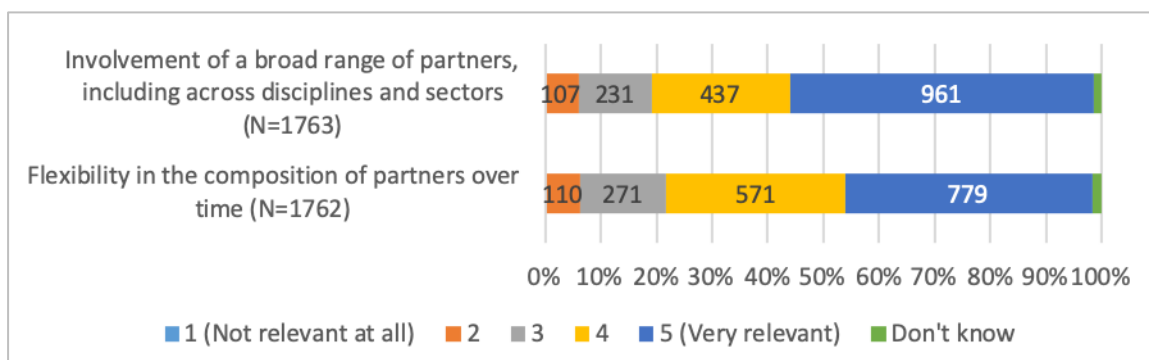


Composition of the partnerships

Regarding the composition of the partnership most respondents indicated that for the proposed European Partnership to meet its objectives the composition of partners needs to be flexible over time and that a broad range of partners, including across disciplines and sectors, should be involved (see Figure 19).

When comparing stakeholder groups only minor differences were found. Academic/research institutions and public authorities found the involvement of a broad range of partners and flexibility in the composition of partners over time slightly more relevant than other respondents, while large companies found both less relevant. SMEs mainly found the flexibility in the composition of partners over time less relevant than other respondents, while no significant differences were found regarding the involvement of a broad range of partners. Citizens provided a similar response to non-citizens. Respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, indicated a slightly lower relevance of the involvement of a broad range of partners and flexibility in the composition of partners over time.

Figure 19: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Partnership composition (non-campaign replies) Aggregation of responses of all candidate initiatives

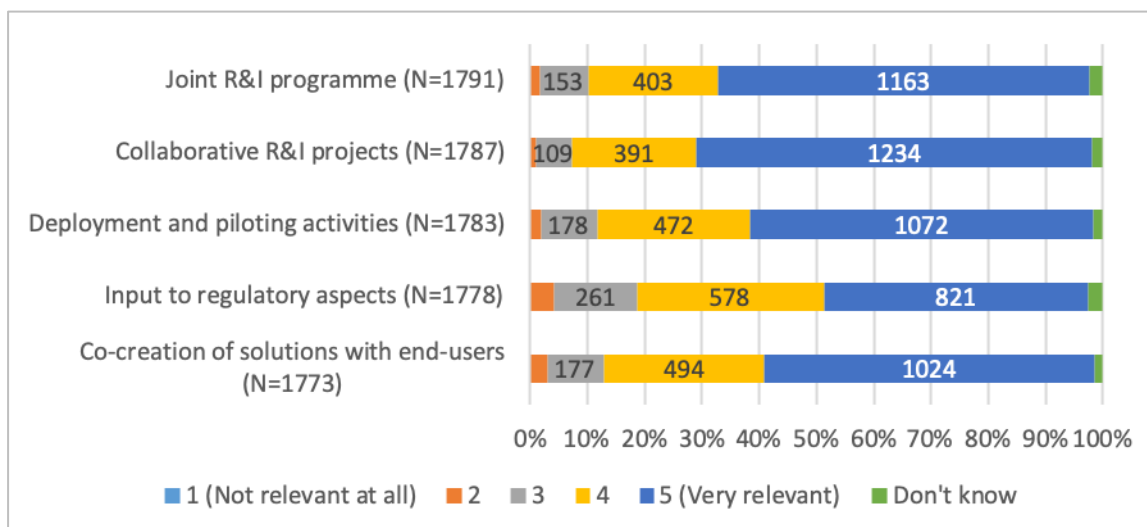


Implementation of activities

Most respondents indicated that implementing activities like a joint R&I programme, collaborative R&I projects, deployment and piloting activities, providing input to regulatory aspects and the co-creation of solutions with end-users are all (very) relevant for the partnerships to be able to meet its objectives (see Figure 20).

Minor differences were found between the main stakeholder categories, the differences found were in line with their profile. As such, academic/research institutions found joint R&I programme & collaborative R&I projects slightly more relevant and deployment and piloting activities, input to regulatory aspects and co-creation with end-users slightly less relevant than other respondents. For SMEs an opposite pattern is shown. Large companies, however, also found collaborative R&I projects slightly more relevant than other respondents, as well as input to regulatory aspects. The views of citizens are similar to non-citizens. Respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, show a slightly higher relevance across all activities shown in Figure 20.

Figure 20: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Implementing the following activities (non-campaign replies) Aggregation of responses of all candidate initiatives



Relevance of setting up a legal structure (funding body) for the candidate European Partnerships to achieve improvements

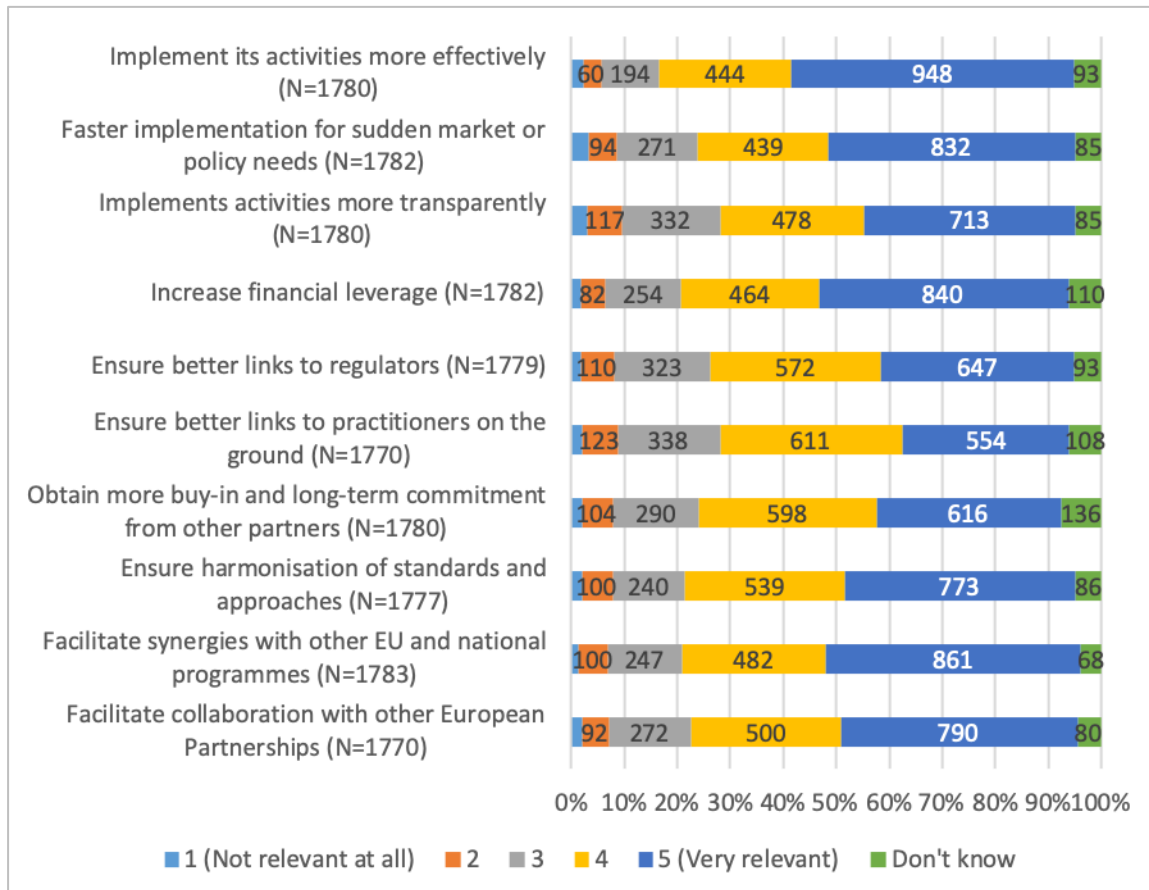
Respondents were then asked to reflect on the relevance of setting up a legal structure (funding body) for achieving a set of improvements, as presented in Figure 21. In general, 70%-80% of respondents find a legal structure (very) relevant for these activities. The legal structure was found most relevant for implementing activities in a more effective way and least relevant for ensuring a better link to practitioners on the ground, however differences are small.

When comparing the main stakeholder categories we found minor differences. Academic/research institutions indicated a slightly lower relevance for transparency, better links to regulators as well as obtaining the buy-in and long-term commitment of other partners. SMEs also indicated a lower relevance regarding obtaining the buy-in and long-term commitment of other partners. Large companies showed a slightly higher relevance for implementing activities effectively, ensure better links to regulators, obtaining the buy-in and long-term commitment of other partners, synergies with other EU/MS programmes and collaboration with other EU partnerships than other open consultation respondents. NGOs find it slightly more relevant to implement activities faster for sudden market or

policy needs. Public authorities, however, find it slightly less relevant to facilitate collaboration with other European Partnerships than other respondents.

The views of citizens show a slightly lower relevance for a legal structure in relation to implementing activities in an effective way. Quite different results are shown for respondents that are/were directly involved in a current/preceding partnership when compared to respondents not involved in a current/preceding partnership, they indicated a higher relevance across all elements presented in Figure 21.

Figure 21: In your view, how relevant is to set up a specific legal structure (funding body) for the candidate European Partnership to achieve the following? (non-campaign replies) Aggregation of responses of all candidate initiatives



Scope and coverage of the candidate European Partnerships based on their inception impact assessments

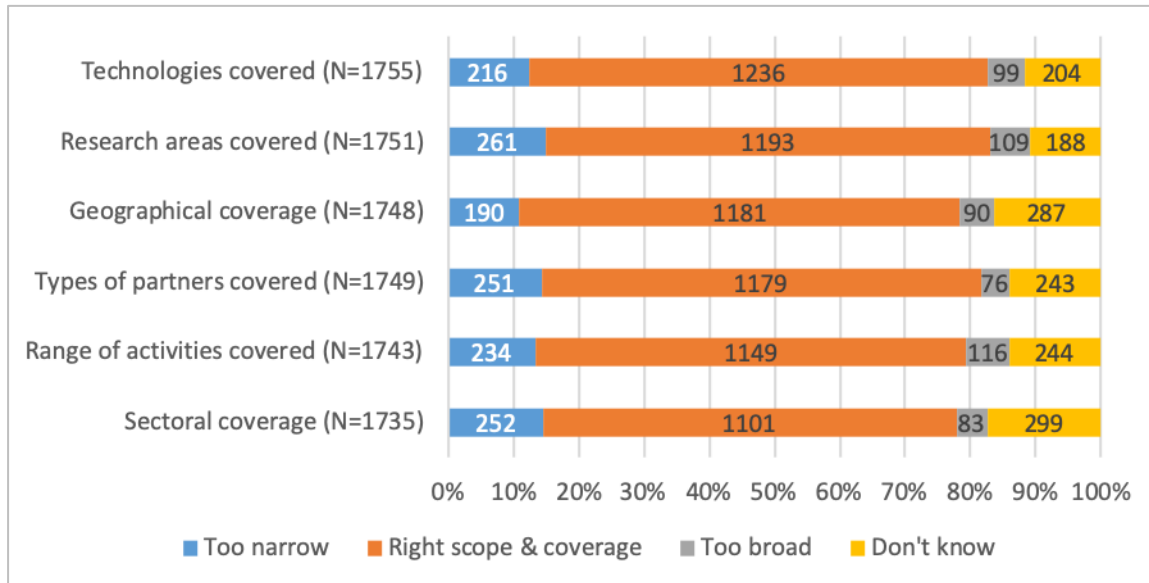
The response regarding the scope and coverage for the partnerships, based on inception impact assessments, shows that the large majority feels like the scope and coverage initially proposed in the inception impact assessments is correct. Figure 22 shows the results. However, about 11% to 15% of the respondents indicated the scope and coverage to be too narrow. About 11%-17% of respondents answered "Don't know". In the open answers respondents mostly reflected on specific aspects of the geographical and sectoral scope and coverage of the specific candidate European Partnerships, no overall lessons could be extracted.

Overall, differences between the main stakeholder categories were found to be minor. Academic/research institutions indicated slightly more often that the research area was "too narrow" than other respondents. SMEs on the other hand indicated slightly more often that the research area and the geographical coverage were "too broad". NGOs and public authorities, however, found the geographical coverage slightly more often "too narrow" when compared to other respondents. Large companies found the range of activities

slightly more often “too broad” and the sectoral focus slightly more often “too narrow” when compared to other respondents.

The views of citizens are the same as for other respondents. Most notably, respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, more often indicated that the candidate institutionalised European Partnership have the “right scope & coverage”.

Figure 22: What is your view on the scope and coverage proposed for this candidate institutionalised European Partnership, based on its inception impact assessment? (non-campaign replies) Aggregation of responses of all candidate initiatives



Scope for rationalisation and alignment of candidate European Partnerships with other initiatives

When asked whether it would be possible to rationalise a specific candidate European Institutionalised Partnership and its activities, and/or to better link with other comparable initiatives, nearly two thirds of respondents answered “Yes” (1000, or 62.15%), while over one third answered “No” (609, or 37.85%). Nearly no differences were found between the main stakeholder categories, only large companies and SMEs indicated slightly more often “Yes” in comparison to other respondents.

The views of citizens are the same as for other respondents. Respondents that are/were directly involved in a current/preceding partnership, indicated “No” more often, the balance is about 50/50 between “Yes” and “No” for this group.

In the open responses respondents often referred to specific similar/comparable and complementary initiatives discussing the link with a specific candidate European Partnership, no overall lessons could be extracted, but more detailed results can be found in the partnership specific result sections.

Relevance of European Partnerships to deliver targeted scientific, economic/technological and societal impacts

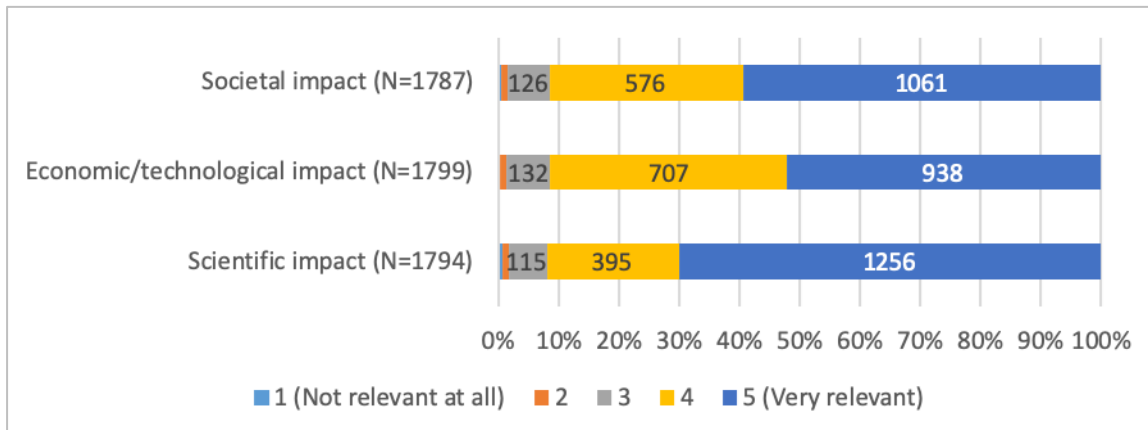
Finally, respondents were asked to rate the relevance of partnership specific impacts in three main areas: Societal impacts, Economic/technological impacts and Scientific impacts. To aggregate results the average of the responses on partnership specific impacts were calculated.

As presented in Figure 23, overall, all three areas were deemed (very) relevant across the candidate partnerships. Scientific impact was indicated as the most relevant impact, more than 90% of respondents indicated that these impacts were (very) relevant.

Only minor difference between stakeholder groups were found. Academic/research institutions found scientific impacts slightly more relevant, while large companies found economic and technological impacts slightly more relevant than other respondents. NGOs found societal impact slightly more relevant, while SMEs found this slightly less important.

Citizens, both EU and non-EU citizens, did not a significantly different view when compared to other respondents. Respondents that are/were directly involved in a current/preceding partnership find all impacts slightly more relevant than other respondents.

Figure 23: In your view, how relevant is it for the candidate European Institutionalised Partnership to deliver on the following impacts? (non-campaign replies) Aggregation of responses of all candidate initiatives



B.6 Responses to the open public consultation for the candidate partnership "Circular Biobased Europe"

B.6.1 Introduction

This section outlines the results of the Open Public Consultation for the candidate European Partnership on Circular bio-based Europe: sustainable innovation for new local value from waste and biomass. The section outlines the following:

- Results on general questions, segregated for this candidate European Partnership:
 - Views on the needs of the future European Partnerships under Horizon Europe
 - Views on the advantages and disadvantages of participation in an Institutionalised European Partnership
- Results on specific questions for this candidate European Partnership:
 - Relevance of research and innovation efforts at the EU level to address problems
 - Views on Horizon Europe interventions to address these problems
 - Views on the relevance of elements and activities in: setting a joint long-term agenda; pooling and leveraging resources; partnership composition; implementation of activities.
 - Views on setting up a specific legal structure (funding body)
 - Views on the proposed scope and coverage of this candidate European Partnership
 - Views on the alignment of the European Partnership with other initiatives
 - Relevance of this candidate European Partnership to deliver impacts

B.6.2 Characteristics of respondents

There are 215 respondents who have answered (part of) the consultation for the candidate Circular Bio-based Europe Partnership. Of these respondents, 31 (14.42%) were citizens. The largest group of respondents were businesses with 71 respondents (33.02%), closely followed by academic and research institutions with 63 respondents (29.03%). The other respondents were representatives from business associations (19, 8.84%), of public

authorities (13, 6.04%), non-governmental organisations (7, 3.25%) or other (10, 4.65%). There was one respondent from a Trade Union.

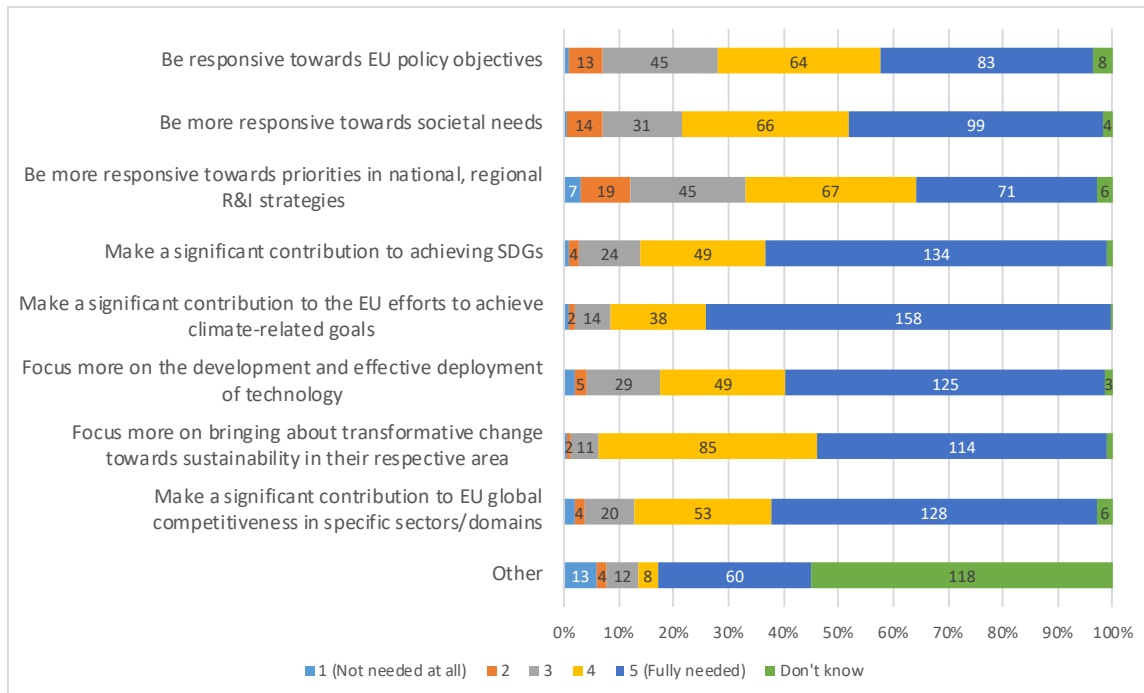
Over two-thirds of respondents, namely 165 (76.74%), have been involved in the on-going research and innovation Framework Programme, of which 132 respondents (80.00%) were directly involved in a partnership under Horizon 2020 or its predecessor Framework Programme 7.

B.6.3 Characteristics of future candidate European Partnerships – as viewed by respondents to the Circular Biobased Europe initiative

At the beginning of the consultation, the respondents were asked to indicate their views of the **needs** of the future European Partnerships under Horizon Europe. All 212 respondents expressing views on the Circular Biobased Europe Initiative answered this question. Overall, a large part of the respondents indicated that many of these needs were 'fully needed'. The option where most respondents gave this answer is to make a significant contribution to the EU efforts to achieve climate-related goals (158, 73.49%). Aside from 'other', the need where the least amount of respondents indicated that improvements were 'fully needed' is being more responsive towards priorities in national and/or regional R&I strategies (71, 33.02%).

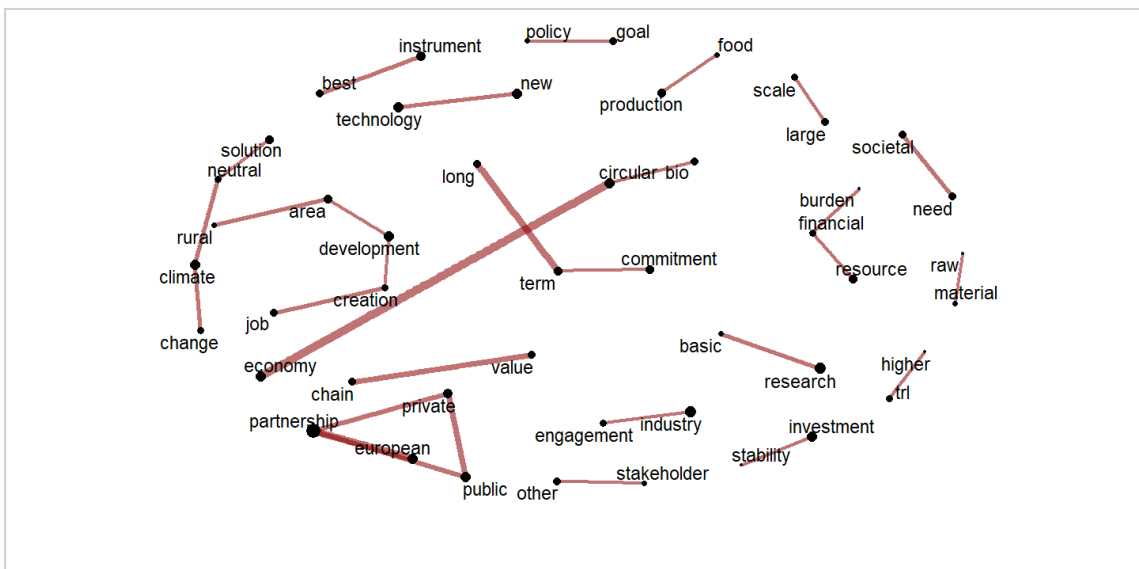
No statistical differences were found between the views of citizens and other respondents for most of the needs. Citizens found the responsiveness towards societal needs of higher relevance, and the development and effective deployment of technology less relevant. Academic/research institutions found the responsiveness towards societal needs, to achieving the UN SDGs, to achieve climate-related goals, the development and effective deployment of technology, sustainability, EU global competitiveness of high relevance and policy objectives and priorities in national and regional R&I strategies less relevant. Business associations and businesses (250+) indicate contribution to achieving the UN SDGs, achieving climate-related goals, the development and effective deployment of technology, change towards sustainability and contribution to EU global competitiveness as a 'highly relevant' and 'relevant' needs. SMEs most strongly agree with needs on contribution to achieving the UN SDGs, to achieve climate-related goals, the development and effective deployment of technology, transformative change towards sustainability and a contribution to EU global competitiveness. However, the needs towards priorities in national and regional R&I strategies are the least relevant for SMEs. NGOs and public authorities think that future European Partnerships under Horizon Europe need to be focused on a significant contribution to achieving the UN SDGs, climate-related goals, the development and effective deployment of technology and towards sustainability.

Figure 24: To what extent do you think that the future European Partnerships under Horizon Europe need to...? Respondents for the candidate initiative Circular Bio-based Europe (N=212)



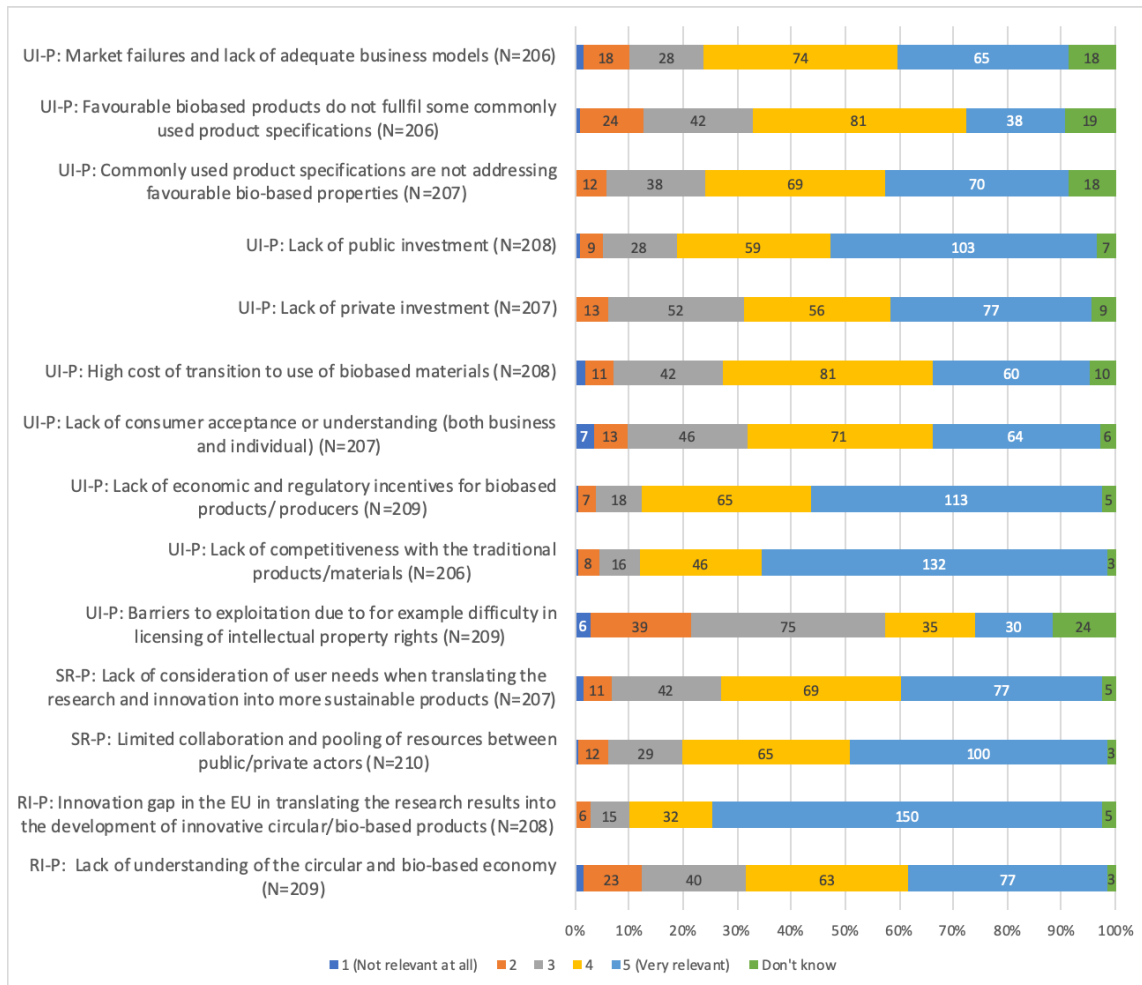
The respondents also had the option to indicate other needs. The results of the analysis resulted in the chart shown in Figure 25 showing the co-occurrences of keywords. The results show that respondents have indicated needs public private European partnerships and circular economy.

Figure 25: Assessment of open answers of other needs, 50 most common co-occurring keywords (N=16)



All types of stakeholders referred to the need to involve a wide range of players, from environmentally focused partners, to local residents and companies. Good communication flows and inclusiveness are seen as key to create awareness and societal change. A business association also mentioned the need to bring sectors together to broaden the scope of results. One large company insisted on the need to ensure that projects lead concrete results on the market (through commercialisation of products and services, standardisation etc.) and that the initiative should therefore focus on high TRL projects.

Figure 27: To what extent do you think this is relevant for research and innovation efforts at EU level to address the following problems in relation to the circular bio-based field - Responses for the Circular Bio-based Europe Initiative



The *innovation gap in the EU in translating research results into the development of innovative circular/bio-based products* was seen by a majority of the open public consultation (OPC) respondents as a 'highly relevant' and 'relevant' problem. Only minor number of academics and businesses (250+), SMEs and EU citizens consider this issue as less relevant.

Dominant majority of the respondents to the OPC see *Lack of public investment* as a 'relevant' or 'very relevant' challenge faced by R&I efforts of EU in fostering a circular bio-based economy. NGOs and public authorities seem to be the most concerned, followed by SMEs, academic and research institution, business associations and businesses (250+), where EU citizens are the least concerned.

On average more than half of respondents consider *Lack of private investment* as 'relevant' or 'very relevant' challenges. The strongest agreement came from academics, followed by business associations and businesses (250+), SMEs, public authorities and NGOs.

Two third of the respondents to the OPC see *Lack of understanding of the circular and bio-based economy* as a 'relevant' or 'very relevant' challenge. Public authorities and EU citizen most strongly agree with that issues. This is followed by academics), SMEs, business associations, businesses (250+) and NGOs.

SMEs, public authorities, academics and NGOs think that future European Partnerships under Horizon Europe see *Lack of consumer acceptance or understanding* as a 'relevant/very relevant' challenge.

The highest share of responses among NGOs, public authorities, business associations, EU citizens followed by SMEs, businesses (250+) and academics think that it is relevant/very relevant for R&I efforts at EU level to address the mobilisations of resources – Limited via public-private collaboration.

All respondents except EU citizen think that the future European Partnerships under Horizon Europe need to be responsive towards *Market failures*.

More than 80 % of the responses among all stakeholders find highly/very relevant for research and innovation efforts at EU level to address the problem of *Lack of economic and regulatory incentives for bio-based products/ producers*.

Most of the respondents among different stakeholder types do not find highly/very relevant for research and innovation efforts at EU level to address the problem of *Barriers in exploitation*.

With regard to the uptake in innovation problems, 132 respondents have indicated that the research and innovation efforts at EU level to address the issue of lack of competitiveness with traditional products/materials is very relevant. The uptake in innovation problem that is seen as the least relevant is that favourable biobased products do not fulfil some commonly used product specifications (38, 18.45%)

There are only two structural and resource problems that the respondents were asked to reflect on. Of these the limited collaboration and pooling of resources between public/private actors was seen as the more relevant for research and innovation efforts at EU level to address, with 100 respondents indicating that this is very relevant (47.62%).

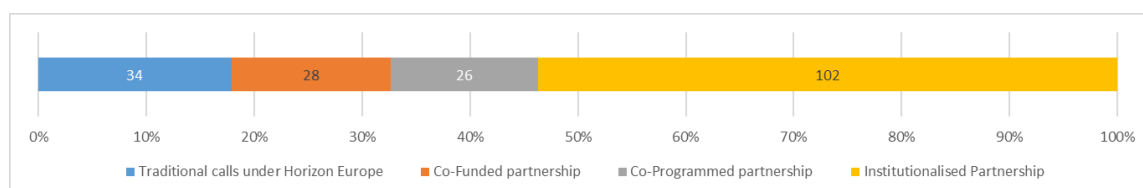
The problem that has received the most responses indicating that it is 'very relevant' is the innovation gap in the EU in translating the research results into the development of innovative circular/bio-based products (150, 72.12%).

No statistical differences were found between the views of citizens and other respondents.

B.6.6 Horizon Europe mode of intervention to address problems

After providing their views on the relevance of problems, respondents were asked to indicate how these challenges could be addressed through Horizon Europe intervention. As shown in Figure 28, nearly 60% of respondents indicated that institutionalised partnerships were the best fitting intervention. The most relevant intervention for academic/research institutions and SMEs is institutionalised partnership followed by traditional calls under Horizon Europe work programmes, where co-programmed partnership and co-funded partnership are the least fitting interventions. Business associations and businesses (250+) also indicated institutionalised partnership as the most fitting intervention, meanwhile co-funded partnership is the least appropriate in their opinion. NGOs and public authorities think that co-programmed and co-funded partnership are the least fitting interventions. Citizens, compared to other respondents, indicated less often that institutionalised partnerships were the best fitting intervention.

Figure 28: In your view, how should the specific challenges described above be addressed through Horizon Europe intervention? - Responses for the Circular Bio-based Europe Initiative



The respondents were asked to briefly explain their answers to the question above. People who stated that an institutionalised partnership was the best fitting answer, mentioned

Figure 30: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives? - Responses for the Circular Bio-based Europe Initiative - Setting joint long-term agenda with strong involvement of

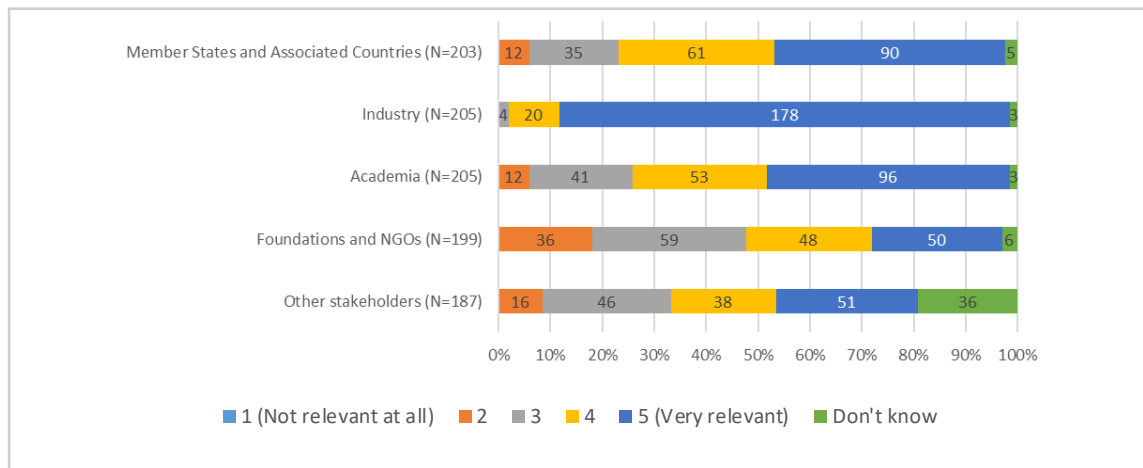
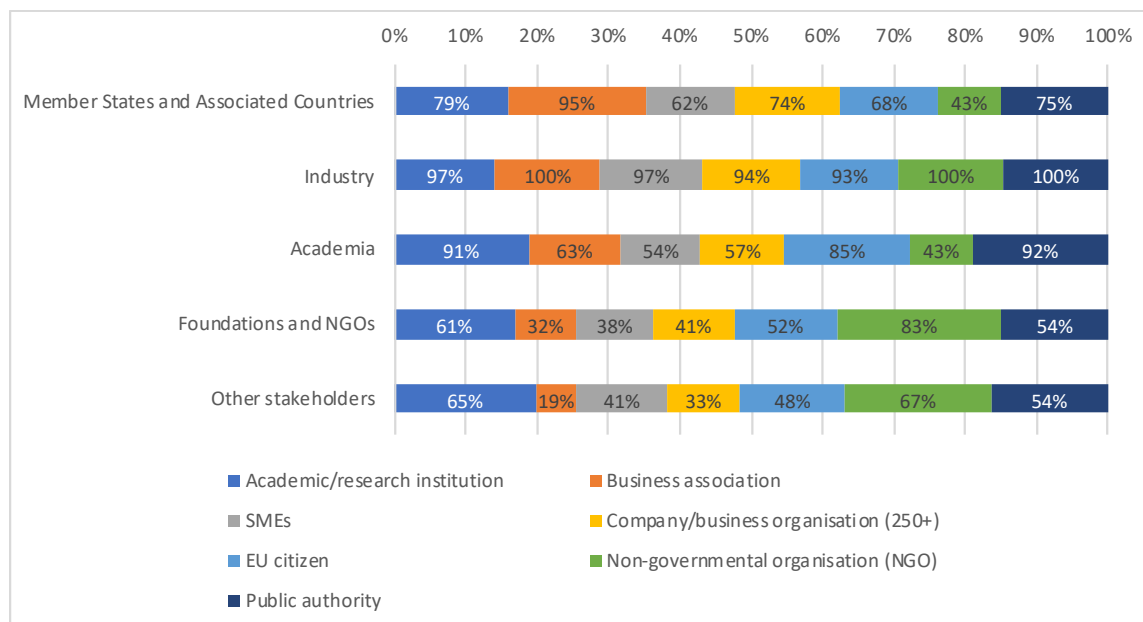


Figure 31: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives? - Responses for the Circular Bio-based Europe Initiative - Setting joint long-term agenda by stakeholder type with strong involvement of

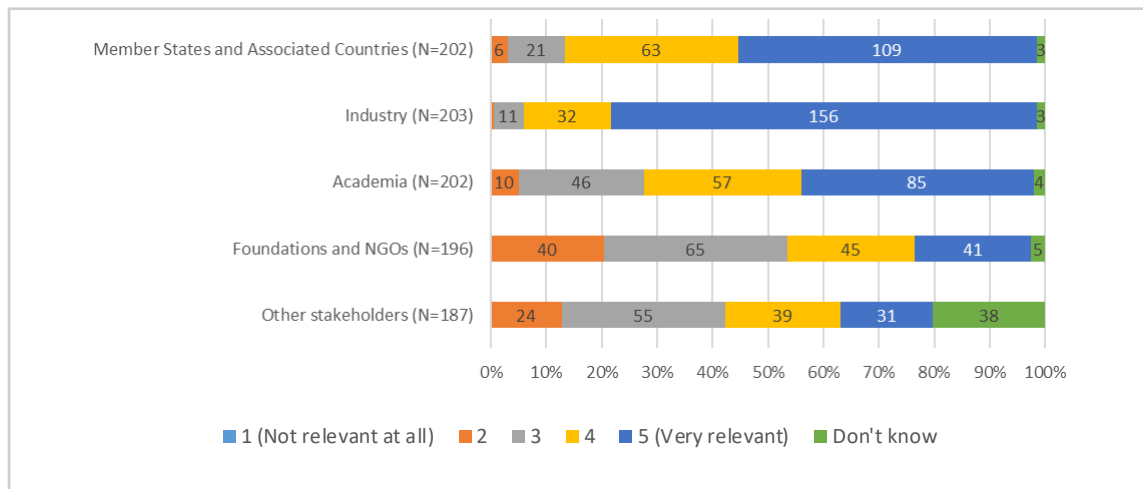


Relevance of elements and activities in pooling and leveraging resources

With respect to the relevance of coordination, alignment or integration with specific stakeholders' groups in pooling and leveraging resources, such as financial, infrastructure, in-kind expertise etc., to meet Partnership objectives, the patterns are very similar. More than two third of respondents in all stakeholder groups indicated that industry was very relevant. Member States and Associated Countries were very relevant for business associations, Academic/research institution, EU citizen and Public authority.

With regard to Academia the least of respondents felt that they were very relevant. However, Academic/research institution, EU citizen and Public authority consider this element as relevant. Most of the respondents among different stakeholder groups did not indicate Foundations and NGOs as very relevant. No respondents from different stakeholder groups indicated that any of the categories was 'Not relevant at all'. No statistical differences were found between the views of citizens and other respondents.

Figure 32: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives - Responses for the Circular Bio-based Europe Initiative - Pooling and leveraging resources (financial, infrastructure, in-kind expertise, etc.) through coordination, alignment and integration with:

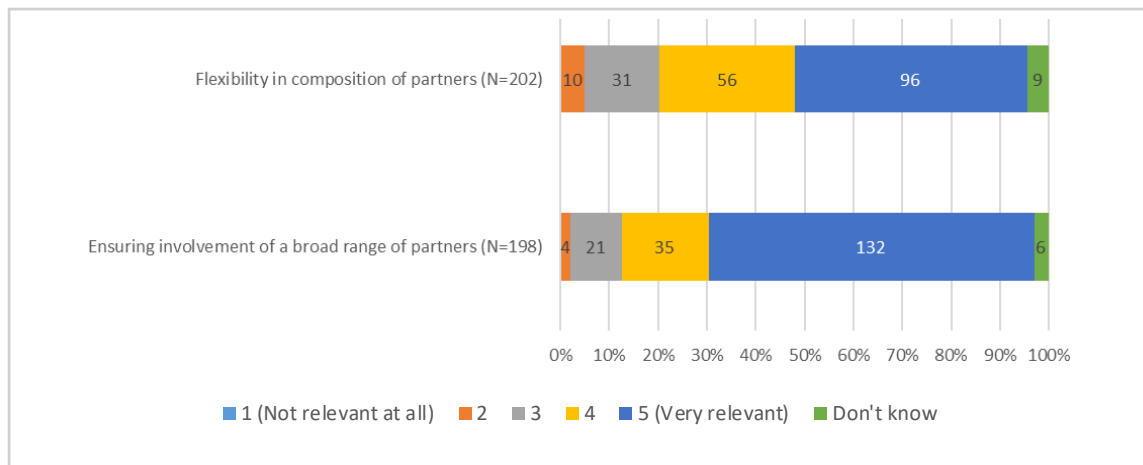


Relevance of elements and activities for the partnership composition

Respondents were asked about the relevance of the Partnership composition, such as the flexibility in the composition of partners over time and the involvement of a broad range of partners (including across disciplines and sectors), to reach Partnership objectives. As it is visible in Figure 33, ensuring involvement of a broad range of partners has more 'very relevant' answers (132, 66.67%) than the flexibility in the composition of partners (96, 47.52%). Overall 80% of respondents have given flexibility either a score of 4 or 5 (very relevant), while 84% have given the broad range of partners a score of 4 or 5 (very relevant).

No statistical differences were found between the views of citizens and other respondents.

Figure 33: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives - Responses for the Circular Bio-based Europe Initiative - Partnership composition



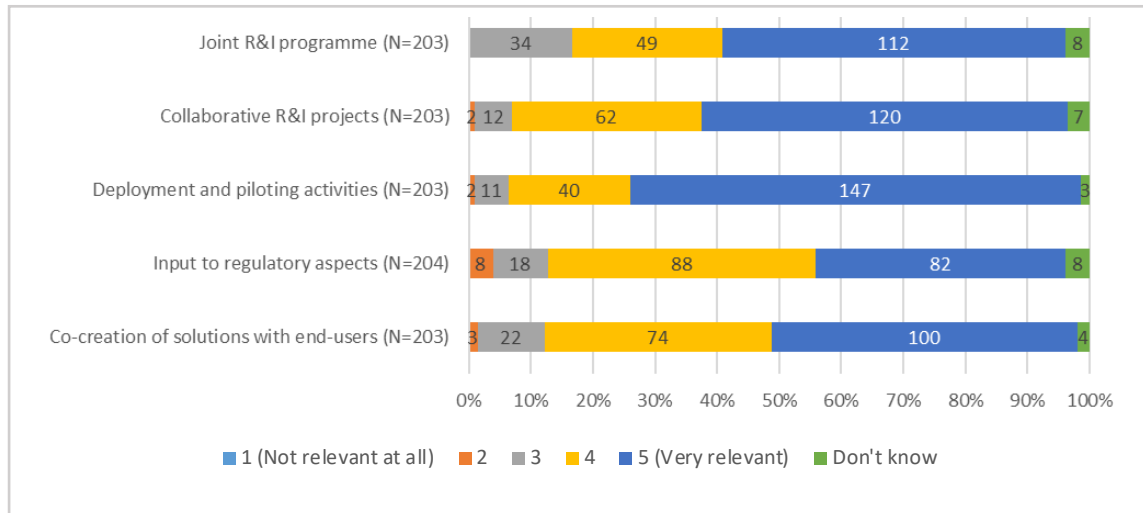
Relevance of implementation of activities

Respondents were asked to provide opinions on the relevance of implementing a set of activities for meeting the objectives of the candidate Circular Bio-based Europe Partnership. Among activities were listed – a joint R&D programme, collaborative R&D projects, deployment and piloting activities, input to regulatory aspects and co-creation of solutions with end-users. Out of 203 respondents, 147 (72.41%) indicated that deployment and piloting activities are very relevant to ensure that the Partnership would meet its objectives. Collaborative R&I projects have also been considered as very relevant by a large number of respondents (120 respondents or 59.11%). In particular, a large majority

of academics, business associations and EU citizens, and all respondents from public authorities, indicated collaborative R&I projects as relevant. In contrast, input to regulatory aspects is considered less relevant by respondents. However, still a large share of academics, business associations, businesses (250+), public authorities and other types of respondents indicated this element as relevant.

Respondents that are/were involved in a current/preceding partnership found joint R&I programmes more relevant than other respondents. Overall, this element was considered as relevant by more than half of business associations, business organisations and NGOs, and by more than two thirds of academics, EU citizens and public authorities.

Figure 34: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives - Responses for the Circular Bio-based Europe Initiative - Implementing the following activities



B.6.8 Relevance of setting up a legal structure (funding body) for the candidate European Partnerships to achieve improvements

Respondents were also asked to assess the relevance of a specific legal structure (funding body) for the candidate European Partnership to implement several activities. According to Figure 35 most respondents indicated that a specific legal structure was 'very relevant' to implement its activities more effectively. The majority of stakeholders from business associations, SMEs, businesses (250+), public authorities and EU citizens indicated a high relevance of a legal structure for a more effective implementation of activities.

Respondents that are/were involved in a current/preceding partnership found the effective implementation of activities, increased financial leverage and the collaboration with other partnerships more relevant than other respondents.

Overall, the majority of respondents in all stakeholder groups indicated the set-up of a legal structure as relevant or highly relevant to: implement activities more effectively and more transparently; increase financial leverage; ensure better links to practitioners on the ground; obtain more buy-in and long-term commitments from other partners; ensure harmonization of standards; and facilitate synergies with other EU and national programmes.

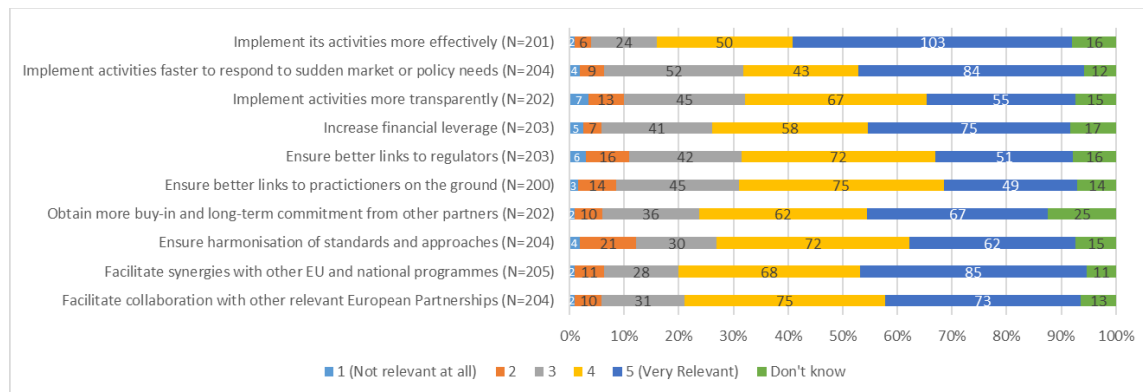
A legal structure was considered relevant or highly relevant for a faster implementation of activities to respond to sudden market or policy needs by the majority of respondents in all stakeholder groups, with the exception of business associations where more than half considered it relevant to a smaller degree.

Contrarily to all other stakeholder groups, a moderate majority of EU citizens considered a legal structure either close to not relevant or relevant to a smaller degree to ensure better

links to regulators. Similarly, the majority of NGOs indicated a specific legal structure to be close to not relevant or relevant only to a small degree to facilitate collaboration with other relevant European Partnerships.

The number of respondents that have indicated that they view a measure as 'not relevant at all' is very small across all the measures and all stakeholder groups.

Figure 35: In your view, how relevant is to set up a specific legal structure (funding body) for the candidate European Partnership to achieve the following? - Responses for the Circular Bio-based Europe Initiative

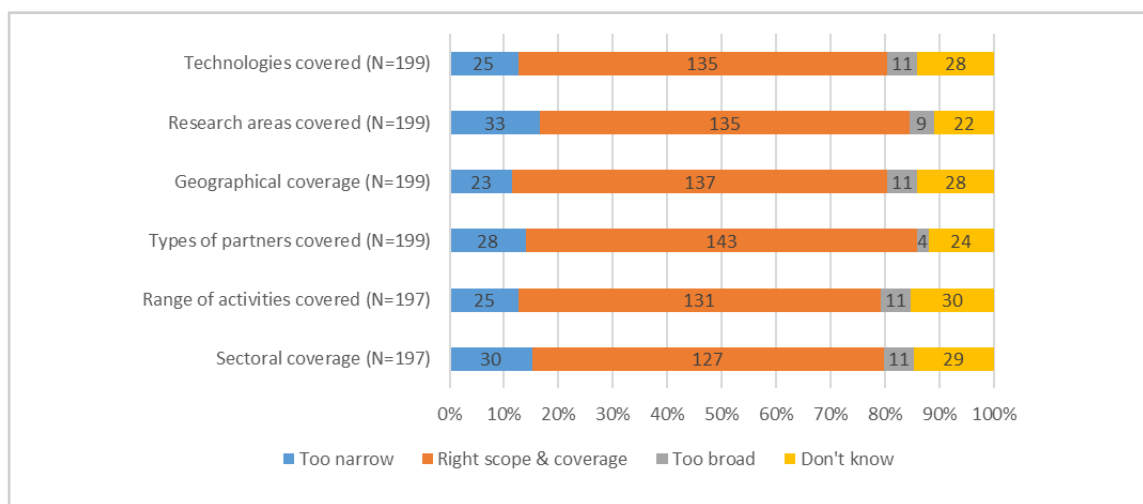


B.6.9 Scope and coverage of the candidate European Partnerships based on their inception impact assessments

Respondents were asked to assess the scope and coverage of the Circular Bio-based Europe Partnership, based on its inception impact assessment. The clear majority of the respondents across all stakeholder groups have indicated that the partnership has the right scope and coverage across all areas, although geographical coverage and types of partners covered have the highest number of right scope and coverage answers. On average, a very small share of respondents have indicated that they felt the scope and coverage were too broad, while a slightly higher but still small share of respondents have indicated that the scope was too narrow. In particular, a higher share of NGOs compared to other stakeholders groups, have indicated this with regards to technologies covered. Similarly, a higher share of academics compared to other stakeholder groups, have indicated geographical coverage, research areas, range of activities and sectoral coverage to be too narrow, although the majority still considered these as correctly covered.

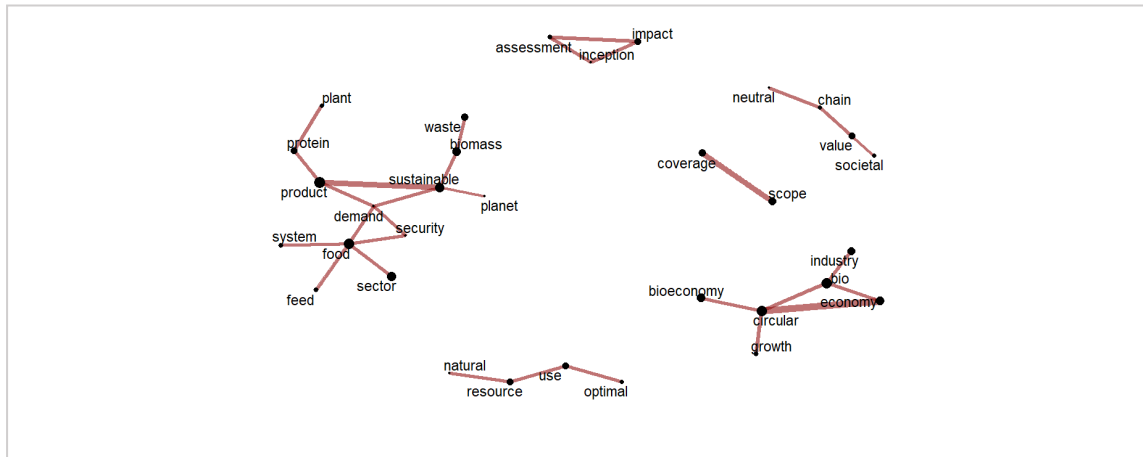
No statistical differences were found between the views of citizens and other respondents.

Figure 36: What is your view on the scope and coverage proposed for this candidate institutionalised European Partnership, based on its inception impact assessment? Respondents for the candidate Circular Bio-based Europe Partnership



Aside from this multiple-choice question, the respondents were also asked to provide any comment that they may have on the proposed scope and coverage for this candidate Institutionalised Partnership. The keyword analysis used for open questions resulted in the graph shown below. This analysis showed the respondents used this question to talk about sustainable biomass, plant protein, food security as well as the circular (bio)economy and an inception impact assessment.

Figure 37: Assessment of open answers with regard to the proposed scope and coverage for this candidate Institutionalised Partnership, 30 most common co-occurring keywords (N=69)



Two business respondents endorse the vision as it has been formulated by the BIC including food security & demand for sustainable products; sustainable planet; jobs and growth in the circular bioeconomy; and circular bioeconomic society. An EU citizen suggested additionally including the development of biomimetic materials for large-scale applications in the energy and construction sector. A representative of academia pointed out that the point of view of the citizens has to be considered. Another representative of academia emphasized that it is necessary to finance innovative technologies. A representative of a regional authority underlined that regional or bigger geographical coverage is needed in terms of volumes and market. A representative of a large company drew the attention to the significant potential coming from the Industrial Symbiosis.

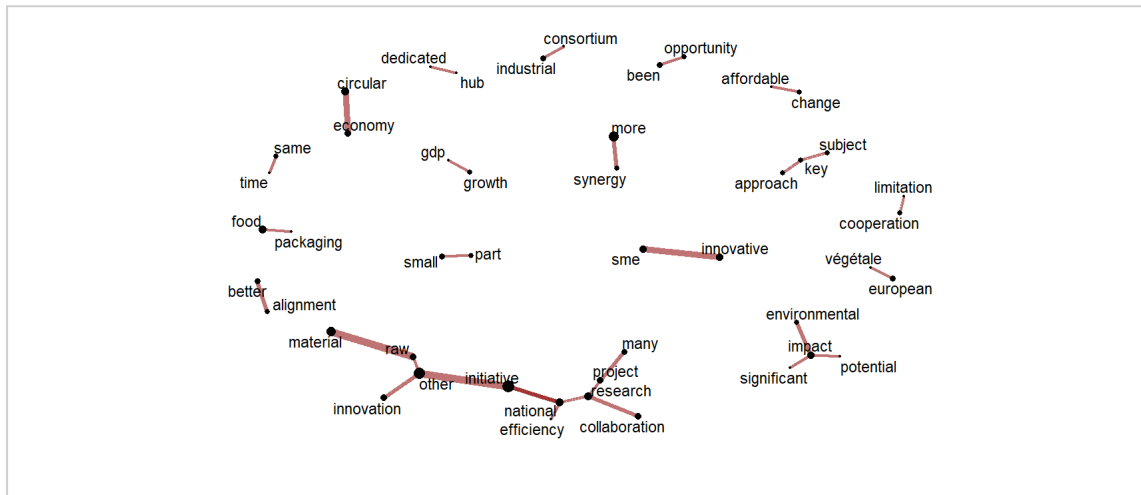
B.6.10 Scope for rationalisation and alignment of candidate European Partnerships with other initiatives

The respondents were also asked if they thought it would be possible to rationalise the candidate European Institutionalised Partnership and its activities, and/or to better link it with other comparable initiatives. 100 respondents (57.47%) have indicated that they think this is the case.

No statistical differences were found between the views of citizens and other respondents.

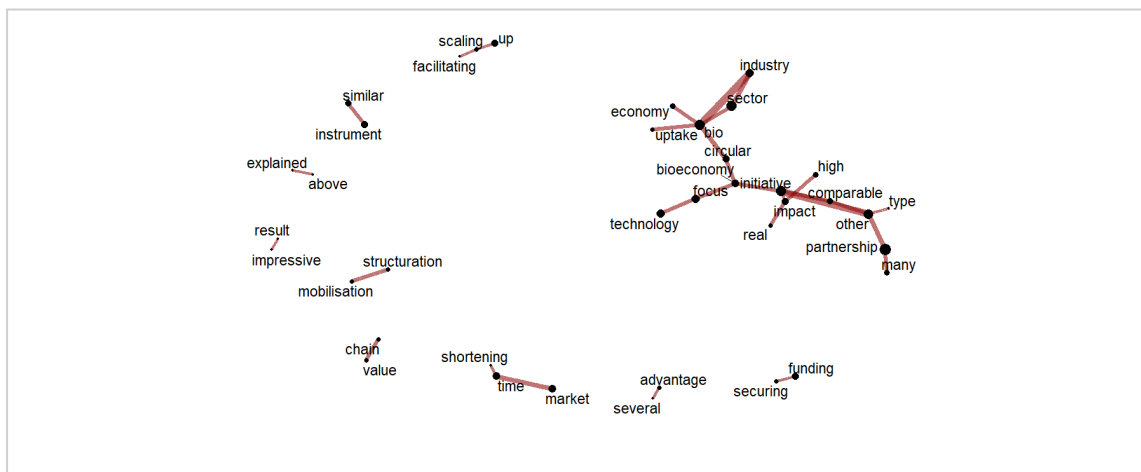
The respondents who answered affirmatively were asked to indicate which other comparable initiatives this proposed partnership could be linked with. The keyword analysis used for open questions resulted in the graph shown in Figure 38. This analysis showed the respondents used this question to talk about several initiatives with which it should actively cooperate and foster links, including Innovative SMEs (suggested by a large company) ; the HEU missions on "Soil health and food" and on " Healthy Oceans, Seas, Coastal and Inland Waters" (suggested by an academic); and European Platforms such as SUSCHEM on plastic circular economy and the materials platform EUMAT (suggested by an academic). Making these links would ensure the initiative reaches its potential of significant environmental impact.

Figure 38: Assessment of open answers with regard to the proposed scope and coverage for this candidate Institutionalised Partnership, 30 most common co-occurring keywords (N=53)



For the respondents who answered negatively on the previous question, the results of the analysis resulted in the chart shown in Figure 39 showing the co-occurrences of keywords. The results show that respondents are interested in the uptake of bioeconomy and circular initiatives by the industry and having real impact comparable to other types of partnerships. Respondents acknowledged that the candidate partnership is the only initiative at EU level that specifically addresses the challenges of the biotechnology sector. A medium company underlined that the Institutionalized Partnership is necessary to enable shorter development and scale-up technologies; to bring new bio-based products to the market; and further strengthen EU's position in the global bio-economy market. A medium company acknowledged that while the bioeconomy will take place in regions, it requires a very broad stakeholder network to identify the relevant technologies and bring them to higher TRLs.

Figure 39: Assessment of open answers on the question why other comparable initiatives are not suitable to be linked, 30 most common co-occurring keywords (N=15)



B.6.11 Relevance of European Partnerships to deliver targeted scientific, economic/technological and societal impacts

Respondents were asked to assess the relevance of the candidate European Institutionalised Partnership to deliver on listed impacts. According to Figure 40, among societal impacts, a greater number of respondents suggest that the Partnership would be 'very relevant' for reducing greenhouse emissions, for maximisation of valorisation of organic waste, and agriculture and forestry residues, and for replacement of oil-based chemicals and materials with bio-based and biodegradable ones. In comparison, the least

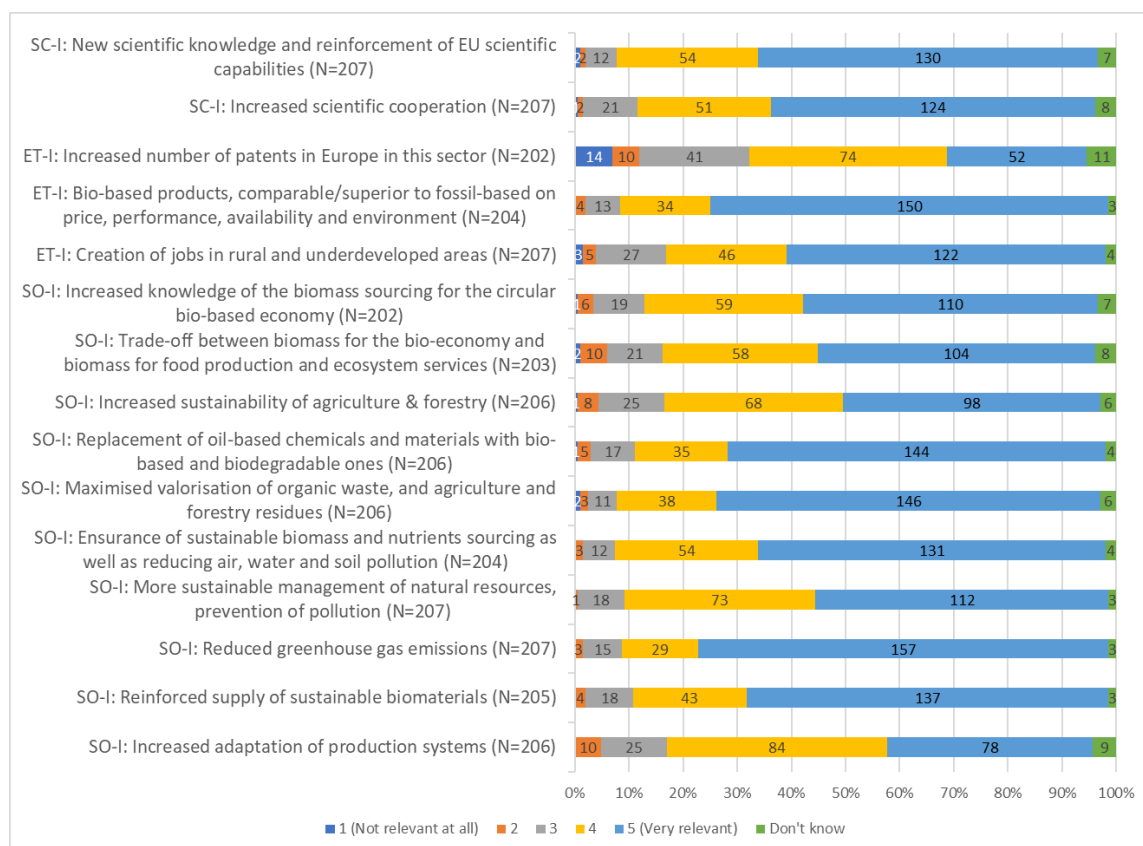
number of respondents considered that the partnership would be 'very relevant' for increasing adoption of production systems. Among economic/technological impact categories, a greater number of respondents (150 out of 204, or 73.53%) indicated that the Partnership would be 'very relevant' for delivery of bio-based products that are comparable and/or superior to fossil-based products. The pattern of responses on impacts in the area of science are very similar – over 60% of respondents believe that the Partnership would be 'very relevant' for generating new scientific knowledge and for increasing scientific cooperation.

The majority of respondents across all stakeholder groups considered European Partnerships to be either very relevant or relevant to deliver the targeted scientific, social and economic impacts. Citizens found the societal impact related to sustainable management of natural resources and the economic/technological impact related to the creation of jobs in rural and underdeveloped areas more relevant.

A greater share of businesses (250+), SMEs, public authorities and NGOs, compared to other stakeholder groups - although still not the majority - considered European Partnerships to be either not relevant or relevant to a smaller degree to deliver targeted social impacts.

An even higher share of the abovementioned stakeholder groups - although not the majority - considered European Partnerships to be either not relevant or relevant to a smaller degree to deliver targeted economic impacts.

Figure 40: In your view, how relevant is it for the candidate European Institutionalised Partnership to deliver on the following impacts? Responses for the candidate Circular Bio-based Europe Partnership



B.6.12 Summary of campaigns results for this specific initiative

One campaign has been identified among respondents that decided to provide views on the candidate Partnership on Circular Biobased Europe. This campaign consists of 20 respondents (campaign #5).

Table 22: Overview of responses of the first campaign (campaign #5) (N=20)

| Question category | Summary of responses |
|--|---|
| Research and innovation problems | The answer category "lack of understanding of the circular and bio-based economy" was assessed 'very relevant' by all respondents. The other categories received a score of 4, on average. |
| Structural and resource problems | With exception of two respondents, all respondents gave a high score (5 'very relevant') for a category "limited collaboration and pooling of resources between public actors and private actors etc.". The other category received a lower score (between 3 and 4). |
| Problems in uptake of digital innovations | Most respondents considered that the following categories are 'very relevant': "lack of competitiveness with the traditional products/materials", "lack of private investment", "lack of public investment". Other answer categories received a lower score, on average. |
| Preferred Horizon Europe intervention | Institutionalised Partnership option was selected by most respondents. Only one respondent indicated that the challenges can be better addressed via "co-funded partnership". When respondents were asked to explain their choice, almost all of them used the following quote: <i>"Challenges mentioned above require joint investments, setting up new value chains and creating synergies. An iPPP addresses the multi-actor nature of the bio-based industries and enables long-term collaboration of different sectors (industry, academia, society, member states, regions) to solve these challenges and to create a favourable climate for investment in the bio-based sector in Europe"</i> . |
| Relevance of actors for setting joint long-term agenda | Almost all respondents consider that involvement of industry is 'very relevant'. The involvement of "Member States and Associated Countries" is considered 'relevant' (score 4) by most respondents. Other categories received a slightly lower score, on average. |
| Relevance of actors for pooling and leveraging resources | Almost all respondents consider that involvement of industry is 'very relevant'. The involvement of "Member States and Associated Countries" is considered 'relevant' (score 4) by most respondents. Other categories received a slightly lower score, on average. |
| Partnership composition | Most respondents suggest that "involvement of a broad range of partners, etc." is 'very relevant'. The second answer category received a lower score, on average. |
| Implementation of activities | Across all respondents consider that "deployment and piloting activities" are 'very relevant'. Other answer categories were given a score of 4 'relevant', on average. |
| Relevance of the legal structure | With exception of one respondent, all respondents consider that the legal structure would be 'very relevant' for implementing Partnership activities more effectively. Other answer categories received an average score of 4 'relevant'. The lowest score |

| Question category | Summary of responses |
|---|--|
| | (namely, 3) was given to the category "implement activities faster to respond to sudden market or policy needs". |
| Scope and coverage of the candidate Partnership | <p>Across all answer categories, most respondents consider that the elements are of right scope and coverage.</p> <p>Respondents were offered an opportunity to provide comments on the proposed scope and coverage of the Institutionalised Partnership. Most of them included the following quote:</p> <p><i>"Scope (cf. 2050 vision signed by BIC & 14 associations):</i></p> <ol style="list-style-type: none"> <i>1. Food security and demand for sustainable products (integrated, efficient production of food, feed, bio-based products, services, energy with minimal environmental impact)</i> <i>2. A sustainable planet (carbon-neutral value chains, optimal use of natural resources, protect environment, add societal value)</i> <i>3. Jobs & growth in the circular bioeconomy (mobilise local feedstock)</i> <i>4. Circular bioeconomic society (participating citizens)."</i> |
| Rationalisation of the candidate Partnership and linking to other initiatives | <p>90% of respondents (18 out of 20) consider that it would not be possible to rationalise the candidate Partnership and its activities, and/or to better link it with other comparable initiatives.</p> <p>Respondents were asked to explain their answer, most of them inserted a following quote: <i>"There is no similar instrument to address the challenges for the bio-based sector in the EU like an iPPP: it covers a funding gap, enables scaling up and shorter time to market through focus on higher TRL (5-8), provides grants (vis a vis loans and which don't have the same effect), bio-based industry sector is still very fragmented between actors and across geographies, essential to continue on-going structuration."</i></p> |
| Societal impact | <p>Almost all respondents consider that the Partnership would be 'very relevant' to deliver on most categories of results. The exceptions include: "increased adaptation of production systems", "more sustainable management of natural resources, prevention of pollution", "increased sustainability of agriculture & forestry" and "increased knowledge of the biomass sourcing for the circular bio-based economy". In those categories, the average score is 4 'relevant'.</p> |
| Economic/technological impact | <p>For the categories "creation of jobs in rural and underdeveloped areas" and "increased number of patents in Europe in this sector", majority of respondents indicated that impacts are 'very relevant'. The remaining answer category received a score of 4, on average.</p> |
| Scientific impact | <p>Across all listed categories, majority of respondents indicated that impacts are 'very relevant'.</p> |

Appendix C Methodological Annex

The Impact Assessment studies for all 13 candidate institutionalised European Partnerships mobilised a mix of qualitative and quantitative data collection and analysis methods. These methods range from desk research and interviews to the analysis of the responses to the Open Consultation, stakeholder analysis and composition/portfolio analysis, bibliometrics/patent analysis and social network analysis, and a cost-effectiveness analysis.

The first step in the impact assessment studies consisted in the definition of the context and the problems that the candidate partnerships are expected to solve in the medium term or long run. The main data source in this respect was desk research. The Impact Assessment Study Teams went through grey and academic literature to identify the main challenges in the scientific and technologic fields and in the economic sectors relevant for their candidate partnerships. The review of official documentations, especially from the European Commission, additionally helped understand the main EU policy proprieties that the initiatives under assessment could contribute to achieve.

Almost no candidate institutionalised European Partnership is intended to emerge ex nihilo. Partnerships already existed under Horizon 2020 and will precede those proposed by the European Commission. In the assessment of the problems to address, the Impact Assessment Study Teams therefore considered the achievements of these ongoing partnerships, their challenges and the lessons that should be drawn for the future ones. For that purpose, they reviewed carefully the documents in relation to the preceding partnerships, especially their (midterm) evaluations conducted. The bibliography in Appendix A gives a comprehensive overview of the documents and literature reviewed for the present impact assessment study.

Finally, the description of the context of the candidate institutionalised European Partnerships required a good understanding of the corresponding research and innovation systems and their outputs already measured. The European Commission services and, where needed the ongoing Joint Undertakings or implementation bodies of the partnerships under Article 185 of the TFEU, provided data on the projects that they funded and their participants. These data served as basis for descriptive statistic of the numbers of projects and their respective levels of funding, the type of organisations participating (e.g. universities, RTOs, large enterprises, SMEs, public administrations, NGOs, etc.) and how the funding was distributed across them. Special attention was given to the countries (and groups of countries, such as EU, Associated Countries, EU13 or EU15) and to the industrial sectors, where relevant. The sectoral analysis required enriching the eCORDA data received from the European Commission services with sector information extracted from ORBIS. We used the NACE codification up to level 2. These data enabled identified the main and, where possible, emerging actors in the relevant systems, i.e. the organisations, countries and sectors that will need to be involved (further) in the future partnerships.

The horizontal teams also conducted a Social Network Analysis using the same data. It consisted in mapping the collaboration between the participants in the projects funded under the ongoing European partnerships. This analysis revealed which actors – broken down per type of stakeholders or per industrial sector – collaborate the most often together, and those that are therefore the most central to the relevant research and innovation systems.

The data provided by the European Commission finally served a bibliometric analysis aimed at measuring the outputs (patents and scientific publications) of the currently EU-funded research and innovation projects. A complementary analysis of the Scopus data enabled to determine the position and excellence of the European Union on the international scene, and identify who its main competitors are, and whether the European research and innovation is leading, following or lagging behind.

All together, these statistical analyses will complement the desk research for a comprehensive definition of the context in which the candidate institutionalised European Partnerships are intended to be implemented. The conclusions drawn on their basis will be confronted to the views of experts and stakeholders collected via three means:

- The comments to the inception impact assessments of the individual candidate institutionalised European partnerships received in August 2019
- The open public consultation organised by the European Commission from September to November 2019
- The interviews (up to 50) conducted by each impact assessment study team conducted between August 2019 and January 2020.

For instance, in all three exercises, the respondents were asked to reflect on the main challenges that the candidate institutionalised European Partnerships should address. In the open public consultations, they mainly reacted to proposals from the European Commission like when they were given to opportunity to give feedback to the inception impact assessment.

The views of stakeholders (and experts) were particularly important for determining the basic functionalities that the future partnerships need to demonstrate to achieve their objectives as well as their most anticipated scientific, economic and technological, and societal impacts. The interviews allowed more flexibility to ask the respondents to reflect about the different types of European Partnerships. Furthermore, as a method for targeted consultation, it was used to get insights from the actors that both the Study Teams and the European Commission were deemed the most relevant. For the comparative assessment of impacts, the Study Teams confronted the outcomes of the different stakeholder consultation exercises to each other with a view of increasing the validity of their conclusions, in line with the principles of triangulation. Appendix B includes also the main outcomes of these three stakeholder consultation exercises.

The comparison of different options for European partnerships additionally relied on a cost-effectiveness analysis. When it comes to research and innovation programmes, the identification of costs and benefits should primarily be aimed at identifying the “value for money” of devoting resources from the EU (and Member States) budget to specific initiatives. Based on desk research and consultation with the European Commission services, the horizontal study team produced financial estimates for different types of costs (preparation and setup costs, running costs and winding down costs) and per partnership option. The costs were common to all candidate European Partnerships. The results of the cost model were displayed in a table, where each cost was translated on a scale using “+” in order to ease the comparison between the partnership options.

A scorecard analysis, which allocated each option a score between 1 and 3 against selected variables, was used to highlight those options that stand out as not being dominated by any of the other options in the group: such options are then retained as the preferential ones in the remainder of our analysis. It also allowed for easy visualisation of the pros and cons of alternative options.

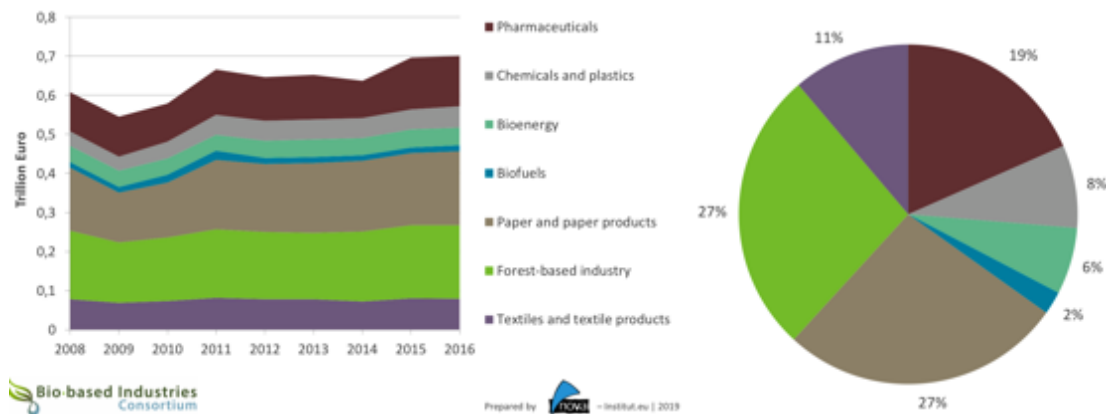
Appendix D Additional information on Section 1, Section 1.2.1: Extended details on the analysis of competitive positioning of Europe in the field of bio-based economy

D.1 Socio-economic performance of the EU bio-based sector

According to the 2017 meta study based on 200 studies around bioeconomy, the socio-economic effects of bioeconomy are not very well known as a whole¹¹⁸. All studies assessed in this report found positive contributions of bioeconomy towards value added generation and job creation in the EU. Those studies that executed a comparison between material uses and energy uses of biomass conclude clearly and unanimously that the material uses create much more value added and employment per tonne of biomass and in total than the energy sectors can.¹¹⁹

The more recent study¹²⁰ shows that between 2008 and 2016, the **turnover in the EU bioeconomy** has increased from less than EUR 2 trillion to about EUR 2.3 trillion. If the sectors of food, beverage and tobacco products are excluded, turnover amounted to EUR 1.14 trillion. Among these, **the bio-based industries turnover** reached about EUR 700 billion in 2016, up from about EUR 600 billion in 2008 (see figure below).

Figure 41: Turnover of the EU Bio-based economy in 2008-2016



In contrast to the overall turnover, overall **employment in the EU bioeconomy** is declining. However, this decrease is mainly due to the decline in the agricultural sector¹²¹ while the other sectors have been stable or even increased their employment. In 2016, the total number of employed persons in the EU bioeconomy amounted to 18.6 million. If only the 'bio-based sectors' are analysed (excluding also the primary biomass production/extraction), the total employment is 3.6 million jobs in 2016, which is the highest value since 2008.

It is important to note that the strategic expectation from the **bio-based economy** (including the impact from the Partnership) is that it builds on innovations while addressing

¹¹⁸ Dammer L., Carus M., Iffland K., Piotrowski S., Sarmento L., Chinthapalli R., Raschka A. (2017) Current situation and trends of the bio-based industries in Europe, Pilot study by nova-Institute for BBI-JU, authors, available at <http://bio-based.eu/markets/#BBISStudy>

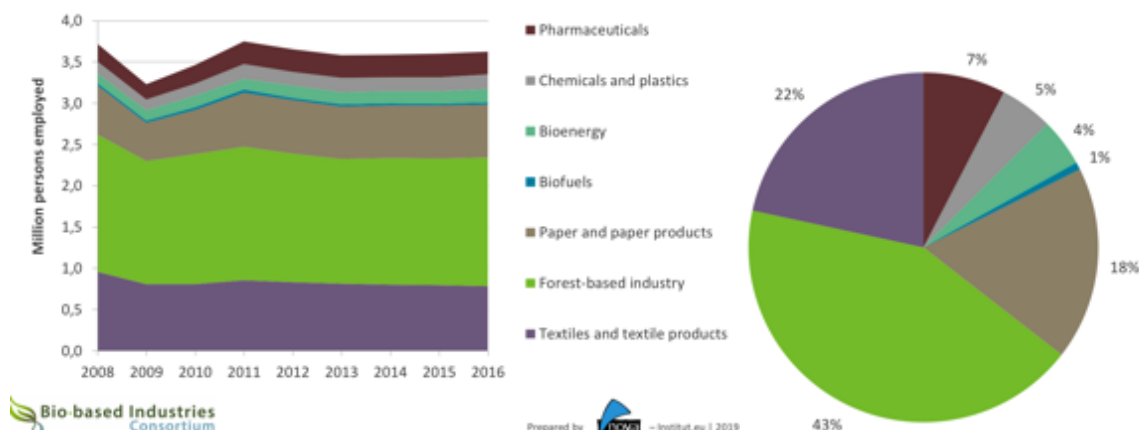
¹¹⁹ ibid

¹²⁰ Piotrowski S., Carus M. (Nova-Institut), Carrez D. (BIC), (2019), *European Bioeconomy in Figures 2008 – 2016*, commissioned by Bio-based Industries Consortium, available at https://biconsortium.eu/sites/biconsortium.eu/files/documents/European%20Bioeconomy%20in%20Figures%202008%20-%202016_0.pdf

¹²¹ This trend is likely due to the increasing efficiency of agricultural production and emerging varied employment opportunities for the rural population.

societal objectives, such as contributing to high-skilled job creation in rural settings, rather than keeping an obsolete employment structure in agriculture.

Figure 42: Employment in the bio-based economy in the EU in 2008-2016



When it comes to **investment** in the bioeconomy there is very little information available. The report by Lux Research quoted USD 9.2 billion of funding attracted globally by bio-based chemicals and materials in the period 2010-2015.¹²² Nova-Institute found indications that while investments in Europe and the USA cover mostly R&D as well as pilot scale facilities, investments in Asia and South America are often on a larger scale and target commercial production plants.¹²³

D.2 Scientific and technological performance of the EU bio-based sector

The **technological and scientific excellence analysis** here is based on the bibliometric analysis covering trends in scientific publications and inventive activities in the area measured by patenting activities in the area of bio-based products and processes.

The **patenting** trend analysis^{124 125} shows very strong leadership from China in an area that has rapidly grown in the last two decades. Once on the same performance level with the EU, China's inventive performance grew from below 3 000 patents in 2001 to over 55 000 patents in 2016, while the EU performance saw a slight decline.

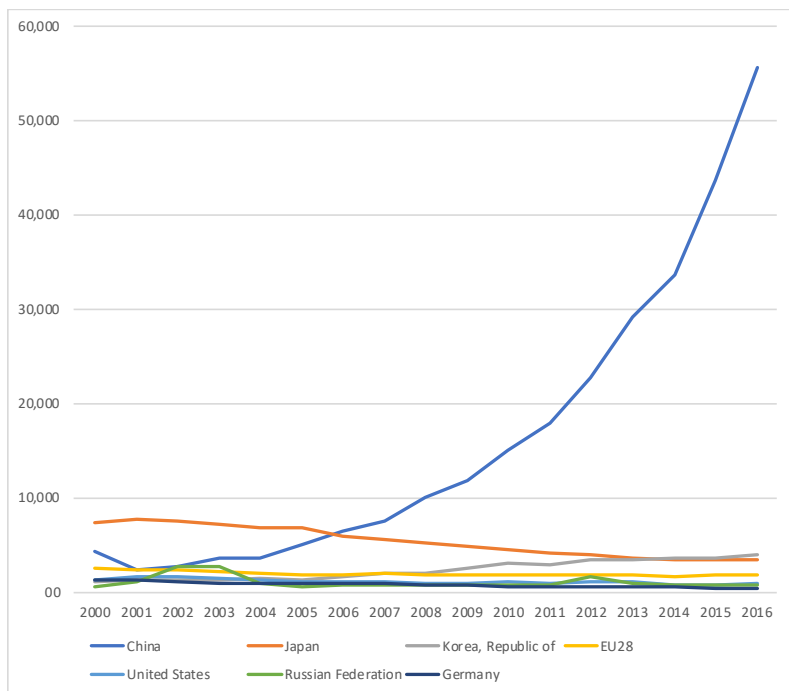
¹²² Dammer L., Carus M., Iffland K., Piotrowski S., Sarmento L., Chinthapalli R., Raschka A. (2017) Current situation and trends of the bio-based industries in Europe, Pilot study by nova-Institute for BBI-JU, authors, available at <http://bio-based.eu/markets/#BBISStudy>

¹²³ *ibid*

¹²⁴ The patent counting methodology is based on Rassenfosse G., Dernis H., Guellec D., Picci L. and van Pottelsberghe de la Potterie (2013) The worldwide count of priority patents: A new indicator of inventive activity, *Research Policy*, 2013, vol. 42, issue 3, 720-737, available at: <https://www.sciencedirect.com/science/article/abs/pii/S0048733312002570>

¹²⁵ Detailed list of the IPC classes selected to the patent analysis is presented in Appendix F.

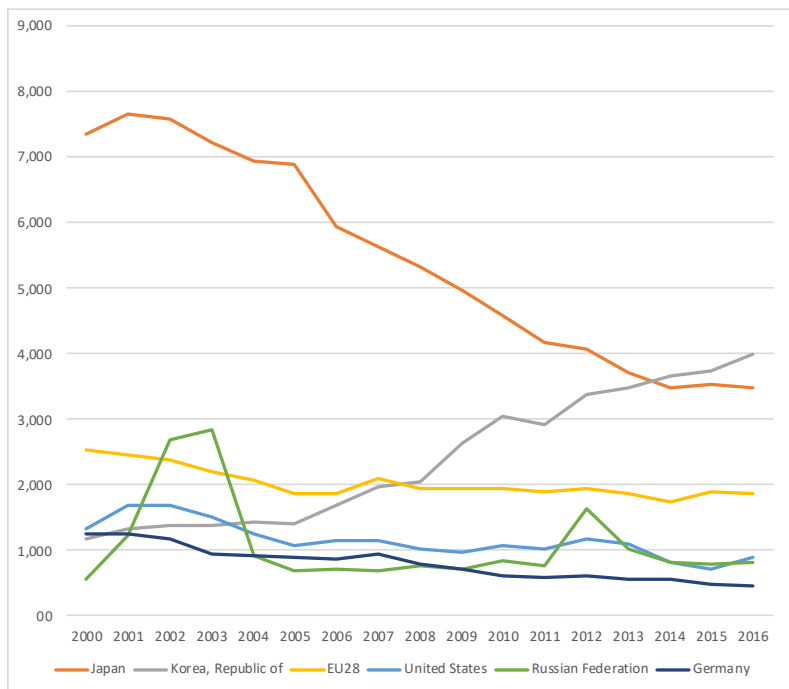
Figure 43: Number of patents in the bio-based area by leading economies



Source: Authors’ own based on data from PATSAT.

For a better view of the trends from other leading countries, the chart below excludes the statistics from China. It shows that over the last two decades, except for South Korea, all leading economies have seen a decline in the patenting activities in the bio-based area, and Japan has exceptionally rapid downward trends. The EU-28 and other economies have been especially challenged by China and South Korea.

Figure 44: Number of patents in the bio-based area by leading economies, excluding China

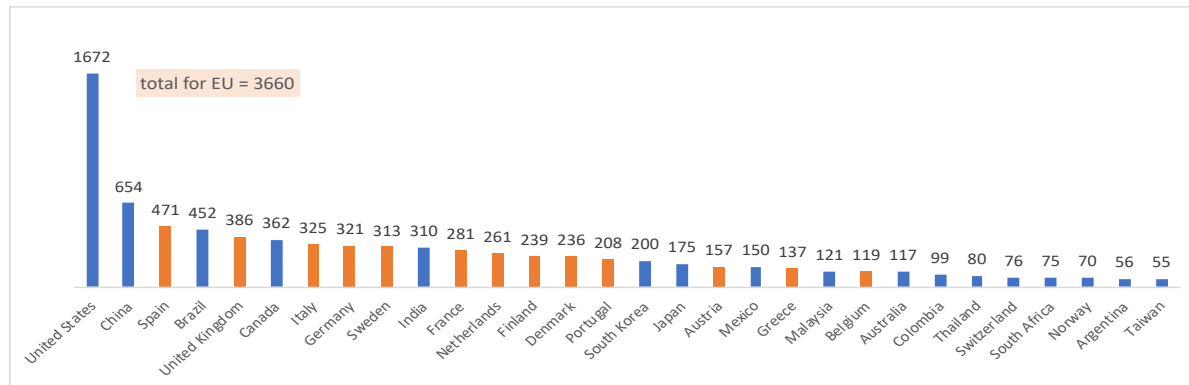


Source: Authors’ own based on data from PATSAT

Within the EU, over the years the leadership in patenting has been with Germany and France, while Poland and Finland have also been performing highly.

When it comes to **scientific publications** in the bio-based area (based on the term 'biorefineries')¹²⁶ the cumulative statistics for the EU countries shows the EU leading on the global level, followed by the USA and China. Within the EU, Spain has performed well coming in 3rd place after China. Other EU leaders are the UK, Italy, Germany and Sweden.

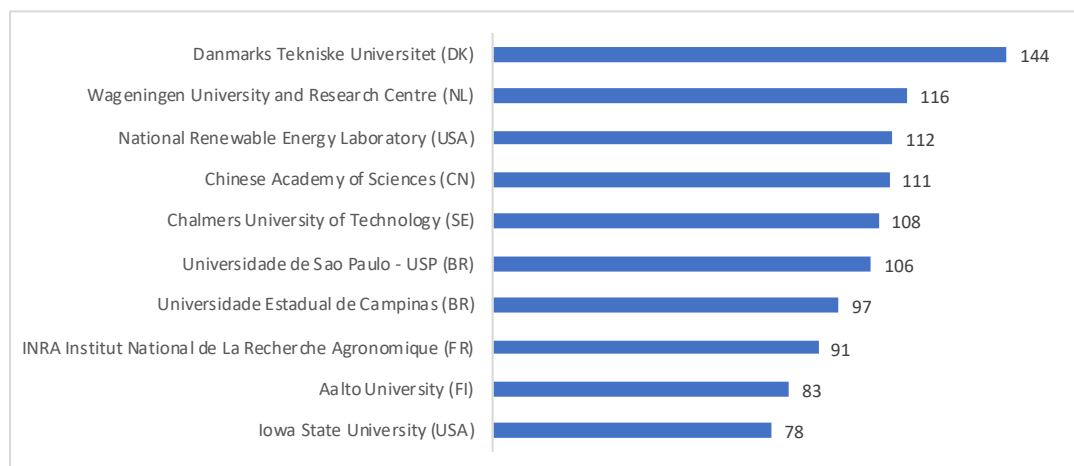
Figure 45: Articles in scientific journals – most prolific countries in the field of 'biorefineries' (2010-2018), number of publications



Source: Scopus. Calculation: Technopolis Group.

In terms of leading (most prolific) organisations, we find a strong presence of EU universities and research institutes, with the Danish DTU and the Dutch Wageningen University and Research Centre the top two leaders. Also a Swedish, French and Finnish organisation are among the top 10. The topic is of key interest to Brazil, as can be seen by two Brazilian organisations among the leaders.

Figure 46: Most prolific organisations in the field of 'biorefineries' (publications 2010-2018)



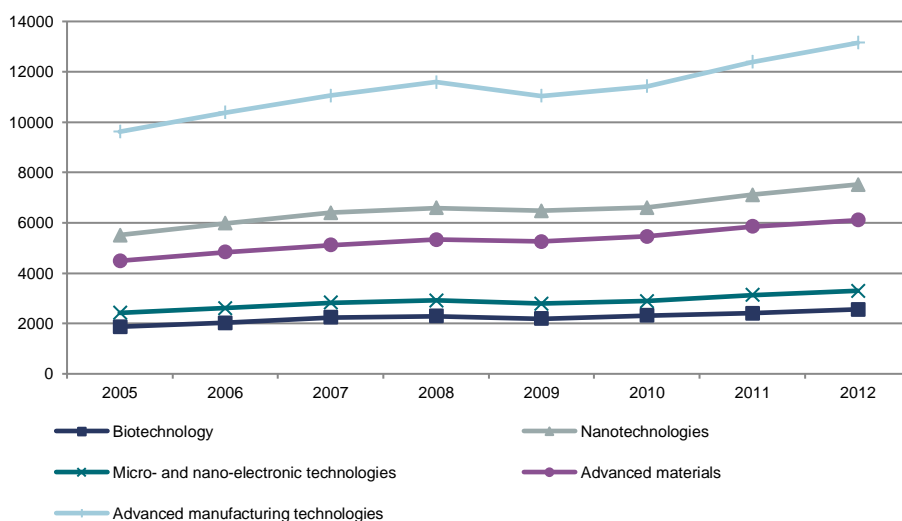
Source: Scopus. Calculation: Technopolis Group.

When it comes to the **R&D expenditure** in bio-based products and services, no specific data has been presented in statistics sources. Special estimates are available only in studies facilitated by the EC. It offers (1) a comparative analysis on the key enabling technologies (KETs) where biotechnology is one of the KETs and (2) estimated the R&D expenditure in the area of biotechnology across the EU to be ca. EUR 2.5 billion in 2012. It was also estimated that the annual average growth rate in R&D expenditure over the

¹²⁶ Details on the methodology for the bibliometric analysis are provided in Appendix G.

period 2005-2012 was 4.6 % in this area.^{127 128} Importantly, the study also highlighted the declining patenting trends against increasing R&I investment in the area during 2005-2012, which is seen not only in EU, but also in the USA.

Figure 47: Business expenditures in R&D, in EUR billion, in KETs in the EU



Source: Frietsch et al., 2017.

D.3 EU and MS policy efforts compared to other countries

Currently, more than 40 states worldwide pursue explicit political strategies to expand and promote their bioeconomies.

In their study, Dietz et al. distinguish between four bio-based transformation paths (TPs): (1) substitution of fossil fuels with bio-based raw materials; (2) productivity increase in bio-based primary sectors; (3) increasing efficiency in biomass utilisation; and (4) value creation and addition through the application of biological principles and processes separate from large-scale biomass production.

Countries having explicit bioeconomy strategies aim to promote transformation processes along at least two of the pathways outlined above. When countries conceive only two transformation pathways, a particular focus is often set on the efficient provision of biomass for TP1, as in the case of Brazil for example.

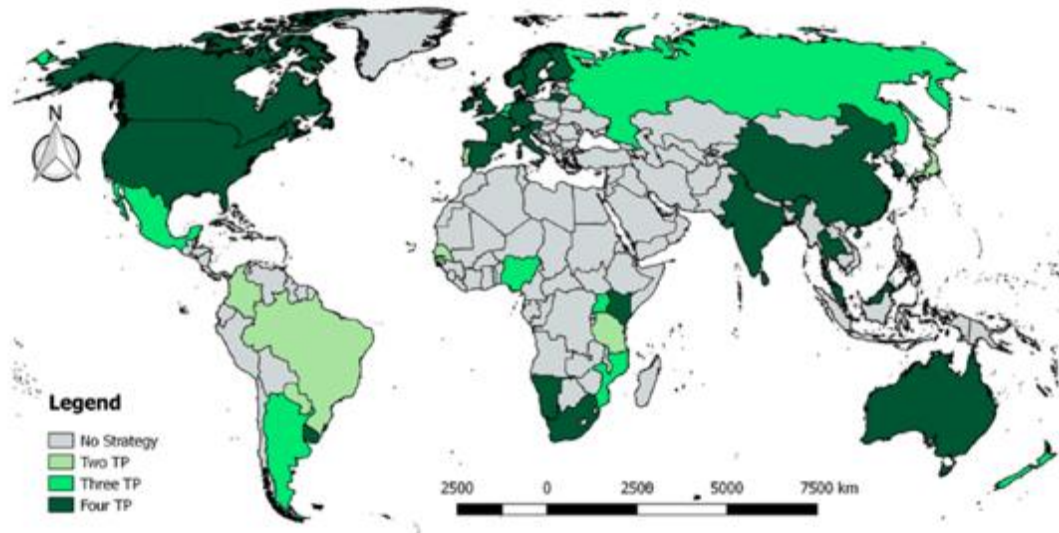
In the case of the European Union, the majority of Member States' bioeconomy strategies are aiming at fostering a transformation process by focusing on four TPs, while exceptions exist for Belgium and The Netherlands who promote three, and Portugal, which is supporting two TPs.¹²⁹

¹²⁷ Frietsch, R., Kladroba, A., Markianidou, P., Neuhäusler, P., Peter, V., Ravet, J., Rothengatter, O., Schneider, J., (2017), *Final report on the collection of patents and business indicators by economic sector: Societal Grand Challenges and Key Enabling Technologies*, European Commission, Brussels.

¹²⁸ Despite the study being dated from 2017, the years covered in the analysis included only up to 2012.

¹²⁹ Dietz, T., Börner J, Janosch Förster J., von Braun J., (2018), *Governance of the Bioeconomy: A global comparative study of national bioeconomy strategies*. Sustainability, Germany.

Figure 48: Transformative pathways by countries



Source: Dietz et al.

Four types of political measures that states can draw upon in promoting their bioeconomies have been outlined below.

Means for enabling governance

- (I) Promoting research and development for a bio-based transformation
- (II) Improving the competitiveness of the bioeconomy through subsidies
- (III) Industrial location policies for bio-based industries
- (IV) Political support for bio-based social change

An analysis of the national strategies based on these categories demonstrates that all these means are fully used by the countries to support the development of their bioeconomies.

Practically all countries with a clear bioeconomy strategy operate at least three of the political measures identified, when the majority of countries even rely on all four measures, which is the case for almost all EU Member States.

However, political support measures alone will not suffice to ensure the development of a sustainable bioeconomy; when the bioeconomy can indeed contribute to the achievement of different SDGs, it can also undermine the achievement of SDGs. An effective political regulation of these conflicting objectives is therefore required. However, most of the states with bioeconomy strategies pay little or no attention to risks and goal conflicts (26 out of 41 states). This is the case for countries such as the USA, Russia, Brazil and Argentina.

In contrast, China and a few African countries clearly admit the necessity to handle risks as a crucial political challenge in implementing a sustainable bioeconomy. Overall, European MS show the highest political sensitivity to potential risks and goal conflicts; the UK identifies five risks, Germany identifies four, Ireland identifies three, France and Austria identify two and the rest of the EU MS identify 1 or no risk.

In their regional assessment, Dietz et al. demonstrate clearly that European Member States have developed the most advanced sustainable bioeconomy strategies, especially the UK and Germany. The role of the European Union of being an active partner in fostering

bioeconomy transformation is plainly reflected in these results. However, most central and eastern EU Member States are, so far, absent from these developments.

Moreover, although many EU Member States have the most advanced bioeconomy strategies compared to other regions, a considerable governance gap still exists between promoting and regulating the bioeconomy. This governance gap is even greater in the Western Hemisphere where regulatory aspects that deal with potential sustainability risks unavoidably arising from bioeconomy strategies are almost completely absent.¹³⁰

¹³⁰ Dietz, T., Börner J, Janosch Förster J., von Braun J., (2018) *Governance of the Bioeconomy: A global comparative study of national bioeconomy strategies*. Sustainability, Germany.

Appendix E Additional information on Section 1, Section 1.2.2: Ongoing partnership The Bio-based Industries Joint Undertaking - BBI JU

E.1 Scope and objectives

The Bio-based Industries Joint Undertaking (BBI JU) is a public-private partnership established under the Innovation Investment Package, as part of Horizon 2020 between the European Commission and the Bio-based Industries Consortium (BIC), aimed at increasing investment in the development of a sustainable bio-based industry sector in Europe.

The objectives of BBI JU are to contribute to a more resource-efficient and sustainable low-carbon economy, and to increasing economic growth and employment, particularly in rural areas. It aspires to bring together all relevant stakeholders, ranging from primary production, large industry, SMEs, clusters, trade associations, academia and RTOs to end-users, to establish innovative bio-based industries as a competitive sector in Europe.

The BBI JU was initiated with the aims to attract consistent private investment, promote R&I along entire values chains, to avoid fragmentation and duplication, and improve coordination in innovation activities of bio-based industries. The institutionalised public-private partnership (PPP) was the selected policy option with the expectation of mobilising greater project resources through significant contributions by industry, and structuring the diverse set of sectors into a functional and innovative EU bio-based industry.

BBI JU intends to invest in R&I, the demonstration and commercialisation of BBI technologies, and to respond to the challenge of creating and maintaining a competitive position of Europe in bio-based innovative solutions.

The role of the BBI JU is to contribute to the implementation of the Strategic Innovation and Research Agenda (SIRA) under Horizon 2020, and to the objectives of the BBI Initiative through the organisation of calls for proposals for supporting research, demonstration and deployment activities in an open, transparent, effective and efficient way, enabling collaboration between stakeholders along the entire value chains, covering primary production of biomass, the processing industry and final use.

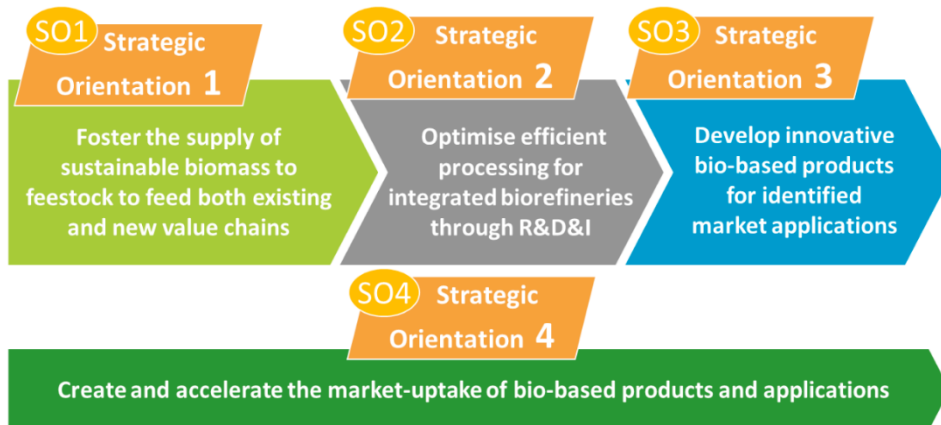
The BBI JU has been mandated to focus on the development of sustainable and competitive bio-based industries in Europe, based on advanced biorefineries that source their biomass sustainably and in particular to:

- demonstrate technologies that enable new chemical building blocks, new materials, and new consumer products from European biomass, which replace the need for fossil-based inputs;
- develop business models that integrate economic actors along the value chain from supply of biomass to biorefinery plants to consumers of bio-based materials, chemicals and fuels, including through creating new cross-sector interconnections and supporting cross-industry clusters;
- set-up flagship biorefinery plants that deploy the technologies and business models for bio-based materials, chemicals and fuels, and demonstrate cost and performance improvements to levels that are competitive with fossil-based alternatives.

SIRA presents the overall strategic orientation of BBI JU, which has been developed by BIC after an extensive consultation with the European Commission and other public and private stakeholders. The original SIRA (2013) underwent a process of revision that resulted in the publication of the adjusted SIRA in July 2017. The SIRA 2017 pursues the crossover between 'traditional' value chains, moving to a multi-value chain approach that intends to transform and valorise new feedstock into new bio-based products for various types of applications.

The SIRA defines four Strategic Orientations of the bio-based industry in Europe, as depicted in the figure below.

Figure 49: Strategic Orientations of the bio-based industry in Europe, defined by BBI JU SIRA



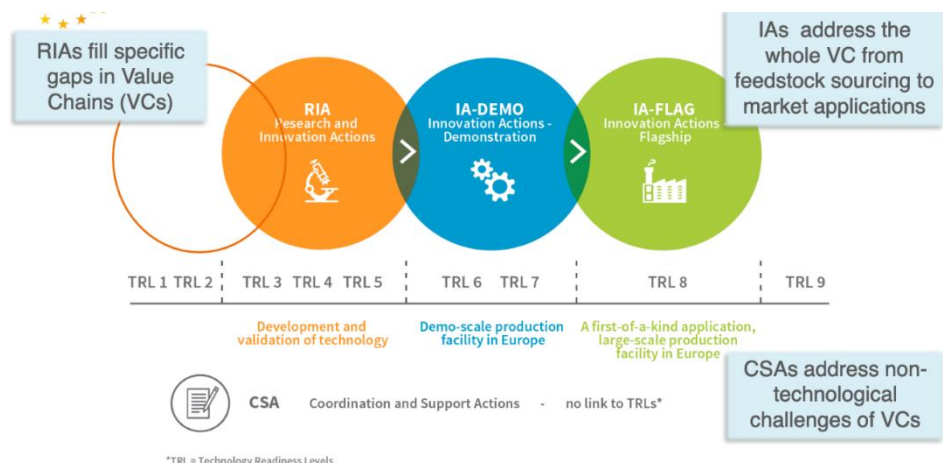
Source: BBI JU.

In their project support programme, BBI JU promote innovation in selected value chains (VCs) including:

- VC1: From lignocellulosic feedstock to advanced biofuels, bio-based chemicals and biomaterials;
- VC2: Next-generation forest-based value chains;
- VC3: Next-generation agro-based value chains;
- VC4: Emergence of new value chains from (organic) waste;
- VC5: Integrated energy, pulp and chemicals biorefineries.

Within BBI JU, the following types of projects are funded: Research and Innovation Actions (RIAs) projects, Innovation Demonstration (IA-DEMO) projects, Flagship projects (IA-FLAG), and Coordination and Support Actions (CSAs).

Figure 50: BBI JU types of actions



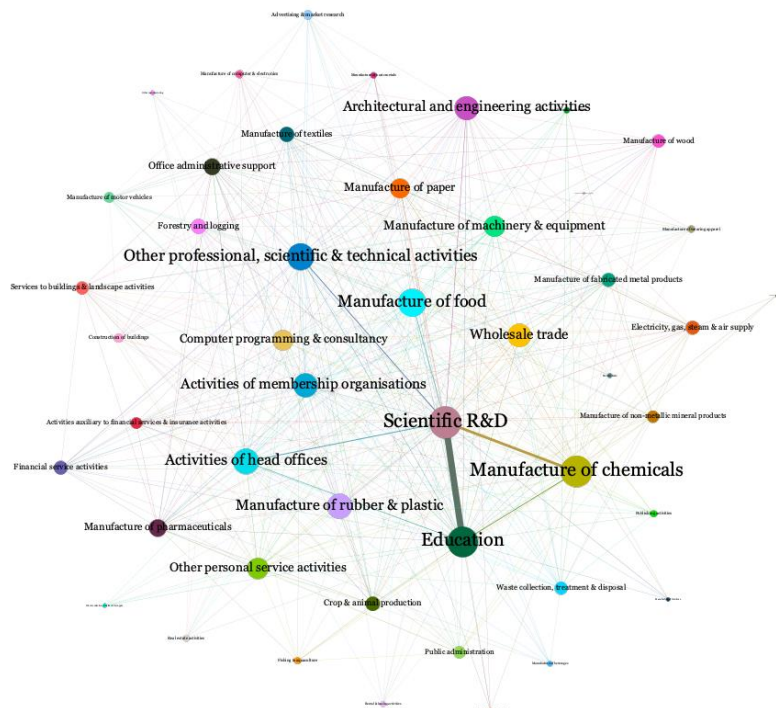
Source: BBI JU

E.2 BBI JU stakeholder analysis

The following two graphs are extracted from the Social Network Analysis of the current partnership participants.

The figure below establishes the participation rates in the relevant partnership, as included in Copernicus Reference Data Access (CORDA).

Figure 51: BBI JU's partner connections by NACE code



Source: Technopolis Group.

It demonstrates the frequency of participation, as well as the connections and collaborations between organisations, shown in terms of their NACE (Nomenclature des Activités Économiques dans la Communauté Européenne)¹³¹ industry sector code.

More than 30 different industry sectors took part in the partnership at least four times. The breadth of the collaborations is quite high, as the collaborations are scattered across all industry sectors and are not limited to only inter-sector collaborations, although inter-sector collaborations still occurred.

The scientific R&D organisations appear as the largest group of participants in the BBI JU partnership. The group/sector has been the most active, followed by education (represented by universities), chemical manufacturers, food manufacturers and other professional, scientific and technical activities. The scientific R&D is also the sector with the highest number of collaborations, making it central to the BBI JU Network.

The majority of collaborations occurred between the main sectors of the partnership, i.e. the sectors with the largest participation; the scientific R&D organisations collaborated the most with the universities (education sector), followed by collaborations with chemical manufacturers. Each of the latter also collaborated between themselves, displaying a collaboration triangle. However, they also collaborated with a high number of smaller

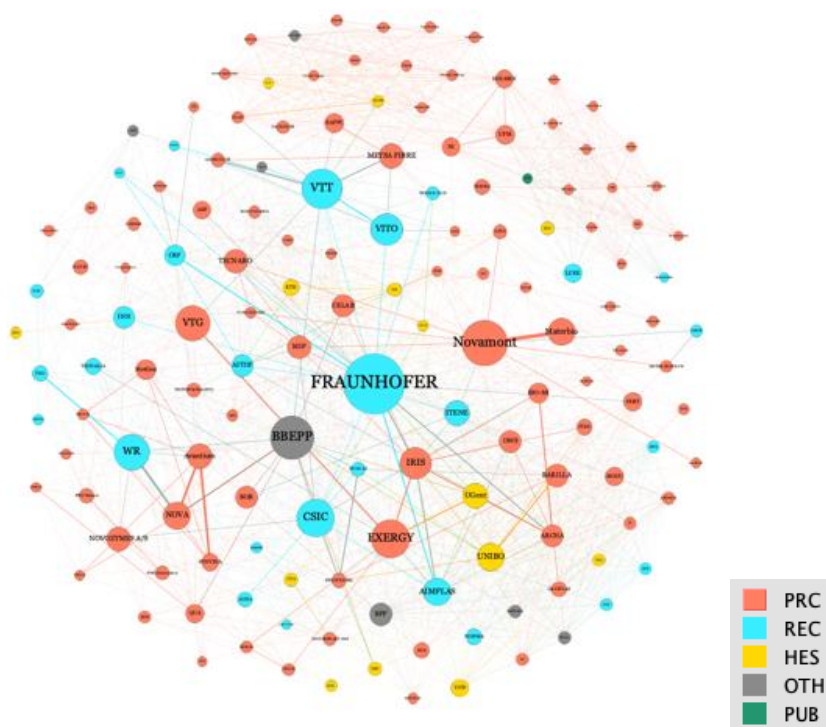
¹³¹ https://ec.europa.eu/competition/mergers/cases/index/nace_all.html

participant sectors such as manufacturers of rubber and plastics, wholesale trade and waste collection, treatment and disposal.

The high number of those present on the network map of the scientific R&D organisations, universities and horizontal organisations like membership organisations, head office consultancies needs to be pointed out. These players are involved in many, if not all, projects, while the specific industrial sector actors only appear in selected thematic projects, so their presence is smaller and cumulatively their linkages with other players are less diverse.

The figure below shows the network connections in terms of type of organisation and distinguishes between the following: PRC – private research companies; REC – public research centres; HES – higher education (universities); OTH – other; PUB – public, non-profit organisations.

Figure 52: BBI JU's partner connections by type of organisation



Source: Technopolis Group.

Private research companies, highlighted in red in the graph, represent the largest group of organisations involved in the BBI JU Partnership. The second largest group is the public research centres (blue), among which is the largest participant of the partnership, Fraunhofer, followed by higher education organisations (yellow).

Most of the collaborations of the partnership take place between private research companies, and they tend to collaborate more than once with the same partner. Public research centres also tend to collaborate primarily with other public research centres, and they often do so on a one-time basis. Hence, collaborations within the partnership are likely to be restricted to collaborations between the same types of organisations. However, the exception is collaborations between private research centres and higher education, as well as between the private research centres and Other sectors, such as with BBEPP.

Among the private research companies, Novamont, EXERGY and VTG are the biggest participants in the partnership, followed by IRIS and MaterBio. The three main participants of the sector did not collaborate with each other; however, they did collaborate with smaller

participants, creating a connection/collaboration hub around them. Other large collaboration schemes developed between Avantium and NOVA, and Avantium and SYNVINA.

Explanation:

The two graphs are made from the participation rates in the relevant partnership as included in CORDA. In the first graph, the organisations are shown in terms of their NACE industry sector. The size of the bubble indicates the frequency of participating, thus, the bigger the bubble, the more often the organisation has participated. The thickness of the lines ('ties') indicates whether two organisations collaborated only once or more than once within the partnership.

The NACE codes were matched by DG RTD using ORBIs database. Please note that not all participants were matched to a NACE code. Missing data for the HES was manually cleaned and adjusted while missing codes for the private sector, research organisations, other and the non-profit sector were not included.

The second graph shows the network in terms of type of organisation. CORDA distinguishes between the following:

PRC – private research (i.e. companies)

REC – research centres (I.e. public research centres)

HES – higher education (universities)

OTH – other

PUB – public, non-profit organisations

E.3 Current achievements of the BBI JU

The BBI JU secretariat is involved in constantly monitoring the activities and performance of the Partnership and projects implemented under its framework and produces annual reports. The KPIs present the progress towards the targets set for 2020. According to the latest progress update (2018), in many KPIs (KPIs 1, 2, 4, 5) the JU achieved results that have gone substantially beyond initial expectation(s). Such dramatic results in KPIs can be explained by the evolving nature of the bio-based products area, the growing interconnectedness of value chains, which are more versatile than the initially modelled nature of bio-based building blocks and materials. This also reflects larger demonstrations of different types of new products.

Table 23: Key performance indicators as presented in annual reports: progress toward 2020 targets

| KPIs numbering and definition | KPI target by 2020 | Result reported in 2018 |
|--|--------------------|-------------------------|
| KPI 1 - New cross-sector interconnections in BBI JU projects | 36 | 143 |
| KPI 2 - New bio-based value chains created with BBI JU projects | 10 | 113 |
| KPI 3 - Number of Grant Agreements signed between BBI JU and the project consortia | 200 | 101 |

| KPIs numbering and definition | KPI target by 2020 | Result reported in 2018 |
|--|--------------------|-------------------------|
| KPI 4 - New bio-based building blocks | 5 | 67 |
| KPI 5 - New bio-based materials | 50 | 147 |
| KPI 6 - New demonstrated consumer products based on bio-based chemicals and materials in IA projects | 30 | 65 |
| KPI 7 - Number of flagship Grant Agreements signed between the BBI JU joint undertaking and project consortia | 5 | 6 |
| KPI 8 - Number of validated technologies that have realised a 'TRL gain' of at least one level in RIA projects | 20 | 33 |

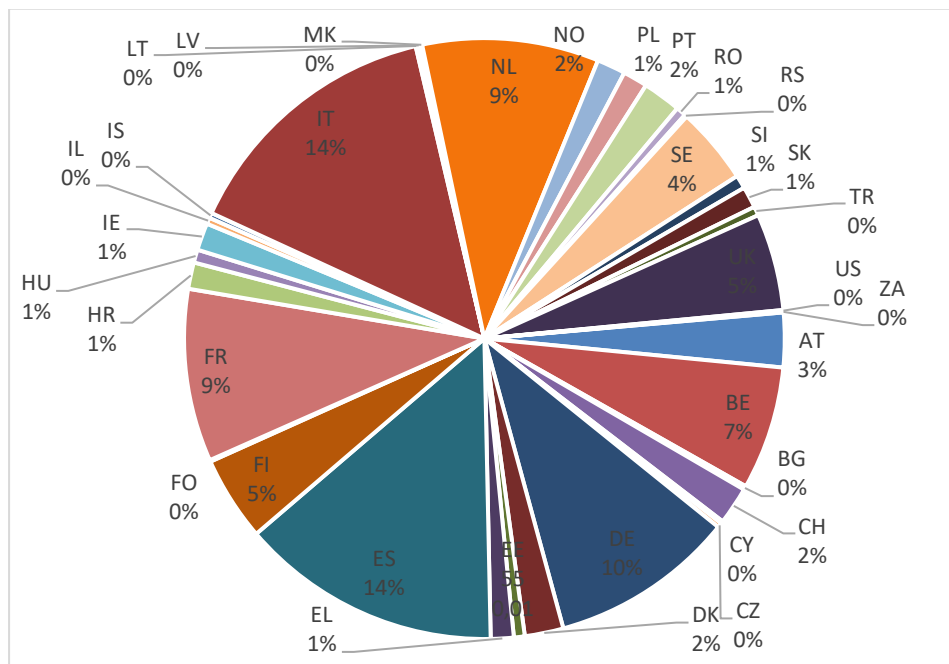
A total of 101 projects has been supported under the BBI JU, which brought together 875 partner organisations. Some partners participated in more than one project, resulting in 9 411 participations across all projects.

Table 24: Participation by types of organisations in the BBI JU projects

| Types of organisations | No of participations | % |
|---|----------------------|------|
| HES – higher education (universities) | 1 153 | 12.3 |
| PRC – private research (i.e. companies) | 5 974 | 63.5 |
| REC – research centres (i.e. public research centres) | 1 692 | 18.0 |
| PUB – public, non-profit organisations | 73 | 0.8 |
| OTH - other | 519 | 5.5 |
| Grand Total | 9 411 | |

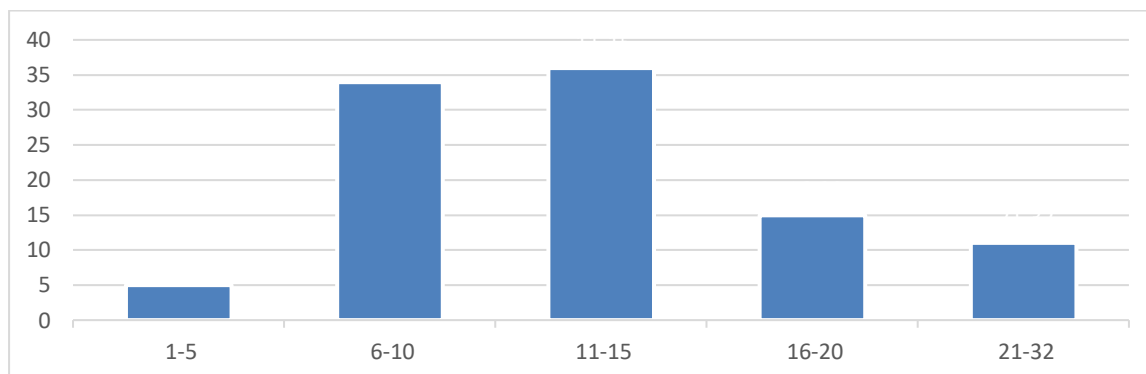
Source: Based on CORDA data.

Figure 53: Country participation in the BBI JU projects, total 9 411



Source: Based on CORDA data.

Figure 54: Distribution of projects by number of participants



Source: Based on CORDA data.

With regard to outputs, 25 out of 101 projects have produced **100 scientific publications** and two projects filed **3 patents**. This is a very low number in comparison with other partnerships, but further analysis of overall industry patent performance and global scientific publications will show the contribution of the BBI JU in these aspects (see detailed bibliometric analysis in Appendix G).

The Bio-based Industries Consortium’s Strategic Innovation & Research Agenda (SIRA)¹³² listed a number of specific objectives for the industry in 2013 (which serves as a base year for the figures presented below), some of which were revised in 2016. While these objectives go beyond the BBI JU, they can provide an indication of how the sector has changed since its creation, partly thanks to its activity.

¹³² <https://biconsortium.eu/sites/biconsortium.eu/files/downloads/SIRA-2017-Web.pdf>

Table 25: BBI specific objectives for the industry

| Specific objective | Target by 2020 | Target by 2030 |
|---|--|--|
| BBI activities will contribute to an increase in biomass supply in Europe. | 10 % increase | 20 % increase |
| BBI activities will boost the mobilisation and utilisation of currently unused sources. | 15 % increase per year | 25 % increase per year |
| BBI results will help maintain and further develop a competitive and knowledge-intensive rural economy in Europe, based on biorefineries. These will result in new, higher and more diversified revenues for farmers and cooperatives, and create new highly skilled jobs. At least four in five of these jobs will be in rural and currently underdeveloped areas. | 400 000 new highly skilled jobs | 700 000 new highly skilled jobs |
| BBI activities will contribute to isolating and valorising protein through additional biomass processing, reducing imports of protein (e.g. soy) for feed in Europe. | 15 % decrease in imports | 50 % decrease in imports |
| BBI activities will trigger programmes to recover and reuse phosphate and potash that will lead to a reduction in imports of those components for fertilisers applied to feedstock production. | 10 % reduction in imports | 25 % reduction in imports |
| The BBI Initiative will contribute to and trigger industrial deployment of bio-based chemicals, biomaterials and advanced biofuels. | <p>20 % of the chemicals and materials produced in Europe will be bio-based</p> <p>At least 2 % of Europe's transport energy demand will be met by sustainable advanced biofuels</p> <p>At least 5 'first-of-their-kind' flagship plants are up and running, demonstrating optimised technologies for biomass conversion into competitive added-value products</p> | <p>25 % of the chemicals and materials produced in Europe will be bio-based</p> <p>6 % of Europe's transport energy demand will be met by sustainable advanced biofuels (if there is a 50 % overall improvement in road transport system efficiency)</p> |
| BBI activities will help create a new generation of bio-based materials and composites so that higher- | The BBI Initiative will contribute to the desired increase in the market | The BBI Initiative will contribute to the desired increase in the market |

| Specific objective | Target by 2020 | Target by 2030 |
|---|---|---|
| performance components can be produced and used in several industries. | application of these materials by a factor of 5 by 2020, compared to 2010 | application of these materials by a factor of 10 by 2030) |
| The BBI Initiative seeks to actively involve academia, research and technology organisations (RTOs) and SMEs in its work, applying the openness and excellence principles, so that the latter (i.e. SMEs) receive at least 20 % of Horizon 2020 funds allocated through the BBI joint undertaking | SMEs to receive at least 20 % of Horizon 2020 funds allocated through the BBI joint undertaking | |

Appendix F Additional information to Section 1, Section 1.2.1 and IPC classes covered in the Patenting analysis (Appendix c)

Note: In defining the list of the IPC classes the scoping of IPC from “the KETs study” was taken as a basis and narrowed down to match better the bio-based products and processes definition. Reference to the KETs study is the following:

Frietsch, R., Kladroba, A., Markianidou, P., Neuhäusler, P., Peter, V., Ravet, J., Rothengatter, O., Schneider, J., (2017), Final report on the collection of patents and business indicators by economic sector: Societal Grand Challenges and Key Enabling Technologies, European Commission, Brussels.

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|----------------------|-------------|-------------------|--|
| Agriculture/forestry | B02B | WIPO, 29 | PREPARING GRAIN FOR MILLING; REFINING GRANULAR FRUIT TO COMMERCIAL PRODUCTS BY WORKING THE SURFACE (making dough from cereals directly A21C; preservation or sterilisation of cereals A23B; cleaning fruit A23N; preparation of malt C12C) |
| Agriculture/forestry | C13B5 | WIPO, 29 | Reducing the size of material from which sugar is to be extracted (for extraction of starch C08B 30/02) [2011.01] |
| Agriculture/forestry | C13B15 | WIPO, 29 | Expressing water from material from which sugar has been extracted (from starch-extracted material C08B 30/10) [2011.01] |
| Agriculture/forestry | C13B25 | WIPO, 29 | Evaporators or boiling pans specially adapted for sugar juices; Evaporating or boiling sugar juices [2011.01] |
| Agriculture/forestry | C13B45 | WIPO, 29 | Cutting machines specially adapted for sugar [2011.01] |
| Agriculture/forestry | C05B | Parts of WIPO, 19 | PHOSPHATIC FERTILISERS |
| Agriculture/forestry | C05C | Parts of WIPO, 19 | NITROGENOUS FERTILISERS |
| Agriculture/forestry | C05D | Parts of WIPO, 19 | INORGANIC FERTILISERS NOT COVERED BY SUBCLASSES C05B, C05C; FERTILISERS PRODUCING CARBON DIOXIDE |
| Agriculture/forestry | C05F | Parts of WIPO, 19 | ORGANIC FERTILISERS NOT COVERED BY SUBCLASSES C05B, C05C, e.g. FERTILISERS FROM WASTE OR REFUSE |
| Agriculture/forestry | C05G | Parts of WIPO, 19 | MIXTURES OF FERTILISERS COVERED INDIVIDUALLY BY DIFFERENT SUBCLASSES OF CLASS C05; MIXTURES OF ONE OR MORE FERTILISERS WITH MATERIALS NOT HAVING A SPECIFIC FERTILISING ACTIVITY, e.g. PESTICIDES, SOIL-CONDITIONERS, WETTING AGENTS |

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|-------------------------------------|-------------|----------------------------------|--|
| | | | (organic fertilisers containing added bacterial cultures, mycelia, or the like C05F 11/08; organic fertilisers containing plant vitamins or hormones C05F 11/10); FERTILISERS CHARACTERISED BY THEIR FORM [4] |
| Pulp and paper | D21C | Own definition based on WIPO | PRODUCTION OF CELLULOSE BY REMOVING NON-CELLULOSE SUBSTANCES FROM CELLULOSE-CONTAINING MATERIALS; REGENERATION OF PULPING LIQUORS; APPARATUS THEREFOR |
| Pulp and paper | D21D | Own definition based on WIPO | TREATMENT OF THE MATERIALS BEFORE PASSING TO THE PAPER-MAKING MACHINE [5] |
| Pulp and paper | D21H | Own definition based on WIPO | PULP COMPOSITIONS; PREPARATION THEREOF NOT COVERED BY SUBCLASSES D21C, D21D; IMPREGNATING OR COATING OF PAPER; TREATMENT OF FINISHED PAPER NOT COVERED BY CLASS B31 OR SUBCLASS D21G; PAPER NOT OTHERWISE PROVIDED FOR [5] |
| Machines (cartons, boxes, printing) | B31D | WIPO, 28, excl. Textile machines | MAKING ARTICLES OF PAPER, CARDBOARD OR MATERIAL WORKED IN A MANNER ANALOGOUS TO PAPER, NOT PROVIDED FOR IN SUBCLASSES B31B OR B31C (manufacture by dry processes of articles made from particles or fibres consisting of wood or other lignocellulosic or like organic material B27N; making layered products not composed wholly of paper or cardboard B32B; making articles from cellulosic fibrous suspensions, e.g. wood pulp, D21J) |
| Machines (cartons, boxes, printing) | C14B | WIPO, 28, excl. Textile machines | MECHANICAL TREATMENT OR PROCESSING OF SKINS, HIDES, OR LEATHER IN GENERAL; PELT-SHEARING MACHINES; INTESTINE-SPLITTING MACHINES (mechanical cleaning of hides or the like D06G) |
| Machines (cartons, boxes, printing) | D01B | WIPO, 28, excl. Textile machines | MECHANICAL TREATMENT OF NATURAL FIBROUS OR FILAMENTARY MATERIAL TO OBTAIN FIBRES OR FILAMENTS, e.g. FOR SPINNING (crude extraction of asbestos fibres from ores B03B; apparatus for retting D01C) |
| Machines (cartons, boxes, printing) | D01C | WIPO, 28, excl. Textile machines | CHEMICAL OR BIOLOGICAL TREATMENT OF NATURAL FILAMENTARY OR FIBROUS MATERIAL |

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|-------------------------------------|-------------|----------------------------------|--|
| | | | TO OBTAIN FILAMENTS OR FIBRES FOR SPINNING; CARBONISING RAGS TO RECOVER ANIMAL FIBRES |
| Machines (cartons, boxes, printing) | D01D | WIPO, 28, excl. Textile machines | MECHANICAL METHODS OR APPARATUS IN THE MANUFACTURE OF MAN-MADE FILAMENTS, THREADS, FIBRES, BRISTLES OR RIBBONS (working or processing of metal wire B21F; fibres or filaments of softened glass, minerals or slag C03B 37/00) |
| Machines (cartons, boxes, printing) | D01F | WIPO, 28, excl. Textile machines | CHEMICAL FEATURES IN THE MANUFACTURE OF MAN-MADE FILAMENTS, THREADS, FIBRES, BRISTLES OR RIBBONS; APPARATUS SPECIALLY ADAPTED FOR THE MANUFACTURE OF CARBON FILAMENTS [2] |
| Machines (cartons, boxes, printing) | D21C | WIPO, 28, excl. Textile machines | PRODUCTION OF CELLULOSE BY REMOVING NON-CELLULOSE SUBSTANCES FROM CELLULOSE-CONTAINING MATERIALS; REGENERATION OF PULPING LIQUORS; APPARATUS THEREFOR |
| Food | A23J | WIPO, 18 | PROTEIN COMPOSITIONS FOR FOODSTUFFS; WORKING-UP PROTEINS FOR FOODSTUFFS; PHOSPHATIDE COMPOSITIONS FOR FOODSTUFFS [4] |
| Food | C12F | WIPO, 18 | RECOVERY OF BY-PRODUCTS OF FERMENTED SOLUTIONS; DENATURING OF, OR DENATURED, ALCOHOL [6] |
| Food | C13K | WIPO, 18 | SACCHARIDES, OTHER THAN SUCROSE, OBTAINED FROM NATURAL SOURCES OR BY HYDROLYSIS OF NATURALLY OCCURRING DI-, OLIGO- OR POLYSACCHARIDES (chemically synthesised sugars or sugar derivatives C07H; polysaccharides, e.g. starch, derivatives thereof C08B; malt C12C; fermentation or enzyme-using processes for preparing compounds containing saccharide radicals C12P 19/00) |
| Food | C13B30 | WIPO, 18 | Crystallisation; Crystallising apparatus; Separating crystals from mother liquors [2011.01] |
| Food | C13B35 | WIPO, 18 | Extraction of sucrose from molasses [2011.01] |
| Food | C13B40 | WIPO, 18 | Drying sugar [2011.01] |

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|-----------------|-------------|--|--|
| Food | C13B50 | WIPO, 18 | Sugar products, e.g. powdered, lump or liquid sugar; Working-up of sugar (C13B 40/00, C13B 45/00 take precedence; confectionery A23G 3/00) [2011.01] |
| Food | C13B99 | WIPO, 18 | Subject matter not provided for in other groups of this subclass [2011.01] |
| Future proteins | C07K | KETs study definition | PEPTIDES (peptides containing β -lactam rings C07D; cyclic dipeptides not having in their molecule any other peptide link than those which form their ring, e.g. piperazine-2,5-diones, C07D; ergot alkaloids of the cyclic peptide type C07D 519/02; single cell proteins, enzymes C12N; genetic engineering processes for obtaining peptides C12N 15/00) [4] |
| Biomass | C10L5/40 | WIPO, green inventory KETs study definition | essentially based on materials of non-mineral origin [2006.01] |
| Biomass | C10L5/42 | WIPO, green inventory KETs study definition | on animal substances or products obtained therefrom [2006.01] |
| Biomass | C10L5/44 | WIPO, green inventory KETs study definition | on vegetable substances [2006.01] |
| Biomass | C10L5/46 | WIPO, green inventory KETs study definition | on sewage, house, or town refuse [2006.01] |
| Biomass | C10L5/48 | WIPO, green inventory KETs study definition | on industrial residues or waste materials (C10L 5/42, C10L 5/44 take precedence) [2006.01] |
| Biomass | C10B53/02 | WIPO, green inventory KETs study definition | of cellulose-containing material (production of pyroligneous acid C10C 5/00) [2006.01] |
| Biomass | A01C3/02 | WIPO, green inventory KETs study definition | Storage places for manure, e.g. cisterns for liquid manure; Installations for fermenting manure (sewerage structures E03F 5/00; silos, bunkers E04H 7/22) [2006.01] |
| Biomass | C02F11/04 | WIPO, green inventory KETs study definition | Anaerobic treatment; Production of methane by such processes [2006.01] |
| Biomass | C05F17/02 | WIPO, green inventory KETs study definition | Apparatus therefor [2006.01] |

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|---------------|-------------|---|--|
| Biomass | B01D53/84 | WIPO, green inventory KETs study definition | Biological processes [2006.01] |
| Biomass | F23G7/10 | WIPO, green inventory KETs study definition | of field or garden waste [2006.01] |
| Bio-materials | C08B | KETs study definition | POLYSACCHARIDES; DERIVATIVES THEREOF (polysaccharides containing less than six saccharide radicals attached to each other by glycosidic linkages C07H; fermentation or enzyme-using processes C12P 19/00; production of cellulose D21) [4] |
| Bio-materials | C08C | KETs study definition | TREATMENT OR CHEMICAL MODIFICATION OF RUBBERS |
| Bio-materials | C08H | KETs study definition | DERIVATIVES OF NATURAL MACROMOLECULAR COMPOUNDS (polysaccharides C08B; natural rubber C08C; natural resins or their derivatives C09F; working up pitch, asphalt or bitumen C10C 3/00) |
| Bio-materials | C09F | KETs study definition | NATURAL RESINS; FRENCH POLISH; DRYING-OILS; DRIERS (SICCATIVES); TURPENTINE |
| Bio-materials | C11B | KETs study definition | PRODUCING, e.g. BY PRESSING RAW MATERIALS OR BY EXTRACTION FROM WASTE MATERIALS, REFINING OR PRESERVING FATS, FATTY SUBSTANCES, e.g. LANOLIN, FATTY OILS OR WAXES; ESSENTIAL OILS; PERFUMES (drying-oils C09F) |
| Bio-materials | C11C | KETs study definition | FATTY ACIDS OBTAINED FROM FATS, OILS OR WAXES; CANDLES; FATS, OILS OR FATTY ACIDS OBTAINED BY CHEMICAL MODIFICATION OF FATS, OILS OR FATTY ACIDS |
| Bio-materials | C13B | KETs study definition | PRODUCTION OF SUCROSE; APPARATUS SPECIALLY ADAPTED THEREFOR (chemically synthesised sugars or sugar derivatives C07H; fermentation or enzyme-using processes for preparing compounds containing saccharide radicals C12P 19/00) [2011.01] |
| Bio-materials | D21H | KETs study definition | PULP COMPOSITIONS; PREPARATION THEREOF NOT COVERED BY SUBCLASSES D21C, D21D; IMPREGNATING OR COATING OF PAPER; TREATMENT OF FINISHED PAPER NOT COVERED BY CLASS B31 |

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|---------------|-------------|-----------------------|---|
| | | | OR SUBCLASS D21G; PAPER NOT OTHERWISE PROVIDED FOR [5] |
| Bio-materials | C08L1 | KETs study definition | Compositions of cellulose, modified cellulose, or cellulose derivatives [2006.01] |
| Bio-materials | C08L3 | KETs study definition | Compositions of starch, amylose or amylopectin or of their derivatives or degradation products [2006.01] |
| Bio-materials | C08L5 | KETs study definition | Compositions of polysaccharides or of their derivatives not provided for in group C08L 1/00 or C08L 3/00 [2006.01] |
| Bio-materials | C08L7 | KETs study definition | Compositions of natural rubber [2006.01] |
| Bio-materials | C09J101 | KETs study definition | Adhesives based on cellulose, modified cellulose, or cellulose derivatives [2006.01] |
| Bio-materials | C09J103 | KETs study definition | Adhesives based on starch, amylose or amylopectin or on their derivatives or degradation products [2006.01] |
| Bio-materials | C09J105 | KETs study definition | Adhesives based on polysaccharides or on their derivatives, not provided for in groups C09J 101/00 or C09J 103/00 [2006.01] |
| Bio-materials | C09J107 | KETs study definition | Adhesives based on natural rubber [2006.01] |
| Bio-materials | C09K17 | KETs study definition | Soil-conditioning materials or soil-stabilising materials [2006.01] |
| Bio-materials | A61K36/02 | KETs study definition | Algae [2006.01] |
| Bio-materials | A61K36/03 | KETs study definition | Phaeophycota or phaeophyta (brown algae), e.g. Fucus [2006.01] |
| Bio-materials | A61K36/04 | KETs study definition | Rhodophycota or rhodophyta (red algae), e.g. Porphyra [2006.01] |
| Bio-materials | A61K36/05 | KETs study definition | Chlorophycota or chlorophyta (green algae), e.g. Chlorella [2006.01] |
| Marine | A01H15 | KETs study definition | Fungi; Lichens (fungal microorganisms C12N 1/14) [2006.01] |
| Biotech | A01H1/00 | OECD | Processes for modifying genotypes (A01H 4/00 takes precedence) [2006.01] |
| Biotech | A01H4/00 | OECD | Plant reproduction by tissue culture techniques [2006.01] |

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|-------------|-------------|--|---|
| Biotech | G01N27/327 | OECD, Eurostat | Biochemical electrodes [2006.01] |
| Biotech | C12M | OECD, Eurostat | APPARATUS FOR ENZYMOLOGY OR MICROBIOLOGY (installations for fermenting manure A01C 3/02; preservation of living parts of humans or animals A01N 1/02; brewing apparatus C12C; fermentation apparatus for wine C12G; apparatus for preparing vinegar C12J 1/10) [3] |
| Biotech | C12N | OECD, Eurostat | MICROORGANISMS OR ENZYMES; COMPOSITIONS THEREOF (biocides, pest repellants or attractants, or plant growth regulators containing microorganisms, viruses, microbial fungi, enzymes, fermentates, or substances produced by, or extracted from, microorganisms or animal material A01N 63/00; medicinal preparations A61K; fertilisers C05F); PROPAGATING, PRESERVING, OR MAINTAINING MICROORGANISMS; MUTATION OR GENETIC ENGINEERING; CULTURE MEDIA (microbiological testing media C12Q 1/00) [3] |
| Biotech | C12P | OECD, Eurostat | FERMENTATION OR ENZYME-USING PROCESSES TO SYNTHESISE A DESIRED CHEMICAL COMPOUND OR COMPOSITION OR TO SEPARATE OPTICAL ISOMERS FROM A RACEMIC MIXTURE [3] |
| Biotech | C12Q | OECD, Eurostat | MEASURING OR TESTING PROCESSES INVOLVING ENZYMES, NUCLEIC ACIDS OR MICROORGANISMS (immunoassay G01N 33/53); COMPOSITIONS OR TEST PAPERS THEREFOR; PROCESSES OF PREPARING SUCH COMPOSITIONS; CONDITION-RESPONSIVE CONTROL IN MICROBIOLOGICAL OR ENZYMOLOGICAL PROCESSES [3] |
| Biotech | C07C29 | Additional codes from KETs Observatory | Preparation of compounds having hydroxy or O-metal groups bound to a carbon atom not belonging to a six-membered aromatic ring [2006.01] |
| Biotech | C07D475 | Additional codes from KETs Observatory | Heterocyclic compounds containing pteridine ring systems [2006.01] |
| Biotech | C07K2 | Additional codes from KETs Observatory | Peptides of undefined number of amino acids; Derivatives thereof [2006.01] |

| FIELD TITLE | IPC CLASSES | SOURCE | DEFINITION |
|-------------|-------------|--|--|
| Biotech | C08B3 | Additional codes from KETs Observatory | Preparation of cellulose esters of organic acids [2006.01] |
| Biotech | C08B7 | Additional codes from KETs Observatory | Preparation of cellulose esters of both organic and inorganic acids [2006.01] |
| Biotech | C08H1 | Additional codes from KETs Observatory | Macromolecular products derived from proteins (food proteins A23, e.g. A23J; preparation of glue or gelatine C09H) [2006.01] |
| Biotech | C08L89 | Additional codes from KETs Observatory | Compositions of proteins; Compositions of derivatives thereof [2006.01] |
| Biotech | C09D11 | Additional codes from KETs Observatory | Inks [2014.01] |
| Biotech | C09D189 | Additional codes from KETs Observatory | Coating compositions based on proteins; Coating compositions based on derivatives thereof [2006.01] |
| Biotech | C09J189 | Additional codes from KETs Observatory | Adhesives based on proteins; Adhesives based on derivatives thereof [2006.01] |

Appendix G Additional information to Section 1, Section 1.2.1 and Bibliometric analysis (Appendix C)

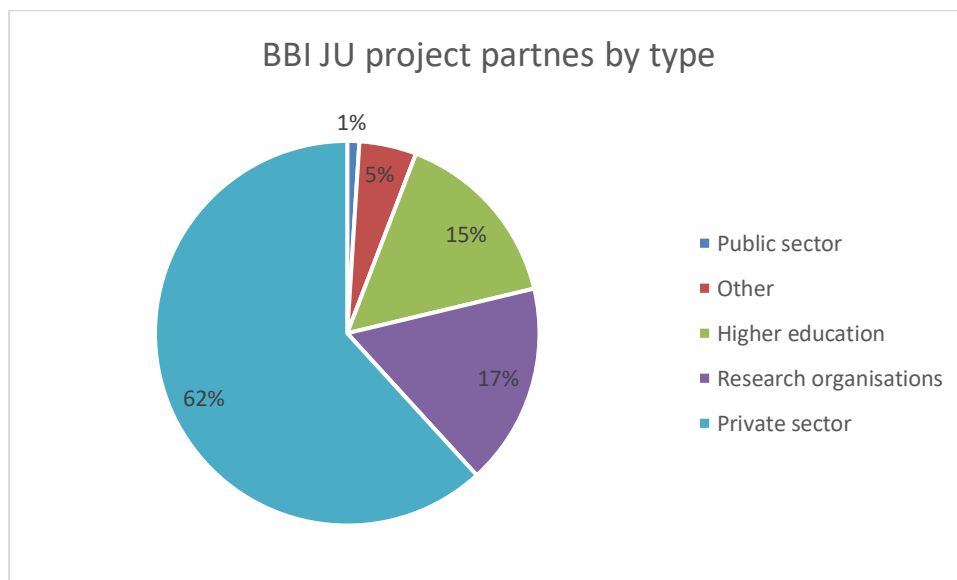
The bibliometric analysis presented here has been performed by the Technopolis Group data team. Methodology has been developed internally by the team.

The topical scoping has been based on the thematic outreach of the current BBI JU projects, which helped to extract relevant keywords and perform global analysis of S&T trends in the area feeding Section 1.2.1

G.1 Scientific analysis of bio-based industries

In BBI JU, 100 projects have been funded since the start of the programme. They brought together 395 individual beneficiaries with a majority of 62 % coming from the private sector.

Figure 55: Composition of BBI JU projects by type of participant



Source: DG RTD. Calculation: Technopolis Group.

Of the BBI JU projects, 25 produced 100 publications in the field of 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy'. They developed as follows:

Table 26: Number and share of publications by year

| Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy | 2016 | 2017 | 2018 | 2019 | Total |
|---|------|------|------|------|-------|
| Total | 5 | 26 | 51 | 18 | 100 |
| Share | 5 % | 26 % | 51 % | 18 % | 100 % |

Source: DG RTD. Calculation: Technopolis Group.

Based on the topic calls, we can see that the largest share of these publications can be found in the area of biorefineries.

Table 27: Evolution of BBI JU projects by topic of calls

| Topics of calls | 2016 | 2017 | 2018 | 2019 | Total | Share |
|---|------------|-------------|-------------|-------------|--------------|--------------|
| Bio-based alternatives to improve protection of human health and the environment | | | 1 | 2 | 3 | 3 % |
| Biopolymers with advanced functionalities for high performance applications | | 1 | 9 | 1 | 11 | 11 % |
| Conversion of lignin-rich streams from biorefineries | | 1 | 3 | 2 | 6 | 6 % |
| Efficient pre-treatment of lignocellulosic feedstock to advanced bio-based chemicals and biomaterials | 1 | | 2 | | 3 | 3 % |
| Exploiting algae and other aquatic biomass for production of molecules for pharma, nutraceuticals, food additives and cosmetic applications | | 1 | 7 | 4 | 12 | 12 % |
| Exploiting extremophiles and extremozymes to broaden the processing conditions to convert biomass into high-value building blocks | | | 1 | | 1 | 1 % |
| Fermentation processes to obtain bio-surfactants and specialty carbohydrates from agricultural and agro-industrial streams | | | 5 | | 5 | 5 % |
| Fibres and polymers from lignin | 1 | 3 | 4 | | 8 | 8 % |
| Functional additives from residues from the agro-food industry | | | 1 | | 1 | 1 % |
| Innovative efficient biorefinery technologies | 1 | 13 | 12 | 3 | 29 | 29 % |
| Lignocellulosic feedstocks into chemical building blocks and high added value products | | | | 1 | 1 | 1 % |
| New sustainable pulping technologies | 2 | | 1 | 1 | 4 | 4 % |
| Nutrient recovery from bio-based waste streams and residues | | | | 1 | 1 | 1 % |
| Practices increasing effectiveness of forest management | | 5 | 4 | 2 | 11 | 11 % |
| Protein products from plant residues | | 1 | | | 1 | 1 % |
| Valorisation of agricultural residues and side streams from the agro-food industry | | 1 | | 1 | 2 | 2 % |
| Valorisation of by-products or waste-streams from the food processing industry into high added-value products for market applications | | | 1 | | 1 | 1 % |
| Total | 5 | 26 | 51 | 18 | 100 | 100 % |
| Share | 5 % | 26 % | 51 % | 18 % | 100 % | |

Source: DG RTD. Calculation: Technopolis Group.

In terms of country affiliation of authors of these publications, we can see overlap but also discrepancies: not all countries involved in the partnership are represented in the

publications, while countries not represented in the partnership appear as author affiliations. Switzerland, Norway, Serbia and South Africa were four non-EU countries that participated.

Table 28: Participating countries by type of organisation

| Countries | HES | PRC | PUB | REC | OTH | Total |
|---------------------|-------------|-------------|------------|-------------|------------|------------|
| Germany | 4 | 45 | | 10 | 1 | 60 |
| Netherlands | 5 | 38 | | 5 | 3 | 51 |
| France | 11 | 23 | 1 | 10 | 2 | 47 |
| Spain | 5 | 17 | | 11 | 3 | 36 |
| Italy | 7 | 16 | | 9 | 1 | 33 |
| United Kingdom | 7 | 20 | | 1 | 1 | 29 |
| Belgium | 5 | 15 | | 3 | 5 | 28 |
| Finland | 1 | 18 | | 8 | 1 | 28 |
| Austria | 1 | 9 | 1 | 2 | 1 | 14 |
| Sweden | 5 | 7 | | 1 | | 13 |
| Ireland | 4 | 6 | 1 | 1 | | 12 |
| Portugal | 1 | 10 | | 1 | | 12 |
| <i>Switzerland</i> | | 6 | 1 | | | 7 |
| <i>Norway</i> | | 4 | | 2 | 1 | 7 |
| Denmark | 1 | 4 | | | | 5 |
| Greece | 1 | 1 | | | | 2 |
| Croatia | | 2 | | | | 2 |
| Cyprus | | 1 | | | | 1 |
| Hungary | | 1 | | | | 1 |
| Lithuania | | 1 | | | | 1 |
| Latvia | | | | 1 | | 1 |
| Poland | 1 | | | | | 1 |
| <i>Serbia</i> | 1 | | | | | 1 |
| Slovenia | | | | 1 | | 1 |
| Slovakia | | | | 1 | | 1 |
| <i>South Africa</i> | 1 | | | | | 1 |
| Total | 61 | 244 | 4 | 67 | 19 | 395 |
| In % | 15.4 | 61.8 | 1.0 | 17.0 | 4.8 | 100 |

Source: DG RTD. Calculation: Technopolis Group.

Broader networks can be identified through the publications: out of the 100 publications included in CORDA, 84 were identified in Scopus. The analysis of the authors' affiliations

by country indicates that participating researchers also co-publish with researchers outside the BBI realm. The following table indicates the authors' country affiliation. If a publication was, for example, by two different Spanish organisations and one from Denmark, Spain would be credited twice in the table below. The information is thus no indication of productivity but does indicate the involved countries.

Table 29: List of countries mentioned as author affiliations (organisations) in BBI publications

| Country | Number of publications | Country | Number of publications |
|-----------|------------------------|----------------------|------------------------|
| Australia | 3 | Netherlands | 19 |
| Austria | 5 | Norway | 1 |
| Belgium | 14 | Portugal | 1 |
| Brazil | 1 | Russian Federation | 1 |
| China | 1 | South Africa | 1 |
| Denmark | 2 | Spain | 40 |
| Finland | 10 | Sweden | 4 |
| France | 18 | Thailand | 1 |
| Germany | 28 | Turkey | 1 |
| Greece | 2 | United Arab Emirates | 3 |
| Ireland | 8 | United Kingdom | 4 |
| Italy | 33 | United States | 6 |
| Latvia | 2 | Vietnam | 1 |

Source: DG RTD. Calculation: Technopolis Group.

Twenty out of the 25 projects with publications published 1 or 2 publications. Four produced 8 to 9 and one even 27.

Table 30: Number of publications by project

| Project acronym | Number of publications by project | Project acronym | Number of publications by project |
|-----------------|-----------------------------------|-----------------|-----------------------------------|
| ABACUS | 1 | POLYBIOSKIN | 9 |
| AgriChemWhey | 1 | PROMINENT | 1 |
| AgriMax | 1 | PROVIDES | 4 |
| BARBARA | 1 | PULP2VALUE | 1 |
| BIOFOREVER | 1 | RESOLVE | 3 |
| BIOrescue | 2 | SmartLi | 8 |
| CARBOSURF | 5 | SSUCHY | 1 |
| EFFORTE | 3 | TECH4EFFECT | 8 |
| EnzOx2 | 27 | US4GREENCHEM | 3 |

| Project acronym | Number of publications by project | Project acronym | Number of publications by project |
|-----------------|-----------------------------------|-----------------|-----------------------------------|
| FUNGUSCHAIN | 1 | VALUEMAG | 9 |
| LIBRE | 4 | WoodZymes | 1 |
| MAGNIFICENT | 2 | Zelcor | 2 |
| NewFert | 1 | | |
| Total | | | 100 |

Source: DG RTD. Calculation: Technopolis Group.

The projects provide the information as to whether a publication is a joint public-private co-publication, or not. While two-thirds are non-collaborative, one-third is collaborative.

Table 31: Number and share of collaborative publications, by year

| Joint public/private publications | 2016 | 2017 | 2018 | 2019 | Total | Share |
|-----------------------------------|------|------|------|------|-------|-------|
| No | 2 | 15 | 37 | 15 | 69 | 69 % |
| Yes | 3 | 11 | 14 | 3 | 31 | 31 % |
| Total | 5 | 26 | 51 | 18 | 100 | 100 % |

Source: DG RTD. Calculation: Technopolis Group.

The 100 publications were published in 70 different journals. The following lists those journals with at least 2 publications.

Table 32: Main journals covering the sector

| Journal title | Total |
|--|-------|
| Biotechnology for Biofuels | 4 |
| Green Chemistry | 4 |
| Molecules | 4 |
| ACS Sustainable Chemistry & Engineering | 3 |
| Forests | 3 |
| Industrial Crops and Products | 3 |
| Journal of Cleaner Production | 3 |
| Marine Drugs | 3 |
| ACS Catalysis | 2 |
| Biotechnology and Bioengineering | 2 |
| Catalysis Science & Technology | 2 |
| Chemistry – A European Journal | 2 |
| Frontiers in Microbiology | 2 |
| Genome Announcements | 2 |
| International Journal of Biological Macromolecules | 2 |

| Journal title | Total |
|--|-------|
| International Journal of Forest Engineering | 2 |
| Journal of clinical and cosmetic dermatology | 2 |
| Scientific Reports | 2 |
| Sustainability | 2 |

Source: DG RTD. Calculation: Technopolis Group.

G.2 BBI and international scientific benchmarking

In order to analyse how the partnership is performing in comparison to the rest of the world, we first need to define the bio-based industries in terms of scope. This can be done, for example, through journals or keywords.

Besides the journal titles of the bio-based industries' publications, we drew keywords from CORDA, which also includes keywords provided by the project. Based on these keywords, the most often used terms are in connection with 'bio'. The list below gives the other terms used most often:

Table 33: Most frequently used keywords for project descriptions

| Key-word | Frequency |
|------------------------|-----------|
| biorefinery/refineries | 18 |
| sustainability | 11 |
| lignin | 10 |
| biomass | 8 |
| food | 7 |
| bio-degradable | 6 |
| bio-economy | 6 |
| cellulose | 6 |
| circular economy | 6 |
| cosmetics | 6 |
| lignocellulose | 6 |
| bio-active | 5 |
| bio-based | 5 |
| cascading approach | 5 |
| enzymatic hydrolysis | 5 |
| proteins | 5 |
| bio-based products | 4 |
| bio-plastic | 4 |
| fractionation | 4 |
| recyclable | 4 |

| Key-word | Frequency |
|--------------|-----------|
| side streams | 4 |

Source: DG RTD. Calculation: Technopolis Group.

We then tested the term 'biorefinery/biorefineries' in Scopus. The search was limited to the years 2010-2018 but we did not limit this by type of publication. This can be analysed by comparing the list of journals and the keywords – which are provided by the authors.

Table 34: 30 most frequently used keywords in the field of 'biorefineries' (2010-2018)

| Biorefineries | 2 459 | Biotechnology | 559 |
|---------------|-------|-------------------------|-----|
| Refining | 2 131 | Lignocellulose | 558 |
| Biomass | 2 106 | Glucose | 489 |
| Biorefinery | 1 986 | Bioethanol | 487 |
| Lignin | 1 306 | Lignocellulosic Biomass | 482 |
| Cellulose | 1 277 | Enzymatic Hydrolysis | 451 |
| Biofuels | 1 195 | Enzyme Activity | 435 |
| Bioconversion | 1 158 | Sustainable Development | 399 |
| Ethanol | 1 053 | Extraction | 398 |
| Biofuel | 1 007 | Optimisation | 394 |
| Hydrolysis | 924 | Biotechnology | 559 |
| Fermentation | 873 | Lignocellulose | 558 |
| Metabolism | 598 | Glucose | 489 |
| Feedstocks | 583 | Bioethanol | 487 |
| Chemistry | 574 | Lignocellulosic Biomass | 482 |

Source: Scopus. Calculation: Technopolis Group.

The comparison of the keywords suggests a rather close match of the bio-based sector with the (worldwide) field of 'biorefineries'.

A second comparison can be made with the journals. However, the limited number within bio-based industries may be of limited explanatory power.

The following provides the list of the most frequently used journals within the field of biorefineries. The ones marked in red are also those among the most frequently 'used' journals in the sector.

Table 35: Most frequently used journals in the field of biorefinery (2010-2018)

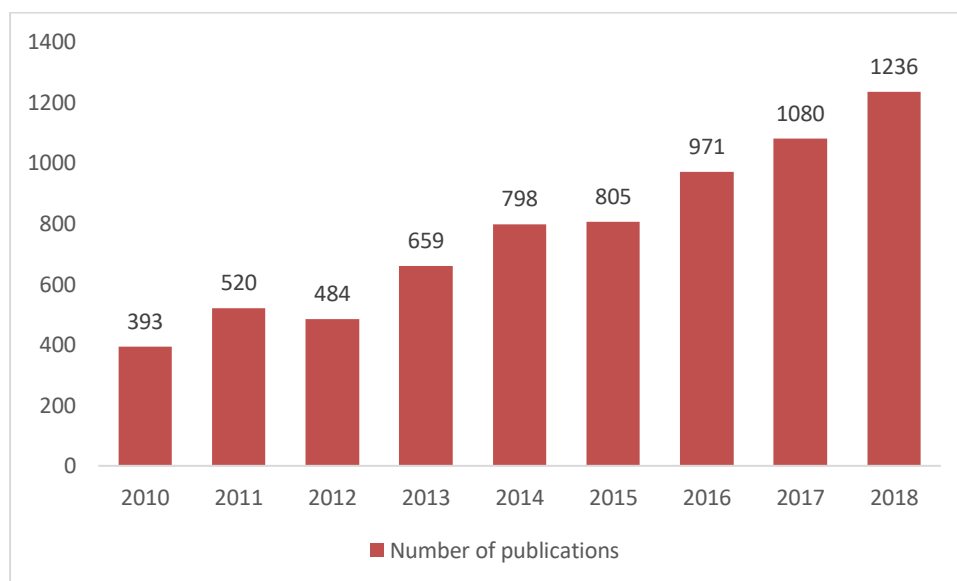
| Journal title | Frequency |
|--------------------------------------|-----------|
| Bioresource Technology | 517 |
| Biotechnology For Biofuels | 184 |
| Biofuels Bioproducts And Biorefining | 167 |
| Biomass And Bioenergy | 165 |

| Journal title | Frequency |
|---|-----------|
| ACS Sustainable Chemistry And Engineering | 152 |
| Industrial Crops And Products | 146 |
| Computer Aided Chemical Engineering | 131 |
| Green Chemistry | 109 |
| Chemical Engineering Transactions | 105 |
| Journal Of Cleaner Production | 104 |
| Renewable And Sustainable Energy Reviews | 89 |
| Applied Energy | 87 |
| Bioresources | 75 |
| Chemsuschem | 75 |
| Industrial And Engineering Chemistry Research | 75 |

Source: Scopus. Calculation: Technopolis Group.

Given this similarity from a content perspective, the following tables provide some information on the global scientific developments in the field. Between 2010 and 2018, almost 9 000 publications were published: an annual average growth of 15.4 % can be calculated; 74 % of the publications were articles and reviews; conference papers (10.9 %), books and book chapters (11.3 %) followed.

Figure 56: Evolution of the number of publications in 'biorefineries'



Source: Scopus. Calculation: Technopolis Group.

In terms of the most prolific countries, the result suggests a very broad – worldwide – interest in the field and scientific competences in Europe, the Americas and Asia/Australia. In this respect, countries that are not necessarily in the lead of top publishing countries, such as Mexico, Colombia and Thailand, can all be found among the top 30 countries. This suggests that the topic is of great interest all over the world.

If we compare the European countries active in bio-based industries and in the world, we can see for example that the worldwide standing of Greece is only mirrored in bio-based

industries, whereas Belgium is more strongly involved than Greek or Austrian organisations.

Table 36: Most prolific countries in the field of 'biorefineries' (2010-2018)

| Country | No of publications | Country | No of publications |
|----------------|--------------------|--------------|--------------------|
| United States | 1 672 | South Korea | 200 |
| China | 654 | Japan | 175 |
| Spain | 471 | Austria | 157 |
| Brazil | 452 | Mexico | 150 |
| United Kingdom | 386 | Greece | 137 |
| Canada | 362 | Malaysia | 121 |
| Italy | 325 | Belgium | 119 |
| Germany | 321 | Australia | 117 |
| Sweden | 313 | Colombia | 99 |
| India | 310 | Thailand | 80 |
| France | 281 | Switzerland | 76 |
| Netherlands | 261 | South Africa | 75 |
| Finland | 239 | Norway | 70 |
| Denmark | 236 | Argentina | 56 |
| Portugal | 208 | Taiwan | 55 |

Source: Scopus. Calculation: Technopolis Group.

In terms of leading (most prolific) organisations, we find that the Danish DTU and the Dutch Wageningen University and Research Centre take the top two places. Also a Swedish, French and Finnish organisation are among the top 10. With two Brazilian organisations up amongst the leaders, the topic is of key interest to Brazil.

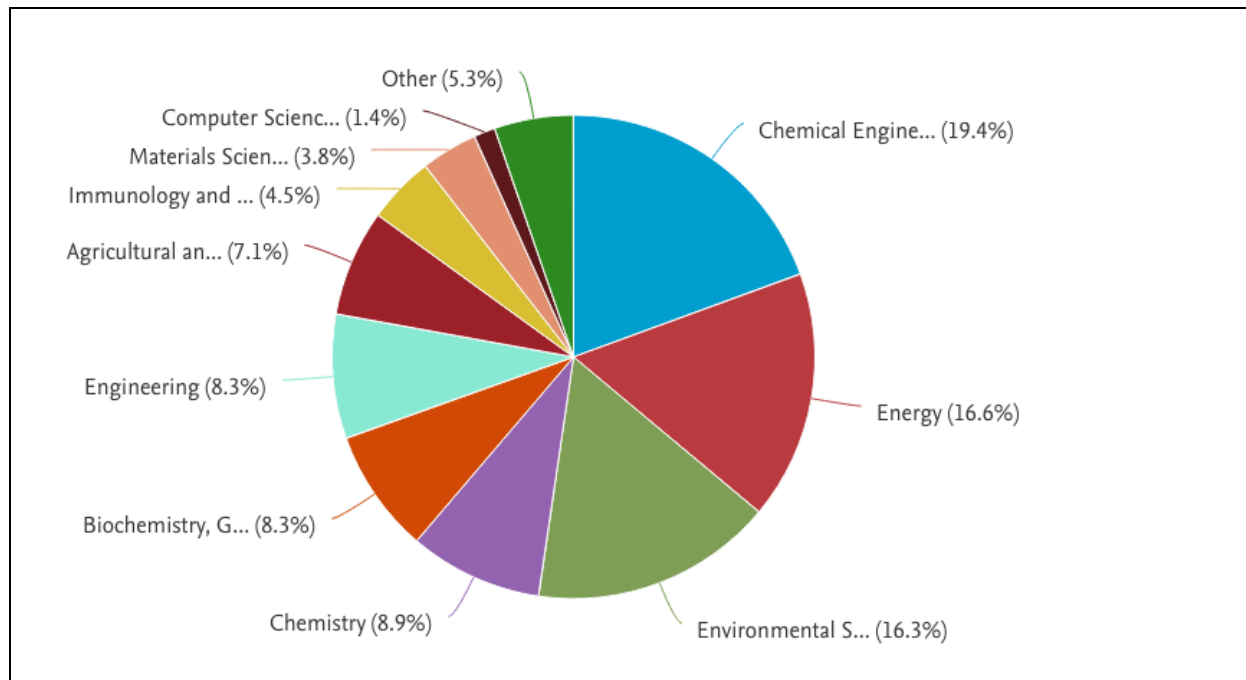
Table 37: Most prolific organisations in the field of 'biorefineries' (publications 2010-2018)

| Name of organisation | Number of publications |
|--|------------------------|
| Danmarks Tekniske Universitet | 144 |
| Wageningen University and Research Centre | 116 |
| National Renewable Energy Laboratory | 112 |
| Chinese Academy of Sciences | 111 |
| Chalmers University of Technology | 108 |
| Universidade de Sao Paulo – USP | 106 |
| Universidade Estadual de Campinas | 97 |
| INRA Institut National de La Recherche Agronomique | 91 |
| Aalto University | 83 |
| Iowa State University | 78 |

Source: Scopus. Calculation: Technopolis Group.

In terms of scientific disciplines that are forming the basis in this field, the following graph indicates that, in particular, chemical engineering is a key discipline, followed by energy and environmental sciences. Across the analysed period, chemical engineering has been a field with rather stable growth (12.2 % on average annually). The Danish DTU, the Greek National Technical University of Athens and Wageningen are the leading universities in the field of biorefineries and the provision of chemical engineering knowhow. In the fields of energy and environmental sciences, DTU and Wageningen are equally among the top; for energy, the US-based National Renewable Energy Laboratory leads the field. Compared to the stable growth mentioned for chemical engineering, energy and environmental sciences have grown in importance at 23 % and 20.6 % respectively.

Figure 57: Main scientific fields underlying 'biorefineries' research (2010-2018)



Source: Scopus. Calculation: Technopolis Group.

G.3 BBI and innovation

While patents are not strictly speaking innovations, patented technology tends to be used in innovations. Thus – and in the absence of better indicators – patents are used as a proxy to innovation.

BBI projects applied for three patents (as recorded in DG RTD internal databases). They come from two projects, EnzOx2 and PULP2VALUE.

G.4 Ambitions

The BBI joint undertaking has commissioned a trend analysis by an independent consulting firm, which was provided in 2017. The report looks at the situation of biorefineries in Europe, national strategies and technological opportunities in a number of industry sectors.

The report notes a few areas where changes (in strategic thinking and policies) could lead to more uptake.

Current biorefinery development is along one of two paths:

- Improvement and expansion of conventional biomass processing facilities (i.e. incremental innovation); or

- Implementation of new processing concepts converting biomass into value-added products (radical innovation).

The biorefineries can be distinguished as energy-driven (or fuel-driven) and product driven:

- In energy-driven (or biofuel-driven) biorefineries, the main goal is to produce huge volumes of relatively low-value biofuel out of biomass;
- In product-driven (i.e. chemicals, materials) biorefineries, the main goal is to produce smaller amounts of relatively higher value-added bio-based products out of biomass.

The study notes that currently there are only limited product-driven biorefineries in operation, mainly due to the fact that some key technologies are still in the R&D, pilot and demo-phase, but also 'because the European and national incentive frameworks only support the production of biofuels, especially second generation; but not the production of bio-based chemicals'.¹³³

The report argues that 'New technology development can lead to improved efficiencies and additional products, especially in the chemical sector'.

In terms of technological development, one can see that biorefineries are in a relatively early stage in the innovation process. With mainly demonstrator or pilot activities, dominant technological avenues have not yet emerged and thus products and commercialisation phases are still to come.

For a bio-based partnership that aims to go beyond the process innovation, a stronger focus on product-based biorefineries aiming at higher value chain products could be envisaged.

The nova report suggests the following:

- A 'strong focus on lignocellulosic biorefineries is questionable, since they can hardly be realized at small or medium scales and the technology is still a challenge';
- There are many opportunities for the further development of sugar, starch and oil-based refineries to higher efficiencies and diversified chemical products, as well as opportunities for specific crops and biomass flows in regional small biorefineries.

¹³³ Dammer L., Carus M., Iffland K., Piotrowski S., Sarmento L., Chinthapalli R., Raschka A. (2017). Current situation and trends of the bio-based industries in Europe, Pilot study by nova-Institute for BBI-JU, authors. Available at <http://bio-based.eu/markets/#BBIStudy>

Appendix H Additional information related to the problem definition

H.1 Taxonomy of failures requiring policy intervention

| Market failures | |
|------------------------------|---|
| Market power | <p>Limited interest from private sector parties to invest in R&D for the development of health technologies for PRNDs due to low potential for return on investment.</p> <p>Lack of universal health coverage means that individuals are often unable to cover the costs for treatments.</p> |
| Externalities | <p>There are weak and underfunded health systems in Africa.</p> <p>Capacity for conducting research in the region is similarly weak.</p> |
| Information asymmetry | <p>Pharmaceutical companies usually have a large extent of monopoly power, making it challenging for countries, in particular, LMICs, to negotiate affordable prices for health technologies.</p> |
| Systemic failures | |
| Capability | <p>Low capacity in Africa to conduct research and development locally</p> |
| Network | <p>Private sector parties have shown relatively limited interest in the development of suitable and affordable health technologies for PRNDs. Whereas public sector parties, including academic organisations, have shown greater interest in this, they usually lack the experience and resources to bring products through the clinical research and product development stages to bring a product to market. This calls for a partnership approach.</p> <p>Fragmentation in the research landscape should be reduced through stronger networking and a partnership approach.</p> |
| Institutional | <p>SSA countries require the development of a capacity to support the conduct of clinical trials in the region, including frameworks for regulatory oversight and medical ethics committees.</p> |
| Infrastructural | <p>Limited staff capacity for the conduct of clinical trials in the SSA region, as well as insufficient laboratory infrastructures (e.g. laboratory equipment, supply chain management systems, digital infrastructure to support data collection and analysis)</p> |
| Transformational failures | |

| | |
|----------------------------|--|
| Directionality | Need for a strong partnership to agree on shared objectives and development of global R&D roadmaps e.g. for TB vaccine development |
| Demand articulation | Equal voice and representation of SSA countries helps to ensure that supported activities are aligned with the local needs and demands for products of greatest relevance to the region |
| Policy coordination | There are many different stakeholders and initiatives in the global health field. A partnership approach allows ensuring proper coordination and alignment. |
| Reflexivity | EDCTP has developed a strong results-based management approach which supports is the ability to monitor its impacts and make necessary adjustments along the way. A strong partnership is able to more rapidly respond to emerging needs, as in the case of the 2014 West Africa Ebola outbreak. |

Source: Weber and Rohracher (2012) adapted by Technopolis Group (2018)

Appendix I Additional information related to the policy options descriptions

I.1 Degree of coverage of the different functionalities by policy option

Table 38: Type and composition of actors (including openness and roles)

| Option 0: Horizon Europe calls | Option 2: Co-funded | Option 3: Institutionalised Art 185 | Option 1: Co-programmed | Option 3: Institutionalised Art 187 |
|---|---|--|--|--|
| <p>What is possible? Any legal entity in a consortium can apply to Horizon Europe calls in ad hoc combinations Calls are open to participation from across Europe and the world (not all entities from third countries are eligible for funding)</p> | <p>What is possible? Partners can include any national funding body or governmental research organisation, Possible to include also other type of actors, including foundations.</p> | <p>What is possible? Partners can include MS and Associated Countries.</p> | <p>What is possible? Suitable for all types of partners: private and/or public partners, including MS, regions, foundations. By default open to AC/ 3rd countries, but subject to policy considerations. Can cover a large and changing community. HE rules apply by default to calls included in the FP Work Programme, so any legal entity can apply to these.</p> | <p>What is possible? Suitable for all types of partners: private and/or public partners, including MS, foundations. By default open to legal entities from AC/ 3rd countries, but subject to policy considerations. In case of countries participating non-associated third countries can only be included as partners if foreseen in the basic act and subjected to conclusion of dedicated international agreements HE rules apply by default, so any legal entity can apply to partnership calls.</p> |
| <p>What is limited? Systematic/ structured engagement with public authorities, MS, regulators, standard making bodies, foundations and NGOs.</p> | <p>What is limited? Requires substantial national R&I programmes (competitive or institutional) in the field. Usually only legal entities from countries that are part of the consortia can apply to calls launched by the</p> | <p>What is limited? Non-associated third countries can only be included as partners if foreseen in the basic act and subjected to conclusion of dedicated international agreements. Needs good geographical coverage – participation of at least 40% of Member States is required</p> | <p>What is limited? If MS launch calls under their responsibility, usually only legal entities from countries that are part of the consortia can apply to these, under national rules</p> | <p>What is limited? Requires a rather stable set of partners (e.g. if a sector has small number of key companies). Basic act can foresee exceptions for participation in calls / eligibility for funding.</p> |

| Option 0: Horizon Europe calls | Option 2: Co-funded partnership, under national rules. | Option 3: Institutionalised Art 185 | Option 1: Co-programmed | Option 3: Institutionalised Art 187 |
|---|---|---|-------------------------|-------------------------------------|
| | partnership, under national rules. | Requires substantial national R&I programmes (competitive or institutional) in the field. While by default the FP rules apply for eligibility for funding/participation, in practice (subject to derogation) often only legal entities from countries that are Participating States can apply to calls launched by the partnership, under national rules. | | |
| <p>What is not possible? To have a joint programme of R&I activities between the EU and committed partners that is implemented based on a common vision.</p> | <p>What is not possible? To have industry/ private sector as partners.</p> | <p>What is not possible? To have industry/ private sector as partners.</p> | | |

Table 39: Type and range of activities (including flexibility and level of integration)

| Option 0: Horizon Europe calls | Option 2: Co-funded | Option 3: Institutionalised Art 185 | Option 1: Co-programmed | Option 3: Institutionalised Art 187 |
|--|---|---|---|---|
| <p>What is possible?</p> <p>Horizon Europe standard actions that allow <i>broad range of individual activities</i> from R&I to TRL 7 or sometimes higher.</p> <p>Calls for proposals published in the Work Programmes of Horizon Europe (adopted via comitology).</p> | <p>What is possible?</p> <p>Activities may range from R&I, pilot, deployment actions to training and mobility, dissemination and exploitation, but according to national programmes and rules.</p> <p>Decision and implementation by “beneficiaries” (partners in the co-fund grant agreement) e.g. through institutional funding programmes, or by “third parties” receiving financial support, following calls for proposals launched by the consortium.</p> | <p>What is possible?</p> <p>Horizon Europe standard actions that allow a broad range of coordinated activities from R&I to uptake.</p> <p>In case of implementation based on national rules (subject to derogation) Activities according to national programmes and rules.</p> <p>Allows integrating national funding and Union funding into the joint funding of projects</p> | <p>What is possible?</p> <p><i>Horizon Europe standard actions</i> that allow a broad range of coordinated activities from R&I to uptake.</p> <p>The association representing private partners allows to continuously build further on the results of previous projects, including activities related to regulations and standardisation and developing synergies with other funds</p> <p>Union contribution is implemented via calls for proposals published in the Work Programmes of Horizon Europe based on the input from partners (adopted via comitology).</p> <p>Open and flexible form that is simple and easy to manage.</p> | <p>What is possible?</p> <p><i>HE standard actions</i> that allow to build a portfolio with broad range of activities from research to market uptake.</p> <p>The back-office allows dedicated staff to implement integrated portfolio of projects, allowing to build a “system” (e.g. <i>hydrogen</i>) via pipeline of support to accelerate and scale up the take-up of results of the partnership, including those related to regulations and standardisation and developing synergies with other funds. E.g. setting up biorefinery plants and promoting their replication by additional investments from MS/ private sector.</p> <p>Procuring/purchasing jointly used equipment (e.g. HPC)</p> <p>Allows integrating national funding and Union funding into the joint funding of projects</p> |
| <p>What is limited?</p> | <p>What is limited?</p> <p>Scale and scope of the programme the resulting funded R&I actions and depend on the participating programmes, typically</p> | | <p>What is limited?</p> <p>Limited control over precise call definition, resulting projects and outcomes, as they are implemented by EC agencies.</p> | <p>What is limited?</p> <p>Limited flexibility because objectives, range of activities and partners are defined in the Regulation, and negotiated in the Council (EP).</p> |

| Option 0: Horizon Europe calls | Option 2: Co-funded | Option 3: Institutionalised Art 185 | Option 1: Co-programmed | Option 3: Institutionalised Art 187 |
|--|-----------------------------------|-------------------------------------|-------------------------|-------------------------------------|
| | smaller in scale than FP projects | | | |
| <p>What is not possible?</p> <p>To design and implement in a systemic approach a portfolio of actions.</p> <p>To leverage additional activities and investments beyond the direct scope of the funded actions</p> | | | | |

Table 40: Directionality

| Option 0: Horizon Europe calls | Option 2: Co-funded | Option 3: Institutionalised Art 185 | Option 1: Co-programmed | Option 3: Institutionalised Art 187 |
|--|--|--|--|---|
| <p>What is possible? Strategic Plan (as implementing act), annual work programmes (via comitology). Possible also to base call topics on existing or to be developed SRIA/roadmap</p> | <p>What is possible? Strategic R&I agenda/roadmap agreed between partners and EC Annual work programme drafted by partners, approved by EC Objectives and commitments are set in the Grant Agreement.</p> | <p>What is possible? Strategic R&I agenda/roadmap agreed between partners and EC Objectives and commitments are set in the legal base. Annual work programme drafted by partners, approved by EC Commitments include obligation for financial contributions (e.g. to administrative costs, from national R&I programmes).</p> | <p>What is possible? Strategic R&I agenda/roadmap agreed between partners and EC Objectives and commitments are set in the contractual arrangement. Input to FP annual work programme drafted by partners, finalised by EC (comitology) Commitments are political/best effort, but usually fulfilled</p> | <p>What is possible? Strategic R&I agenda/roadmap agreed between partners and EC Objectives and commitments are set in the legal base. Annual work programme drafted by partners, approved by EC (veto-right in governance) Commitments include obligation for financial contributions (e.g. to administrative costs, from national R&I programmes).</p> |
| <p>What is limited? No continuity in support of priorities beyond the coverage of the strategic plan (4 years) and budget (2 years Annual work programme).</p> | | | | |
| <p>What is not possible? Coordinated implementation and funding linked to the concrete objectives/ roadmap, since part of overall project portfolio managed by agency</p> | | | | |

Table 41: Coherence (internal and external)

| Option 0: Horizon Europe calls | Option 2: Co-funded | Option 3: Institutionalised Art 185 | Option 1: Co-programmed | Option 3: Institutionalised Art 187 |
|--|---|---|---|---|
| <p>What is possible? Coherence between different parts of the Annual Work programme of the FP ensured by EC</p> | <p>What is possible? Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC Synergies with national/regional programmes and activities</p> | <p>What is possible? Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC Synergies with national/regional programmes and activities Synergies with other programmes</p> | <p>What is possible? Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC If MS participate: Synergies with national/regional programmes and activities Synergies with industrial strategies</p> | <p>What is possible? Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC Synergies with other programmes or industrial strategies If MS participate: Synergies with national/regional programmes and activities</p> |
| <p>What is limited? Synergies with other programmes or industrial strategies</p> | <p>What is limited? Synergies with other programmes or industrial strategies</p> | <p>What is limited? Synergies with industrial strategies</p> | <p>What is limited? Synergies with other programmes</p> | |
| <p>What is not possible? Synergies with national/regional programmes and activities</p> | | | | |

Appendix J Additional information on Section 7: Horizon Europe Key Impact Pathways - Monitoring/evaluation indicators

| | Short-term (typically as of year 1+) | Medium-term (typically as of year 3+) | Long-term (typically as of year 5+) |
|--|---|--|---|
| Scientific impacts | | | |
| Key Pathway 1. Creating high quality new knowledge | Nr of FP peer reviewed publications | Field-Weighted Citation Index of FP peer reviewed publications | Number and share of peer reviewed publications from FP projects that are core contribution to scientific fields |
| Key Pathway 2 Strengthening human capital in R&I | Number of researchers involved in upskilling (training, mentoring/coaching, mobility and access to R&I infrastructures) activities in FP projects | Number and share of upskilled FP researchers with increased individual impact in their R&I field | Number and share of upskilled FP researchers with improved working conditions, including researchers' salaries |
| Key Pathway 3. Fostering diffusion of knowledge and Open Science | Share of FP research outputs (open data/ publication/ software etc) shared through open knowledge infrastructures | Share of open access FP research outputs actively used/cited after FP | Share of FP beneficiaries having developed new transdisciplinary/ trans-sectoral collaborations with users of their open FP R&I outputs |
| Societal impact (environmental & social) | | | |
| Key Pathway 4. Addressing EU priorities & global challenges through R&I | Number and share of outputs aimed at addressing specific EU policy priorities & global challenges (including SDGs) | Number and share of innovations and scientific results addressing specific EU policy priorities & global challenges (including SDGs) | Aggregated estimated effects from use of FP-funded results on tackling specific EU policy priorities & global challenges (including SDGs) including contribution to the policy and law-making cycle (such as norms and standards) |
| Key Pathway 5. Delivering benefits and impacts through R&I missions | Outputs in specific R&I missions | Results in specific R&I missions | Targets achieved in specific R&I missions |
| Key Pathway 6. Strengthening the uptake of innovation in society | Number and share of FP projects where EU citizens and end-users contribute to the co-creation of R&I content | Number and share of FP beneficiary entities with citizen and end-users engagement mechanisms after FP project | Uptake and outreach of FP co-created scientific results and innovative solutions |

| | Short-term (typically as of year 1+) | Medium-term (typically as of year 3+) | Long-term (typically as of year 5+) |
|--|--|--|--|
| Economic / Technological impact | | | |
| Key Pathway 7. Creating more & better jobs | Number of FTE jobs created, and jobs maintained in beneficiary entities for the FP project (by type of job) | Increase of FTE jobs in beneficiary entities following FP project (by type of job) | Number of direct & indirect jobs created or maintained due to diffusion of FP results (by type of job) |
| Key Pathway 8. Generating innovation-based growth | Number of innovative products, processes or methods from FP (by type of innovation) & Intellectual Property Rights (IPR) applications | Number of innovations from FP projects (by type of innovation) including from awarded IPRs | Creation, growth & market shares of companies having developed FP innovations |
| Key Pathway 9. Leveraging investment in R&I | Amount of public & private investment mobilised with the initial FP investment | Amount of public & private investment mobilised to exploit or scale-up FP results (including foreign direct investments) | EU progress towards 3% GDP target due to FP |

Source: European Partnerships – Coordinated impact assessment study, Presentation during the pre-kickoff meeting, 20th June 2019

Appendix K Additional information on Section 7: The preferred option

K.1 Other considerations for the selection of the Institutionalised Partnership

There are a few other considerations that come in addition to the assessment framework applied in this study, which were expressed by many stakeholders and which are important to consider. We summarise below the most commonly expressed views of the stakeholders that have been interviewed for this impact assessment.

- IP gives more long-term perspectives than the other options, which is important for the industry actors. The discontinuation of the IP would cause the perception of a downgrade of the initiative and the sector, and risks acting as a disincentive to industries, including SMEs, to engage intensely with the initiative. There is an opportunity to benefit from the created momentum and experience, and to even more intensify the efforts to drive the sector forward.
- In the absence of an IP, companies that would like to invest, no matter what, could decide to do so outside Europe.
- One benefit of an IP is more visibility and more opportunities for a dedicated service with staff helping SMEs, attending conferences and creating visibility. Some companies feel that they are a part of a joint effort. An IP would be stronger than the baseline option in reaching out to potential beneficiaries across Europe in an effort to promote participation in the initiative. Because of the availability of dedicated staff, an IP would be able to perform better in terms of the possibility to accompany the projects during their implementation (e.g. BBI have more people and support for a smaller number of projects).
- The complexity of the system requires a strong organisational focus and organisational identity with a strong management team. Smaller organisations are better at functioning in a dynamic environment where there is a need to react and change quickly. The dynamism in the bio-based industry is very high because the interdependencies are very high, and they change all the time as well.
- The existence of a real-time monitoring system allows for the possibility to take timely corrective action in cases of deviation.

At the same time, the discussion with the wide range of stakeholders led to suggestions on a number of **conditions** that will be needed to be ensured for a future IP to function better than the current one. These are:

- Improve governance whereby different stakeholders can drive the activities of the Partnership in a collaborative, balanced and synergetic manner. A full integration between the interest of the industry and the public interest (represented by the EC and other actors) is a necessary condition. A situation where one actor has the perception that other actors dominate the agenda is not desirable and is potentially counterproductive and damaging for the Partnership. Formalisation of the role of the advisory and the role of state representative groups would be necessary.
- Topics for calls should be counterchecked by all stakeholders to avoid the perception that they are driven by one type of stakeholder.
- In terms of contributions from the industry, the rules need to be fixed upfront as a result of a negotiation. The co-funding model should be based on securing a realistic model that does not add unnecessary administrative and regulatory burdens for the EC and considers the realities of the business mentality.
- A better definition is required of the remit for the different partners and the programme office.

- Better synergies are needed with other programmes to increase the impact.

Appendix L Definitions

| | |
|--|--|
| Bioeconomy | The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services. [Biomedicines and health biotechnology are excluded]. (EC) |
| Circular economy | It is an economic model in which the value of products and materials is maintained for as long as possible; waste generation and resource use are minimised, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value. (EC) |
| Bioeconomy sectors | Sectors of the European bioeconomy comprising the primary sectors (agriculture, forestry and aquaculture), the sectors food, beverages, tobacco and pulp and paper products, that can be considered fully bio-based and are thus fully accounted to the bioeconomy. Bio-based shares of other sectors such as the chemical industry, pharmaceuticals and textiles, are also relevant and normally are covered in the bioeconomy scope. Valorisation of organic and agriculture waste, carbon capture and utilisation of biological methods are increasingly seen as part of bioeconomy. |
| Bio-based products | Bio-based products refer to non-food products derived from biomass (plants, algae, crops, trees, marine organisms and biological waste from households, animals and food production). Bio-based products may range from high value-added fine chemicals such as pharmaceuticals, cosmetics, food additives, etc., to high-volume materials such as general bio-polymers or chemical feedstocks. The concept excludes traditional bio-based products, such as pulp and paper, and wood products, and biomass as an energy source. |
| Bio-based industries | Bio-based industries are the sectors of bioeconomy that normally exclude food, beverages and tobacco production (can still include them in the novel/non-traditional value chains). |
| Circular Bio-based Europe (CBE) | It is a proposed title for a potential European Partnership for a circular bio-based Europe under the Horizon Europe research and innovation framework programme for 2021-2027. The objective of the proposed European Partnership is to step up research and innovation with a view to replacing, where possible, non-renewable fossil and mineral resources for the production of renewable products and nutrients with biomass and waste. |
| Sustainable development | It is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (UN) |
| The United Nations Sustainable Development Goals (SDGs) | SDGs are a collection of 17 global goals designed to be a blueprint to achieve a better and more sustainable future for all. The SDGs, set in 2015 by the United Nations General Assembly and intended to be achieved by the year 2030, are part of the UN's 2030 Agenda. |

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| Bio-based Industries Joint Undertaking (BBI JU) | The Bio-Based Industries Joint Undertaking (BBI JU) is a public-private partnership between the European Union and the Bio-based Industries Consortium (BIC). Operating under Horizon 2020, this EU body is driven by the Vision and the Strategic Innovation and Research Agenda (SIRA) developed by the industry. |
| Bio-based Industries Consortium (BIC) | BIC is an association that collectively represents the private sector partners in the BBI JU partnership. It includes agriculture, agro-food, technology providers, forest-based sector, chemicals and energy sectors, as well as research and technology organisations (RTOs), universities and European trade associations as associate members. |
| Research and innovation (R&I) projects | BBI JU projects that focus on development, validation and formulation of technologies. (TRL 3, 4, 5) |
| Innovation Action - demonstration projects (IA-DEMO) | BBI JU projects that focus on supporting demonstration and scaled up activities. (TRL 6-7) |
| Flagship projects (IA FLAG) | BBI JU projects that support first-of-a-kind applications of technology (TRL 9) and large-scale production facilities. |
| Coordination and Support Action (CSA) projects | BBI JU projects that focus on increasing networking opportunities and exchange of ideas via supporting accompanying measures such as standardisation, dissemination, awareness-raising and communication, networking, coordination or support services, policy dialogues and mutual learning exercises and studies, including design studies for new infrastructure. |

