



# Engaging Stakeholders and Citizens in the Bioeconomy

BioSTEP Research Recommendations



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[www.bio-step.eu](http://www.bio-step.eu)

## ABOUT BIOSTEP

BioSTEP ([www.bio-step.eu](http://www.bio-step.eu)) aims to engage citizens and various stakeholder groups in discussions about the future development of Europe's bioeconomy. Its objective is to increase the overall awareness and understanding of the bioeconomy as well as its consequences and benefits by considering citizens' needs and concerns. BioSTEP applies a three-tier approach to reach all relevant actors in the bioeconomy domain by using tailored engagement tools, such as workshops, conferences, exhibitions and debates on the bioeconomy. At the regional level, BioSTEP applies and tests a 'living lab' approach to facilitate the involvement of public-private networks of stakeholders in bioeconomy-based innovation and business model development processes.

## ABOUT THIS DOCUMENT

This paper presents a set of research recommendations, which builds on the lessons learned from the application of BioSTEP's participatory tools. These ranged from education and information activities to intensive stakeholder dialogues and the co-creation of regional bioeconomy roadmaps. The detailed evaluation of these participatory tools can be accessed on [www.bio-step.eu/results](http://www.bio-step.eu/results).

## ACKNOWLEDGMENT & DISCLAIMER



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## BACKGROUND

Stakeholder and public engagement are key elements of EU policy development, as well as of responsible research and innovation. Over a period of three years, BioSTEP has designed and implemented a wide range of citizen and stakeholder engagement activities regarding the development of Europe's bioeconomy. These covered different modes of participation, ranging from education and information activities to intensive stakeholder dialogues and the co-creation of regional bioeconomy roadmaps.

BioSTEP experimented with different participatory tools including workshops, living lab activities, and exhibitions that aimed to facilitate stakeholder and public engagement in the bioeconomy. The lessons learned from these activities include the following:

- » **Education and information:** BioSTEP's exhibition "Bioeconomy in Everyday Life" turned out to be a highly effective public engagement tool – particularly for interested members of the public that have no expert knowledge on the bioeconomy. Future exhibitions (or similar formats) should provide more background information on the bioeconomy concept, and provide specific information regarding the sustainability of bio-based products and processes. Out of all the social media venues used to promote the project (including Facebook and LinkedIn), Twitter was the most effective tool to reach the interested public.
- » **Dialogue:** A key feature of effective stakeholder dialogues is the involvement of participants throughout the entire duration of the respective project/initiative. BioSTEP has shown that an initial broad online survey can be an effective tool to start engaging with stakeholders at a very early stage. Engagement activities should be tailored to the national/regional context and consider the respective "culture of participation." Activities and events should be relevant to current policy discussions. Mobilisation of

individual businesses, NGOs/CSOs and citizens turned out to be difficult in BioSTEP; targeted outreach efforts, including direct personal invitations and financial compensation for participation may be necessary in future projects.

- » **Co-production of knowledge:** The living lab approach as applied in BioSTEP can facilitate co-creation in the context of regional strategy development. However, the approach proved relatively time-consuming and limited in its ability to engage entrepreneurs. Its success depends on the commitment and participation of the respective regional authorities, as they are key stakeholders when it comes to strategy implementation.

New, innovative instruments for stakeholder engagement are necessary in the bioeconomy field, particularly regarding involvement of NGOs/CSOs and citizens. Building on these lessons learned, this paper presents a set of recommendations for future effective stakeholder and public engagement in the bioeconomy, aiming to maximise the impact of EU Research & Innovation. BioSTEP's research recommendations focus on five distinct topics:

- 1 **Integrating priorities of civil society into bioeconomy research agendas**
- 2 **Developing and testing models for co-creation in the bioeconomy**
- 3 **Communicating complex topics of the bioeconomy to the general public**
- 4 **Analysing the regional transition to the bioeconomy**
- 5 **Ensuring responsible research and inclusive innovation in the bioeconomy**

These research recommendations go beyond the bioeconomy and can be applied to other topics where effective stakeholder and public engagement can improve EU policy development, research and innovation.

# 1 INTEGRATING PRIORITIES OF CIVIL SOCIETY INTO BIOECONOMY RESEARCH AGENDAS

## 1.1 Background

The outcomes of current bioeconomy value chains do not fit the needs of society as a whole. It is therefore important that civil society get involved in research and innovation agendas – as a first step toward broad acceptance of bioeconomy products and processes, civil society organisations (CSOs) should be involved in discussions regarding bioeconomy implementation.

Involving CSOs requires understanding that they follow a different logic than scientists and business stakeholders (Martinuzzi et al., 2016). Mission-driven CSOs focus more on policy impacts and the needs of citizens than on scientific publications and building up academic track records. Their mission is to influence current bioeconomy policy-making at the regional, national or EU level – thus, they prioritise bringing science closer to civil society and increasing the diversity and resilience of bioeconomy research and innovation. If bioeconomy research and innovation agendas want to safeguard their legitimacy vis-à-vis European citizens, by avoiding a scenario in which agenda setting is driven by business interest groups, they should be guided by the globally agreed Sustainable Development Goals (SDGs).

In addition to involving CSOs as partners in research projects, future EU research framework programmes (FPs) should (1) involve them more significantly in other roles (e.g. agenda setting, proposal evaluation), (2) put stronger emphasis on the societal impacts of the whole programme, and (3) fund more and smaller projects to counter concentration effects and reduce entry barriers. Simulation of European research programmes showed that such a scenario would substantially increase the FPs' contributions to high-level policy

objectives (e.g. SDGs), enhance the respective competencies of different types of organisations (universities, businesses and CSOs) and bring science and citizens closer without diluting scientific excellence (Martinuzzi et al., 2016). The CIMULACT project<sup>1</sup> has demonstrated that upstream engagement of citizens and CSOs in (bioeconomy) research and innovation agenda-setting is possible and marks a shift in how research and innovation is defined. Open science is not just about making science available to people, it is also about engaging people in setting the direction for research and innovation. CSOs and citizens – alongside experts and stakeholders – are capable of producing unique, concrete and innovative input to the bioeconomy research and innovation agenda.

## 1.2 Goal

For society at large to appreciate bioeconomy value chains, CSOs and the public at large must participate as co-creators in the relevant research and innovation agenda-setting. Developing balanced and inclusive bioeconomy research and innovation agendas implies that the traditional “triple helix” of university, industry and government must be expanded to a “quadruple helix” that includes civil society.

## 1.3 How to achieve this goal

Involving civil society in bioeconomy research and innovation agendas requires designing arenas for knowledge co-creation and innovation in which a broad variety of stakeholders participate. While consensus building at EU level can be difficult due to divergent regional needs and preferences, local and national bioeconomy research and innovation

<sup>1</sup> Citizen and Multi-Actor Consultation on Horizon 2020, URL: [www.cimulact.eu](http://www.cimulact.eu)

constitute starting points for broader coalitions. National bioeconomy strategies implemented in e.g. Germany, Italy and France demonstrate a potential way forward. Future research should look at these case studies as examples of co-creation of research agendas and take into account good practices from other policy fields. It should also develop a structured approach for civil society participation in research agendas that includes as core components participatory multi-criteria analyses (pMCA), transformative scenario planning (TSP) and citizen vision workshops that promote social imagination.

## 1.4 Expected impact

- » democratisation of research and innovation agenda-setting to ensure an embedded participatory approach and greater democratisation in bioeconomy strategy building
- » increased engagement of civil society and professionals in bio-based developments
- » more societal knowledge regarding the contribution of the bioeconomy to the UN's Sustainable Development Goals

# 2 DEVELOPING AND TESTING MODELS FOR CO-CREATION IN THE BIOECONOMY

## 2.1 Background

Although public engagement is currently a hot topic – especially new ways to engage with different stakeholders and publics – most activities in this arena still fall into the realm of direct dissemination and dialogue rather than **co-creation** of new knowledge. The latter is a more innovative and informed type of engagement in which wider stakeholders and publics are embedded, empowered and involved. There is a need for greater understanding of the strengths and limitations of co-creation, and a need to develop new tools to facilitate this form of engagement.

Placing co-creation (also referred to as co-production) in context, models of science/society relationships and the nature of the engagement strategies can be characterised as: (1) public education; (2) public dialogue and participation, and (3) public and stakeholder co-creation of research agendas, knowledge, and innovations.

A **public education** approach to engagement often portrays the biosciences and biotechnology as sources of societal progress that need to be

promoted in society at large, but also protected from societal intervention – publics are not part of the knowledge creation process. The approach assumes that the public mistrusts science (due to science illiteracy and ignorance) and thus cannot make informed judgements about new biosciences and technologies. The role of scientists and experts is thus to instruct and educate publics, and to tackle this mistrust of new science.

A **public dialogue and participation** approach to engagement involves more open societal debate around bioscience research and biotechnology development – it is the approach prominent in current policies around the bioeconomy and EU engagement initiatives. Debate often involves public authorities, industry and citizens (and/or their representatives) as advisors, but publics do not participate in the direct creation of scientific knowledge and technological development. In fact, involving stakeholders and publics in open debates can legitimise bioscience research and biotechnology development decisions, even though it is not clear what role and input these stakeholders and publics have had in shaping them.

An approach of **co-creation of research agendas, knowledge, and innovations** intertwines science and technology with society. Citizens and other interest groups are actively involved in the process of knowledge production – scientists, experts and lay publics collaborate and work together in new hybrid forms of collectives. Knowledge is still created in formal R&D spaces (such as laboratories), but it takes into account activities of citizens outside the laboratory.

This last form of engagement offers exciting opportunities to encourage the involvement of a range of representatives (e.g. researchers, industry, etc.), stakeholders and publics in the development of the biosciences, biotechnology and wider innovation in a democratic and socially just co-created form that can ensure wider societal benefit.

## 2.2 Goal

The goal of this research recommendation is to create awareness around and improve current methods for co-production/co-creation and to develop and test new tools. Specifically the goal is to:

- a. facilitate greater awareness and understanding of existing co-creation tools
- b. develop new forms of co-creation that can empower and inform a wide range of stakeholders

## 2.3 How to achieve the goal

The above goal can be achieved through a number of activities:

- a. **Greater awareness and understanding of existing co-creation tools**
  - » further define co-creation principles by bringing together a wide range of researchers and practitioners

- » create an online open access data catalogue of existing co-creation tools – map their characteristics, strengths and weaknesses

- b. **Develop new forms of co-creation that can empower and inform a wide range of stakeholders**

- » create new tools for co-creation for the bioeconomy
- » train practitioners to apply those new tools
- » create and test new infrastructure and spaces that can facilitate co-creation, such as innovation locations that have dedicated 'engagement labs' or engagement services

## 2.4 Expected impact

Investing in research that supports greater understanding of the strengths and limitations of co-creation, and developing new tools to facilitate this form of engagement will lead to:

### Specific Impacts

- » enhanced socially robust product development
- » confidence in both product design and implementation
- » increased awareness among consumers and citizens about bioeconomy processes and products
- » greater public ownership of bioeconomy investments
- » greater understanding of the bioscience innovation process (risks and benefits)

### Overarching Impact

- » democratically informed research and innovation processes that support development of a sustainable knowledge-based bioeconomy

## 3 COMMUNICATING COMPLEX TOPICS OF THE BIOECONOMY TO THE GENERAL PUBLIC

### 3.1 Background

The bioeconomy as a system is complex and difficult to communicate, and the same holds true for specific bio-based products and processes. Knowledge about the social, economic and environmental impacts of bio-based products and processes is indispensable to an informed public debate about the future development of the bioeconomy at regional, national and EU level. Although bio-based products and processes have less of a “negative image” than fossil-based products, there is a general lack of awareness and knowledge of them. The prefix “bio” leads consumers to have high expectations that products are completely plant-based, organically grown, non-toxic and biodegradable, which is not always the case. During the BioSTEP exhibitions, citizens raised questions such as: How durable are bio-based products in contrast to their traditional counterparts? Does it take less energy and water to produce bio-based products? How long will it take for bio-based products to degrade? What is the overall social, economic and environmental impact of bio-based products? These questions should be addressed in a way that is easy to understand in communication materials.

Further research should therefore identify and test bioeconomy communication strategies – ones that appeal to the public. These should use innovative visualisation concepts, augmented reality, multi-lingualism, participation and learning to reach citizens and convey benefits but also perceived risks of the bioeconomy.

### 3.2 Goal

The goal of this research recommendation is to test and identify suitable tools for the communication of the complex topics which constitute the bioeconomy system that are interactive and fun, but also provide in-depth information on bio-based

products and processes, so that citizens can make informed decisions about the bioeconomy (e.g. as consumers) and participate in informed debates about the bioeconomy (e.g. in the context of strategy development).

### 3.3 How to achieve the goal

- » evaluate all communication efforts of relevant EU bioeconomy projects to identify promising engagement tools, then prioritise them and develop blueprints for the most effective tools
- » use exhibitions about innovative bio-based products in public spaces, as these have proven to be an effective tool to catch the interest of the public – but develop exhibition communication formats that show a more complete picture of the bioeconomy and its complexity, including potential social, economic and environmental trade-offs
- » start communication efforts about the bioeconomy ‘on the ground’ in biocommunities (e.g. among citizens in regions) and focus on contents such as health, waste, biomass management, recycling, and locally made bio-based goods
- » engage with young people in particular, via education systems (schools, universities, etc.), taking into account that the media (especially television, radio and print) play a significant role in spreading information and raising awareness

### 3.4 Expected impact

- » increased public awareness of the bioeconomy with increased knowledge on the specific bio-based products and processes including their effects and potential trade-offs
- » better informed consumer decisions
- » broader public engagement in bioeconomy debates and in the development bioeconomy strategies



## 4 ANALYSING THE REGIONAL TRANSITION TO THE BIOECONOMY

### 4.1 Background

A shift towards a bio-based economy involves radical structural changes in value chains and business models. These changes involve new relationships between multiple different partners, different inputs and processes, combining knowledge in new ways, generating new markets, and different infrastructures (e.g. transport, waste reuse, research). The growth of the bio-based economy depends on the development of new forms of engagement and cooperation between a range of stakeholders and publics across existing sectoral and organisational boundaries, to create new networks and clusters.

As BioSTEP has shown (Davies et al., 2016), bio-based transitions can be facilitated by quadruple helix relationships. Clearly, businesses from a range of sectors are key players in the development of bio-based value chains, combining activities from primary (e.g. agriculture, fishing and forestry), industrial (e.g. chemicals, logistics, investors) and waste-related sectors. However, other entities are also key, including governmental bodies (as regulators, policy-makers and funders), universities and education/research institutions, hybrid entities (e.g. innovation centres and knowledge platforms), as well as civil society organisations and non-governmental organisations, customers/consumers, and citizens.

The capacity of actors to engage with others to build new bio-based value chains and clusters varies strongly between regions. New relationships are evolving spontaneously in some regions but, elsewhere, new bio-based networks are slower to emerge (even where there is clear potential), due e.g. to a lack of intermediary or bridging organisations to support new networks, or because of lock-in to existing relationships, markets and

knowledge. Over one third of European regions are estimated to have low bioeconomy maturity, meaning that they cannot fully exploit existing potential on their own and so are slow to generate new bio-based economic, social and environmental benefits (Spatial Foresight et al., 2017).

There is therefore dual risk. First, the transition to a bio-based economy is slower than it could be, implying economic, social and environmental costs. Second, the structural shift to a bio-based economy further widens regional economic disparities, as laggard regions are slower to take advantage of new bioeconomy opportunities. Regional economic disparities widened within OECD countries in 1995–2013 (OECD, 2016) as productivity gains in leading regions did not diffuse rapidly to other regions – the gap in labour productivity between the leading 10 percent of OECD regions and the bottom 75 percent of regions grew by almost 60 percent. High-tech and knowledge-intensive sectors have become more concentrated in metropolitan areas, while former industrial hubs have lost medium- and low-skilled jobs and manufacturing has become more dispersed (Iammarino et al., 2017).

While studies (Charles et al., 2016; Spatial Foresight et al., 2017) have documented variation in bioeconomy development and its role in smart specialisation strategies across European regions (European Commission, 2017), it remains unclear why such regional differences exist. Variation is not simply due to the availability of bio-materials, the existence of businesses in relevant sectors, or the adoption of a bio-related smart specialisation strategy. Instead, regional differences in the bioeconomy are likely to be shaped by a broad range of place-specific factors and relationships which either support or hinder structural change towards bioeconomy-related activities.

## 4.2 Goal

- » investigate the reasons for variations in the emergence, diffusion and growth of bio-based economic activities across European countries and regions – including specific regional economic, technological, institutional and socio-cultural factors
- » in particular, explore how relationships and engagement between stakeholders/publics (or lack thereof) either facilitate the evolution and expansion of bio-based value chains and networks or inhibit bioeconomy-oriented structural change
- » consider how support for engagement and interaction could help to reduce fragmentation and thereby accelerate the transition to the bioeconomy – especially in marginalised regions

## 4.3 How to achieve the goal

- » conduct research that draws on case studies of regions with smart specialisation strategies (or other similar regional strategies which include a focus on bio-based themes or possibly a particular segment of the bioeconomy)
- » include not only regions with successful bio-based sectors, but also regions which have identified bio-based activities as potential strengths but where growth is slow – investigated regions should cover varying degrees of economic and technological dynamism in a range of institutional and socio-cultural contexts

- » examine the extent to which new bio-based networks are being formed across existing sectoral or institutional boundaries, and whether these are being supported or obstructed by existing networks/value chains
- » investigate how new bio-based networks are forming, i.e. the different steps in the emergence and growth of new networks
- » assess which factors are key to the emergence and cumulative growth of new networks in regions seeing an expansion of bioeconomy, as well as factors which are hindering growth of bioeconomy networks and transition

## 4.4 Expected impact

The above research will provide an improved evidence base for better policy instruments at EU, national and regional levels – including EU cohesion policy and EU rural development policy. Resulting better policy instruments can lead to:

- » more inclusive, future-oriented, coherent and effective strategies for supporting regional and rural development – particularly in less-developed regions
- » a more efficient and impactful allocation of EU regional and rural policy funding
- » a stronger and more rapid transition to bio-based economic activities, particularly in areas undergoing industrial restructuring

## 5 ENSURING RESPONSIBLE RESEARCH AND INCLUSIVE INNOVATION IN THE BIOECONOMY

*Many of BioSTEP's engagement activities raised questions about social impact, ethical research practices, responsible innovation and the need for social inclusion and empowerment in the development of the bioeconomy. There appears to be a need for a recommendation in this area that goes beyond normal project recommendations and toward a suggested programme of work related to research, networking, knowledge transfer, training and possible infrastructure investments.*

### 5.1 Background

Although innovators and policy-makers have considered the implications of advances in the biosciences and biotechnology for decades, recent years have seen an increasing focus on the bioeconomy's ethical and social dimensions. In parallel, policy-makers increasingly discuss the need to define responsibilities in bioeconomy innovation processes, examining the wider ethical dimensions of investment in and promotion of the bioeconomy.

Sustainability assessments are often used to map the bioeconomy's social, economic and environmental impacts, but more work is needed on improving the scope, tools and approaches to integrate these impact assessments within wider sustainability frameworks. A new science policy initiative, the Responsible Research and Innovation (RRI) agenda, constitutes such an approach and is a core component of European research policies. The RRI agenda emerged from discussions about ethical and social responsibility in science, set out in Europe's 2001 Science and Society Action Plan – that plan aimed at improving the connection between science and European citizens. Under the 7th Framework programme for Research and Technology (FP7), researchers in 2007 carried out the Science in Society (SiS) programme aimed at fostering 'public engagement and a two-way

dialogue between science and civil society' (European Commission, 2012). Since 2010, SiS has focused on developing a framework for Responsible Research and Innovation in which societal actors work together during the whole research and innovation process in order to better align both the process and its outcomes with the values and expectations of European society (European Commission, 2012).

Several working definitions of RRI have emerged (e.g. Douglas & Stermerding, 2013; Owen et al., 2012; Stahl et al., 2014); however a prominent advocate of RRI is European Commission officer René von Schomberg (2011), who proposes that RRI is a transparent and interactive process that spans and acknowledges mutual responsibility across different actors; its aim is to address the 'right impacts', in his words (von Schomberg, 2011, p.2), focusing on ethical acceptability, sustainability and societal desirability in order to achieve key positive impacts (Ribeiro et al., 2017). Stahl et al. (2014) state that RRI encompasses all aspects of the discourse concerning the question of what can be done in order to ensure that science, research, technology and innovation have positive, socially acceptable and desirable outcomes (Stahl et al. 2014, pp.76).

The RRI agenda was more explicitly set out in the Rome Declaration on Responsible Research and Innovation in Europe in 2014 (which builds on earlier declarations), and requires decisions in research and innovation to consider the principles on which the European Union is founded, i.e. the respect of human dignity, freedom, democracy, equality, the rule of law and human rights. The current European Commission Horizon 2020 RRI strategy interprets this as encompassing six 'key' themes:

- » engagement
- » gender equality

- » science education
- » open access
- » ethics
- » governance

New developments within the bioeconomy must embed these core principles not only within some funding and research processes, but as part of the development and implementation stages. With the latter only being done sporadically, more work is needed on raising awareness as well as developing, applying and testing tools.

### 5.2 Goal

The goal of this research recommendation is to identify ways to establish good ethical and RRI practice, through the development of new tools and processes that embed ethical principles and the RRI agenda, specifically focusing on the following objectives:

- Greater understanding of the social, economic and environmental impact of new bio-based products**
- Enhanced understanding and mapping of areas of uncertainty and the development of transparent approaches for managing uncertainty**
- Delivery of more comprehensive and coherent ways of integrating bio-based technology assessment, which also makes any trade-off decisions more transparent**
- Embedding of RRI principles in bio-based product research, design and technology development**
- Democratisation and promotion of social justice in bio-based product development and innovation through the inclusion of key principles, such as inclusive engagement and gender sensitivity practices**
- Enhanced embedding of open science principles in bio-based product research**

### 5.3 How to achieve the goal

The above goals can be achieved through a series of research, networking, knowledge transfer and training activities:

- Greater understanding of the social, economic and environmental impacts of new bio-based products**
  - » create new knowledge through original research on social, economic and environmental impacts
  - » further develop robust tools to map social, economic and environmental impacts
  - » create networks for researchers to work with technology assessment and impact assessment practitioners
- Enhanced understanding of and mapping of areas of uncertainty and the development of transparent approaches for managing uncertainty**
  - » map social, environmental and economic impacts
  - » identify areas of uncertainty in impact research, and how knowledge gaps can be filled
  - » develop tools to manage uncertainty, i.e. risk management approaches
- Delivery of more comprehensive and coherent ways of integrating bio-based technology assessment, which also make any trade-off decisions more transparent**
  - » develop approaches to facilitate the integration of different impacts within a sustainability assessment framework
  - » develop scenario modelling that increases the transparency of any trade-offs calculus and embedded values
  - » create new tools to support greater decision-making transparency in priority setting for bioeconomy investments, specifically making more transparent the process of weighing potential risks and benefits

**d. Embedding of RRI principles in bio-based product research, design and technology development**

- » set up new networks to share knowledge on the existing ethical and RRI tools that may be applicable to the bioeconomy
- » develop new ethical frameworks and RRI tools for specific groups of bio-based products, e.g. for the automotive industry etc.
- » evaluate existing and new tools and provide training for private and public institutions on how to use these tools

**e. Democratisation and promotion of social justice in bio-based product development and innovation through the inclusion of key principles, such as inclusive engagement and gender sensitivity practices**

- » develop collaborative RRI standard setting approaches to define ethical product design
- » develop further approaches to facilitate inclusive engagement with local communities
- » develop ethical labelling standards for bioeconomy products

**f. Enhanced embedding of open science principles in bio-based product research**

- » produce new approaches to design transparency and for communicating ethical research and sustainability assessment

## 5.4 Expected impact

- » socially and ethically informed bioeconomy investment decisions
- » socially robust product development
- » consumer confidence in bioeconomy product credentials
- » greater ownership of purchase decision-making amongst consumers
- » improved communication of the social, environmental and economic impacts of bioeconomy product development

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## THE BIOSTEP TREE OF KNOWLEDGE





Shaping the bioeconomy together

## IMPRINT

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### Editors

Holger Gerdes, Zoritzza Kiresiewa,  
Ecologic Institute

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