RESULTS OF THE JRC-SCAR BIOECONOMY SURVEY

January 2015

Author:

J.W.A. Langeveld

Project: Bioeconomy Information System and Observatory Project (BISO)
Set up of the Bioeconomy Observatory
FP7 Grant Agreement N° 341300
Duration: 01/03/2013 – 29/02/201

DISCLAIMER:

The information and views set out in this study and those of the authors do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this study. Neither the Commission nor any person acting on the Commission's behalf may be held responsible for the use which may be made of information contained therein.

Langeveld, J.W.A. (2015): Results of the JRC-SCAR Bioeconomy survey

STATUS: PUBLIC

This report has been prepared by:

J.W.A. Langeveld
Biomass Research
P.O. Box 247
6700 AE Wageningen
The Netherlands

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under Service Contract n° CCR.PSR.B182795 (Technical assistance for the realisation of a "Member State survey" for the EU Bioeconomy Observatory.)

RESULTS OF THE JRC – SCAR BIOECONOMY SURVEY

BIOMASS RESEARCH REPORT 1501 – BRIEF VERSION

Bibliographical data:

J.W.A. Langeveld – Biomass Research

STATUS: PUBLIC

Publications available from https://biobs.jrc.ec.europa.eu/

Biomass Research
P.O. Box 247
6700 AE Wageningen

T: +31 (0) 6 520 58 537
info@biomassresearch.eu
www.biomassresearch.eu

Table of contents

1. INTRODUCTION

Unprecedented and unsustainable exploitation of natural resources, potentially irreversible changes in the global climate and the lack of ability to stop the loss of biodiversity form a serious threat to the biological basis of the European society. Over the next decades, the global population is expected to increase to exceed 9 billion in 2050. These complex and inter-connected challenges will need to be addressed by an integrated and effective policy combined by an extended programme for scientific research and innovation in order to facilitate sustained changes in lifestyle and resource use across all levels of the economy.

In order to be able to cope with increasing global population, (over)exploitation of natural resources, increasing environmental pressure and climate change, Europe has to change the way it is organising the production, consumption, processing and recovering of its biological feedstocks. The bioeconomy has been proposed as a key element of a smart and green development path. Advancements in bioeconomy research and innovation uptake will facilitate the improved management of biological resources and the opening and development of diverse food and bio-based markets.

Bioeconomy has been defined in the European Commission's COM(2012)60 as:

> ''The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. Its sectors have a strong innovation potential due to their use of a wide range of sciences (life sciences, agronomy, ecology, food science and social sciences), enabling and industrial technologies (biotechnology, nanotechnology, information and communication technologies (ICT), and engineering), and local and tacit knowledge''[1]

There are many possible reasons for a country to engage in the Bioeconomy. Driving forces for Bioeconomy policy may be merely political – to realise policy existing or newly defined objectives, economic – to stimulate existing economic performance, and/or to generate new market power, as well as oriented towards realisation of environmental objectives – for example, to reduce waste, or Greenhouse Gas emissions, and help improve environmental quality.

Bioeconomy is the field where all types of biomass uses are coming together and links to all biomass uses may be found (Figure 1.1). The actual link between different sectors in practice is, however, relatively small. In the connecting field, competition may occur between biomass generating sectors – which, in principle, may be mutually replacing each other – and biomass converting sectors – which may compete for available feedstocks.

[1] Source: Commission Staff Working Document of COM(2012) 60 final. Innovation for Sustainable Growth. A Bioeconomy for Europe.

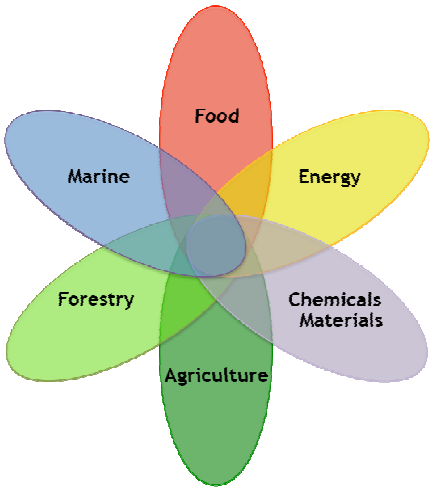

Figure 1.1. Fields covered in the Bioeconomy
Source: European Commission (2014)[2]

All Bioeconomy areas already have their own strategy, actions and innovation. Focussed action in research and policy is needed to use them to address major basic challenges that are prevalent in the current research and policy agenda's. By using a cross-sectoral approach, bioeconomy areas can be linked in an effective way to develop new, innovative research areas, and enhance policy coherence. The development of a good connectivity between individual areas is a prerequisite for effective bioeconomy development.

Establishing a bioeconomy can boost economic growth and jobs in rural, coastal and industrial areas, reduce fossil fuel dependence and improve the economic and environmental sustainability of primary production and processing.

The Bioeconomy Strategy and Action Plan presented in a 2012 Communication on Bioeconomy aims to facilitate the development of an innovative, resource efficient, sustainable and competitive use of biological resources, reconciling their exploitation for industrial purposes with food security while providing sufficient environmental safeguards. Under Action N° 6 of the Bioeconomy Action Plan consists in establishing a Bioeconomy Observatory.

The establishment of the Observatory is part of the implementation of the EU Bioeconomy Strategy and Action Plan laid down in the European Commission Communication on Bioeconomy of February 2012 (COM(2012)60)[3]. Objective of the action plan is to emphasise the importance of the bioeconomy for Europe in addressing major societal and economic challenges and to create a more favourable environment for its realisation.

[2] European Commission (2014). Where next for the European Bioeconomy? Brussels, Directorate-General for Research and Innovation
http://ec.europa.eu/research/bioeconomy/pdf/where-next-for-european-bioeconomy-report-0809102014_en.pdf
[3] Commission Staff Working Document of COM(2012) 60 final. Innovation for Sustainable Growth. A Bioeconomy for Europe.

The Bioeconomy Observatory, as the Strategy does, focuses on three main pillars (Figure 1.2):

- "Research" (investments in Research, Innovation and Skills)
- "Policy" (reinforced policy interaction and stakeholder engagement)
- "Markets" (enhancement of markets and competitiveness in bioeconomy)

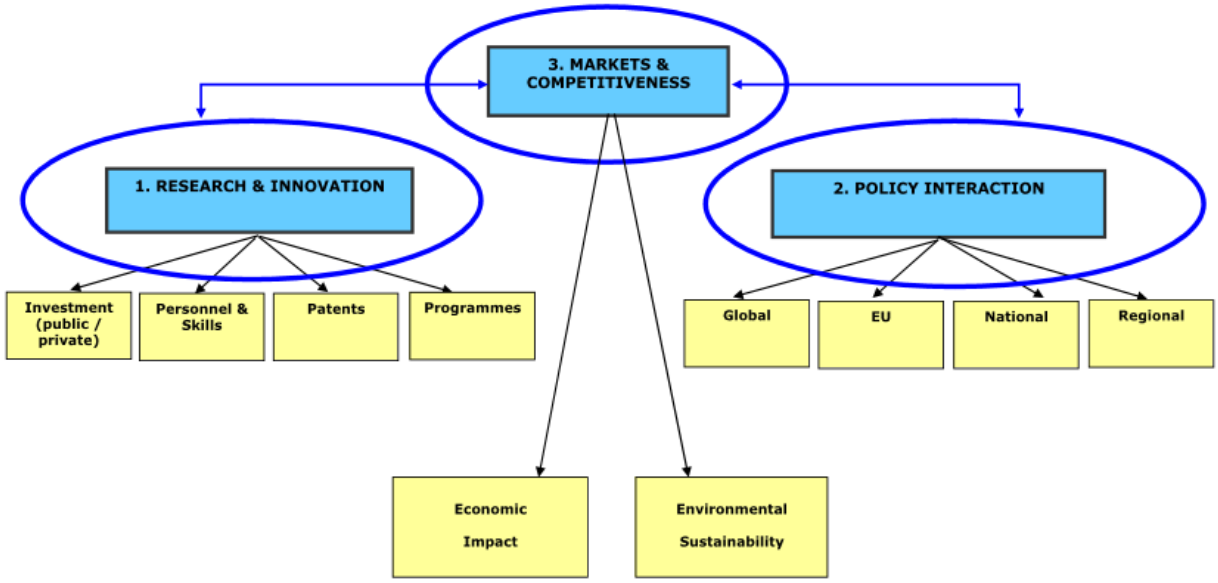

Figure 1.2 Three pillars of the Bioeconomy Information System Observatory (BISO) project[4]

The Joint Research Centre (JRC) is in charge of setting up the Bioeconomy Observatory, in close collaboration with existing information systems that allows the Commission to regularly assess the progress and impact of the bioeconomy and develop forward-looking and modelling tools. The project time line goes from the first quarter of 2013 until the first quarter of 2016; the project acronym is BISO (Bioeconomy Information System Observatory).

The establishment of the Bioeconomy Observatory is expected to support one of the major objectives of the EU Bioeconomy Strategy, which is "to contribute to achieve the full potential of the bioeconomy, by providing the knowledge base for a coherent policy framework and promoting relevant innovation activities, thereby giving specific support to markets and policies related to the bioeconomy".

Data collection and data analysis from the Bioeconomy Observatory will provide a solid basis for decision-making on the bioeconomy, in particular for policy-makers. The primary target audience for the Bioeconomy Observatory will be policy-makers (be it at EU or at national Member States

[4] Source: Plan, D. (2013). The EU Bioeconomy Observatory. First stakeholders roundtable. 26th November 2013. Brussels. https://ec.europa.eu/jrc/sites/default/files/events/20131126-biso-roundtable/20131126-biso-roundtable-plan.pdf

level), who will be provided with comprehensive and authoritative data and information on bioeconomy.

Data and information collected about bioeconomy research, policy and markets will be available online through the BISO website. More specifically, key bioeconomy data and information collected at national level are summarised in a series of "national bioeconomy country profiles" for the EU-28 Member States which can be downloaded from the website (https://biobs.jrc.ec.europa.eu/policy).

In this way, Member States authorities are provided with comprehensive and authoritative data and information on bioeconomy. They are also key partners for the Observatory in terms of "supply" of national bioeconomy data and information to the Bioeconomy Observatory. In order to access, collect and confirm the accuracy of bioeconomy data and information gathered at national level, partnership between the Bioeconomy Observatory and the Member States remains crucial.

Partnership between the Bioeconomy Observatory and the Member States has been established through bilateral interaction with individual Member States authorities and through cooperation with the Standing Committee on Agricultural Research (SCAR) and in particular its Strategic Working Group on Sustainable use of Bio-resources for a Growing Bioeconomy (SBGB).

The Standing Committee on Agricultural Research (SCAR) of the European Union was established in 1974 by a Regulation of the Council of the EU. It is formed by representatives of Member States, and presided over by a representative of the Commission, who has a mandate to advise the Commission and the Member States on the coordination of agricultural research in Europe. It was given a renewed mandate in 2005 to play a major role in the coordination of agricultural research efforts across the European Research Area.

The Membership is composed by the 28 EU Member States, as well as representatives from Candidate and Associated Countries as observers. The SCAR members currently represent 37 countries. Since 2005, more than 20 working groups have been set up by European countries engaging voluntarily and on a variable-geometry basis in the definition, development and implementation of common research agendas based on a common vision of how to address major challenges in the field of agricultural research.[5]

In 2013, SCAR and DG-JRC decided to join forces in the development of a survey to collect essential data on national Bioeconomy policies, legal status of Bioeconomy development and national as well as regional/cluster R&D initiatives and public R&D funding. Together, DG-JRC and SCAR could provide a broad link to existing policies as well as R&D practices in the field of both classical and emerging Bioeconomy sectorial developments.

The common "Bioeconomy Member States survey" was run in 2014 aiming to collect information on the bioeconomy at individual national Member State level, with a particular focus on national research activities and policy initiatives for the bioeconomy. Biomass Research has provided support

[5] http://ec.europa.eu/research/agriculture/scar/groups_en.htm

in the implementation and analysis of the survey. The general objective was to collect at individual Member State level and (on the basis of a preliminary questionnaire prepared by the JRC and SCAR) quantitative data and qualitative information on bioeconomy. In the survey, there was a particular focus on national bioeconomy research activities and national bioeconomy policy initiatives.

Biomass Research has worked in close collaboration with both the DG JRC and SCAR, in particular with the chair of its Strategic Working Group on Sustainable use of Bio-resources for a Growing Bioeconomy (SBGB). Data and information have been collected through "national survey contact points" who received (and often returned) a questionnaire.

The current report presents an overview of the main results of the survey, as they have been used to be incorporated to national files presented on the Bioeconomy Observatory website. It contains the following elements: the questionnaire is introduced in Chapter 2; main results of the survey are presented in Chapter 3, which is followed by a discussion (Chapter 4); and the individual questionnaires are presented in the Annexes[6].

[6] Annexes are not included in the brief version of the report.

2. METHODOLOGY AND QUESTIONNAIRE

A questionnaire was developed including six questions and several sub-questions, organised in two sections. In the first section, questions were oriented towards existence and character of national Bioeconomy policies. The second section focused on national Research and Development.

An overview of the questions is presented in Table 2.1. Many questions were open or offering plenty room for explanation and additional descriptions. Priority rankings were asked related to the main drivers to engage in the Bioeconomy (Question 2) and to the perceived benefits of research cooperation initiatives in the EU (Question 6). National policies, existing Bioeconomy regions and clusters and R&D projects could be listed. Question 4 requested annual public funding budgets for different types of Bioeconomy related research.

Table 2.1 Overview of questions of the JRC-SCAR Bioeconomy survey

Question	Subject	Type
1	Definition of Bioeconomy implemented in national policy documents. Comparison to definition used by the European Commission	Open
2	Main drivers to engage in the Bioeconomy	Priority ranking
3a	National policy strategies covering Bioeconomy	Yes/no + explanation
3b	Identification of national Bioeconomy policies	Yes/no + description, links
3c	Bioeconomy regions and clusters	Listing
4	Bioeconomy R&D programmes	Listing + explanation, public budget
5	Bioeconomy research and innovation projects	Listing + description
6	Benefit of European research cooperation	Ranking + listing existing programmes

An overview of the questionnaire is presented in Annexe 1.

The survey and a first draft of the questionnaire were presented to members of the SCAR Strategic Working group on Sustainable Bioresources for a Growing Bioeconomy, during its meeting in the Hague on June 13, 2014. Feedback on the preliminary setup was received and elaborated in the process of the finalisation of the questionnaire.

The final questionnaire was sent out to national SCAR contact points together with a personal introduction letter on June 20. The intended first deadline was August, 15. This deadline was later extended to September, 1, 2014. An overview of the contact points involved in the survey is presented in Annex 2.

Submissions were received from Belgium, Switzerland, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Hungary, Ireland, Israel, Italy, Latvia, the Netherlands, Norway,

Sweden, Slovenia, Turkey and the United Kingdom. Belgium submitted two questionnaires, one for each major region. Italy used the framework for an old questionnaire. The questionnaire by Latvia was received late.

3. RESULTS

Survey participation

A total of 21 countries responded to the survey (Figure 3.1). Of them, 20 submitted a questionnaire, 17 Member States (Belgium, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Hungary, Ireland, Italy, Latvia, the Netherlands, Sweden, Slovenia, and the United Kingdom), and four non-Member States (Switzerland, Israel, Norway, and Turkey). One country (Slovak Republic) announced that submission was intended. Belgium submitted two questionnaires, one for Flanders and one for Wallonia.

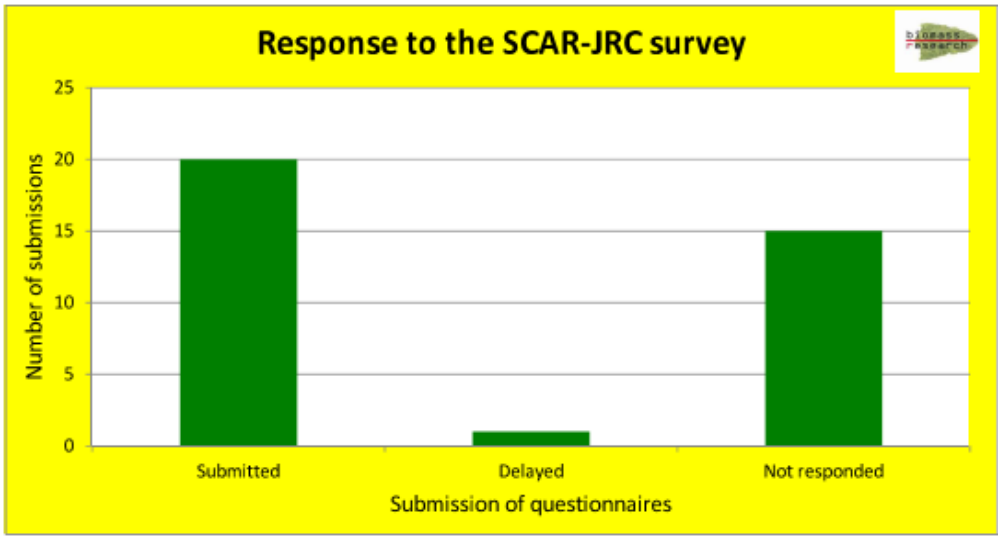

Figure 3.1 Questionnaire submission

Not all questionnaires were complete. Italy used an old format, and did not provide answers to all questions. Other countries missed questions as well (Figure 3.2).

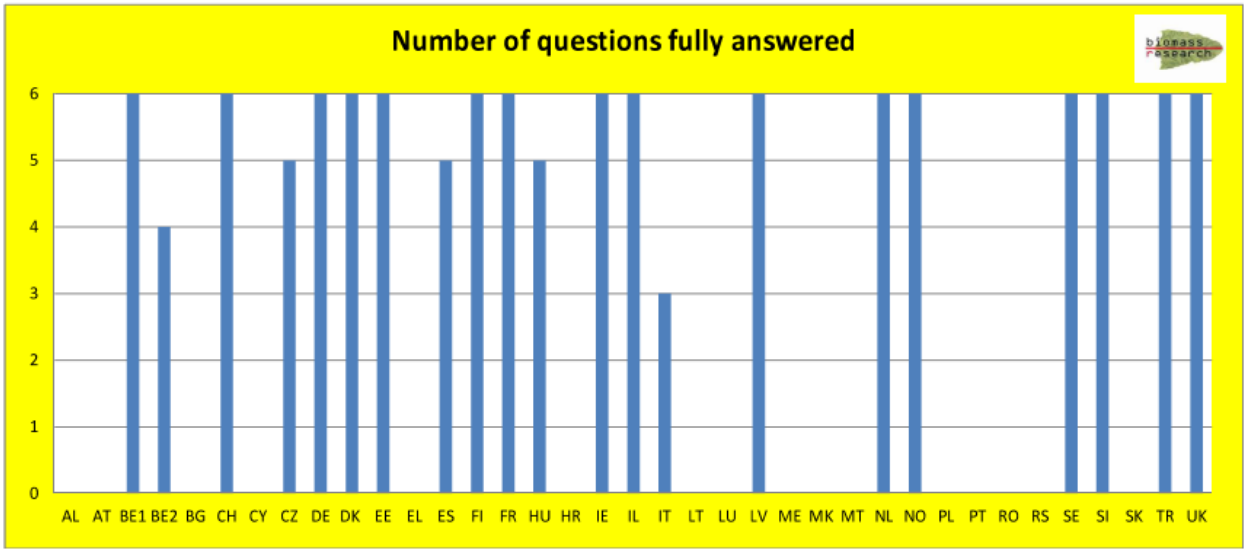

Figure 3.2 Number of questions that were fully answered

Question 1: Bioeconomy policy and definition

Twelve countries (60%) use a definition for the Bioeconomy that is more or less similar to the definition used by the European Commission (Figure 3.3). Among Member States that submitted the questionnaire, ten (63%) have a similar definition to the one used by the Commission. Most of the other countries do not use a definition.

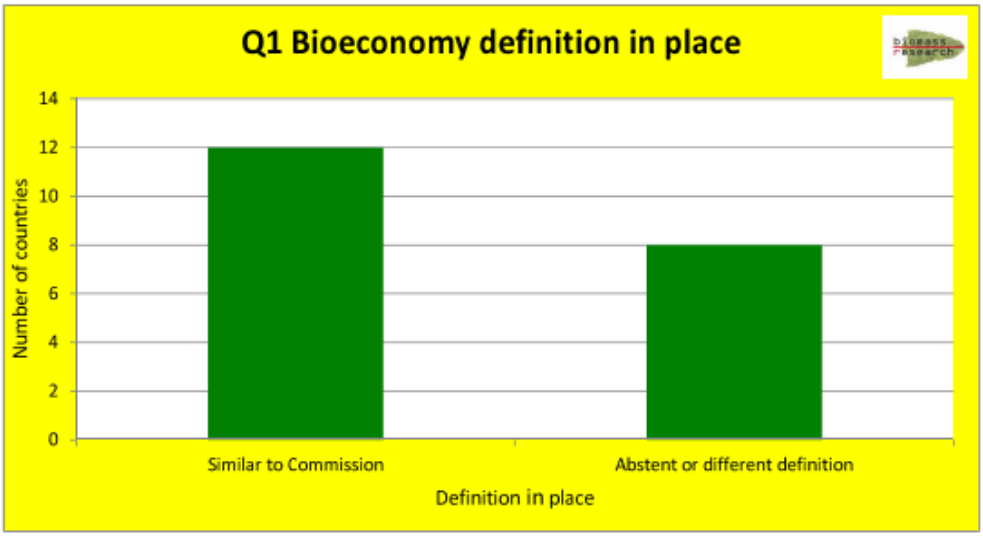

Figure 3.3 Bioeconomy definition resemblance with the Commission's definition

Question 2: Drivers to implement a Bioeconomy policy

Reasons to implement Bioeconomy policy are related to factors with a merely political, economic, or environmental character. The average ranking of 20 submissions shows priority of individual

drivers ranges between 3.0 and 4.5. Economic drivers are given a higher average score (4.3) than political (average score 3.7) and environmental objectives (average 3.5). Hence, the development of a Bioeconomy policy is seen as an opportunity to enhance economic development, including both classic and new Bioeconomy sectors, while food security and the need to combat climate change are also relevant (Figure 3.4).

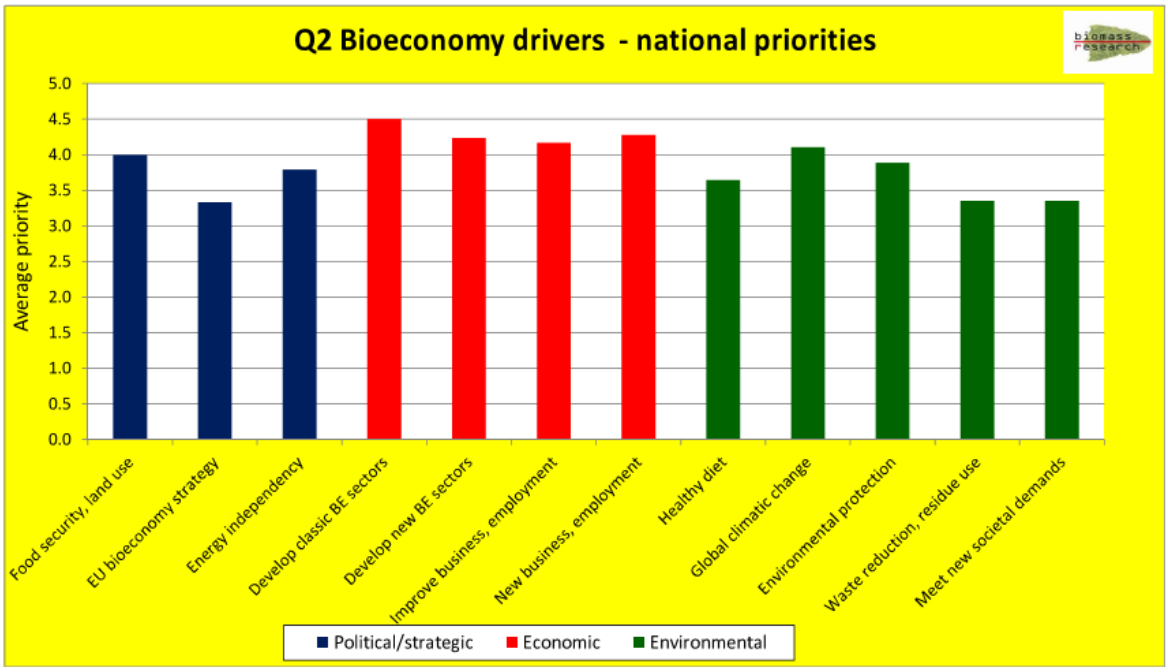

Figure 3.4 Drivers to develop a Bioeconomy strategy

Question 3: National policy strategies

Nine countries are implementing a Bioeconomy strategy (Figure 3.5). Flanders, Germany, Finland and Sweden have developed a full strategy; Switzerland, Denmark, Estonia, the Netherlands and Wallonia implement a partial strategy.

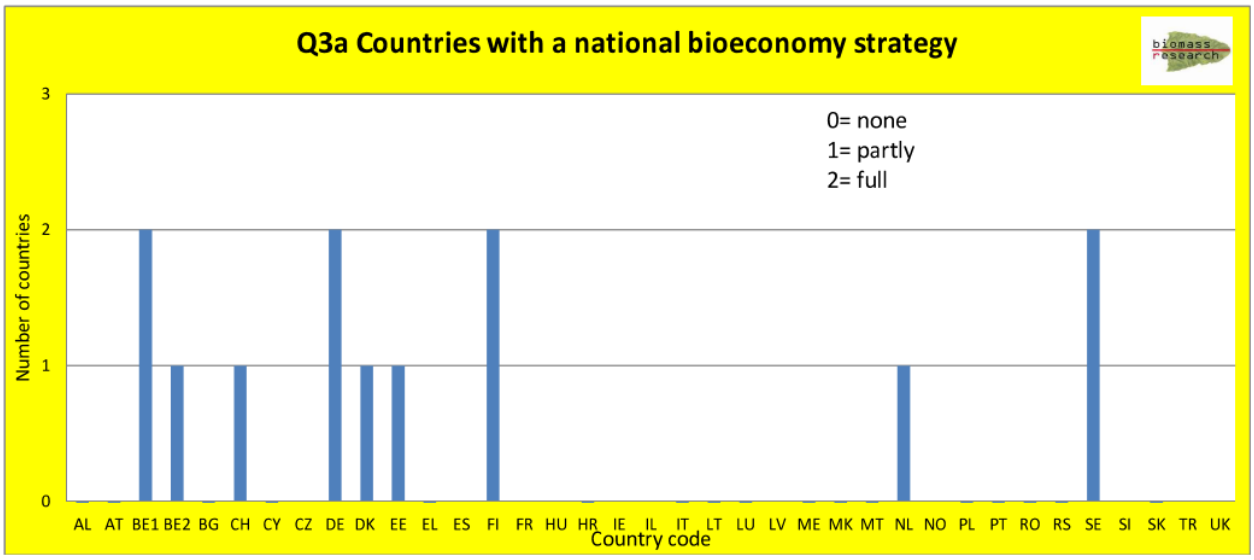

Figure 3.5 Countries with a Bioeconomy strategy

Five countries (Germany, Estonia, Finland, Hungary and the Netherlands) have installed a national Bioeconomy Agency. In most cases, two ministries are (jointly) in charge of the implementation of the Bioeconomy strategy (Figure 3.6).

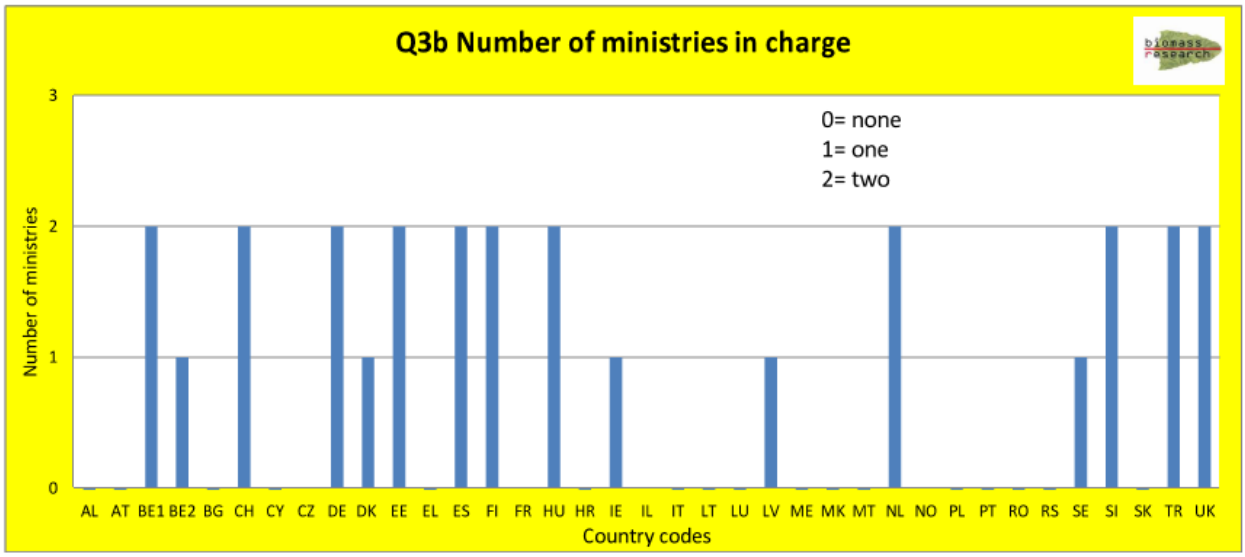

Figure 3.6 Number of ministries in charge of the Bioeconomy strategy

Question 4: Bioeconomy related R&D programmes

The budget for R & D programmes in the bioeconomy receives some 2.3 billion of public funds[7]. This amount is based on the questionnaires that were submitted and cannot be considered as fully representative for countries that did not submit any details on their information. Details of the funding of bioeconomy research & development programmes are presented in Table 3.1. Agriculture is the sector receiving most of the R & D funding. It annually receives 1.3 billion Euro which is more than half of all reported public funding. Industrial use of biomass receives 185 million Euro's (8%); while 185 million Euro is allocated to energy use; marine, fisheries and aquaculture receive 172 million Euro's (7%). A relatively small amount is designated to generic bioeconomy programs (6%).

Table 3.1 Bioeconomy related national research budgets

Sector / activity	**Budget** [1]	**Share of total budget** [2]
Generic Bioeconomy [a]	136	5.8%
Agriculture	1,344	57.5%
Forestry	10	0.4%
Marine, fisheries, aquaculture	172	7.4%
Waste as biomass sources	58	2.5%
Food and feed use of biomass (food/feed value chains)	27	1.2%
Energy use of biomass (bioenergy)	185	7.9%
Industrial uses of biomass [b]	196	8.4%
Key enabling technology (industrial biotechnology)	54	2.3%
Communication, stakeholder involvement	0	0.0%
Other (please specify)	155	6.6%
All	2,338	100.0%

[a] Covering several elements and sectors of the bioeconomy; [b] Including paper and pulp, wood and wood products, chemical production, pharmaceutical production, and other industrial uses.

Question 5: Case-studies of Bioeconomy related research and innovation projects

More than 100 case-studies of successful Bioeconomy development have been reported. Nearly half of them were listed by Germany. Large numbers of case-studies were also reported by Flanders, Germany, Denmark and the UK. An overview of the number of case studies reported is given in Figure 3.7.

[7] Only funds from research programmes, no budgets from structural or innovation funds were reported.

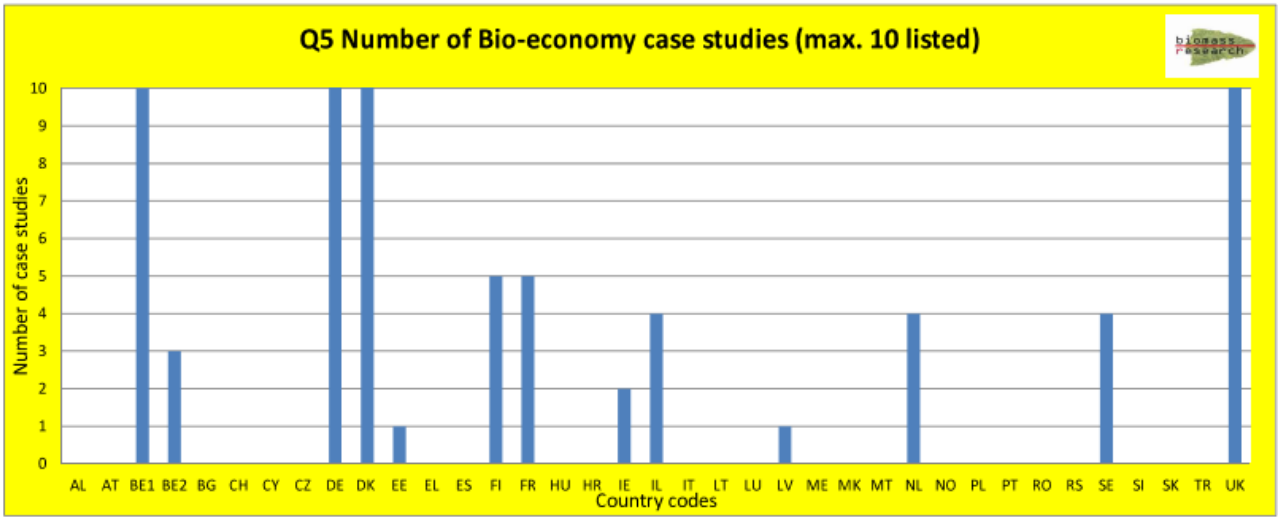

Figure 3.7 Number of case studies reported[8]

Question 6: Bioeconomy transnational R&D collaboration

The participating countries see large (potential) benefits of participation in international R&D programmes related to the Bioeconomy, although in many cases countries find it difficult to assess priority. Table 3.2 presents an overview of rankings allocated to individual elements. The lowest ranking (1) was not given. Most frequent were the highest rankings (4 and 5).

Table 3.2 Rankings reported on perceived benefits of transnational R & D collaboration

Ranking **Sector / activity**	**1**	**2**	**3**	**4**	**5**	**All**
Food security	0	1	0	6	6	13
Policy framework	0	0	2	5	3	10
Bioenergy	0	0	5	2	4	11
Social inclusion	0	0	4	2	2	8
Economic, market framework	0	0	3	3	5	11
Knowledge, practices transfer	0	0	1	8	4	13
Resource efficiency	0	0	2	5	5	12
Biorefineries	0	1	2	4	4	10
Algae	0	1	2	2	1	11
Animal feed	0	1	4	5	0	6
Healthy food research	0	1	1	5	5	12
Sustainability criteria	0	0	1	3	9	13
Genetics	0	1	2	5	4	12
Renewable resources	0	1	3	3	4	11
Footprint methodology	0	1	1	3	3	8
All	0	8	33	63	61	4

[8] For the sake of conciseness, a maximum of ten case are presented studies per country

Average ranking scores per element were high, ranging between 3.5 and 4.6. Highest scores were given to research on the development of sustainability criteria, and to research on biorefineries, food security, resource efficiency and knowledge transfer (Figure 3.8). Average scores for political/strategic and economic elements were similar (4.1). Scores for environmental elements were slightly higher (4.2).

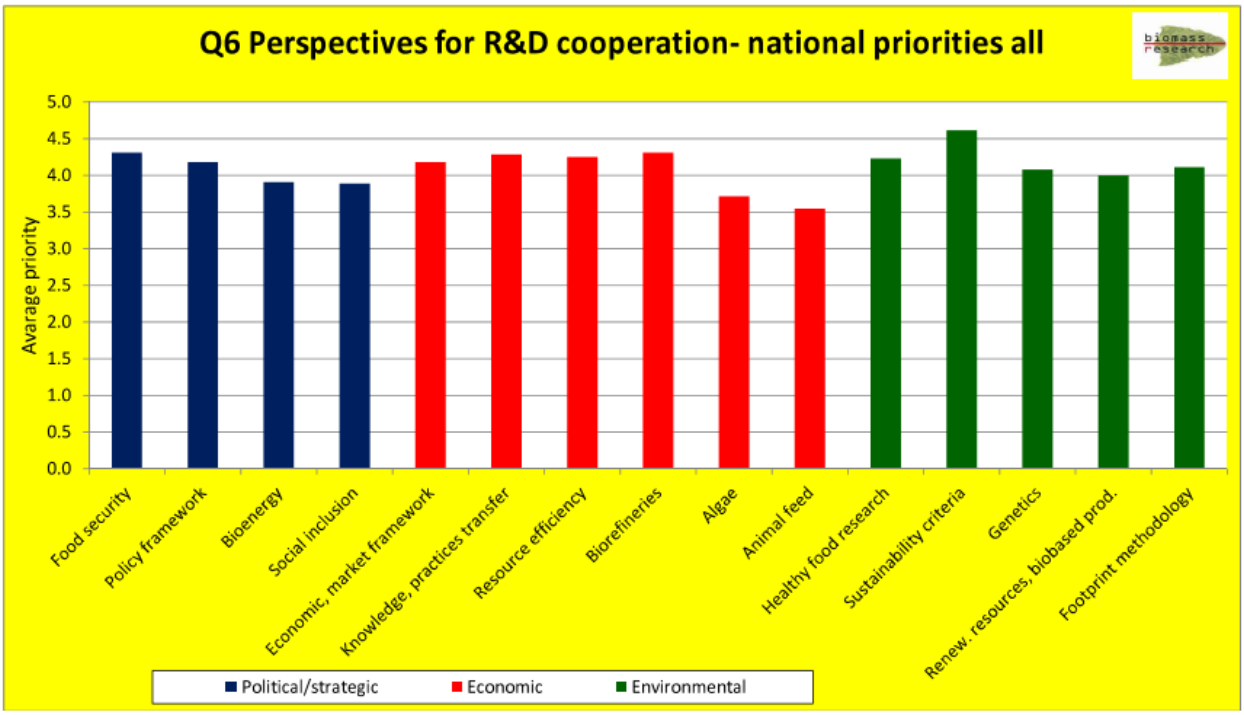

Figure 3.8 Perspective for international cooperation (all submissions)

A comparison between scores of Member States and non-Member States shows few differences. Member States generally give higher rankings, which suggests higher expectations of international cooperation. Environmental elements are given the highest ranking (Figure 3.9).

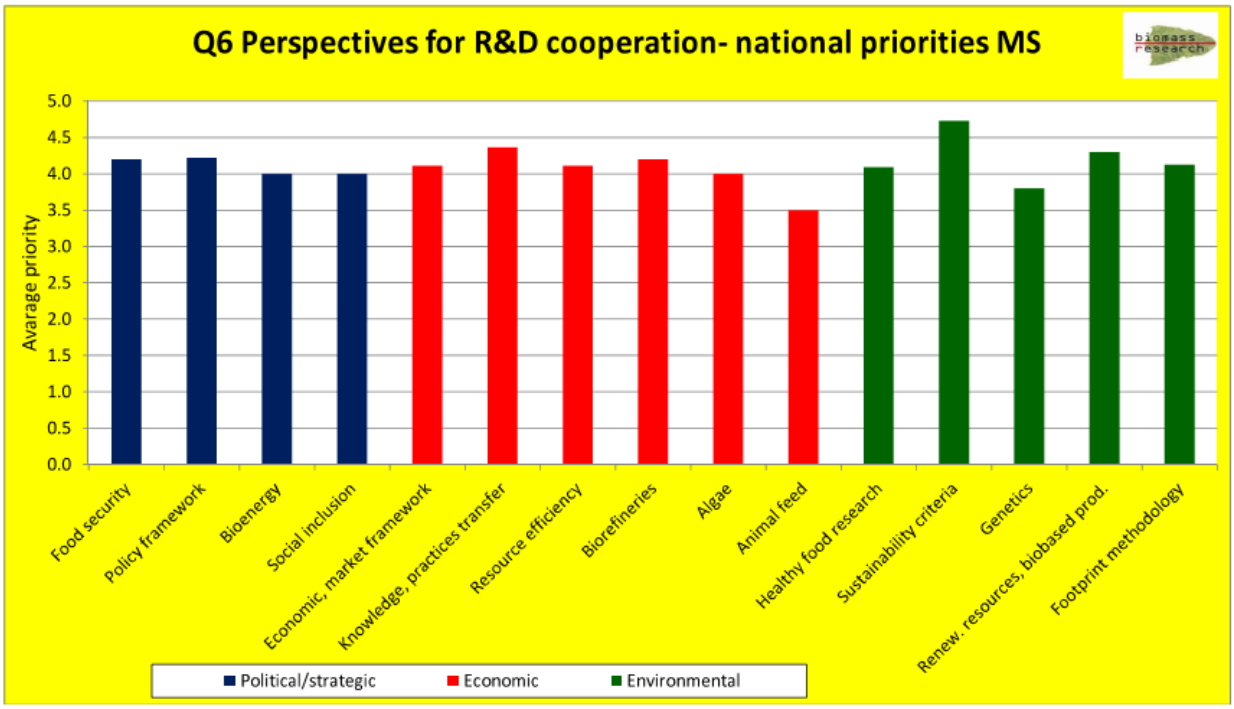

Figure 3.9 Perspective for international cooperation (Member States only)

4. DISCUSSION AND CONCLUSION

Following an active policy towards the development of a strong and effective Bioeconomy in the EU, the European Commission is working towards the establishment of a Bioeconomy Observatory. The development of the BISO project is supported by a "Bioeconomy Member States survey" to collect information on the bioeconomy at individual Member State level national, with a particular focus on national research activities and policy initiatives for the bioeconomy. A SCAR (Standing Committee on Agricultural Research) member list has been used to identify national contact points in 28 European nations including all EU Member States.

Each of the contact points was approached, requesting collaboration in the distribution and/or filling of the questionnaire in their home country. In most cases, the questionnaire was redirected to the responsible ministries as requested. Sometimes, a new contact point had to be approached. General response to the request was positive, with more than half of the countries submitting a questionnaire within the requested period which included the summer period of 2014.

The response was higher than previously was anticipated, which suggests that the right forum has been used to address issues of Bioeconomy Observatory. Twenty countries have submitted a questionnaire; Belgium submitted two (one for each major region). The quality of the submitted questionnaires was high, often providing a lot of details related to policy, R&D and regional initiatives.

This does not mean that all countries have provided similar quality of answers. As a rule, countries already active in the development of a Bioeconomy policy and research framework (e.g. Germany, Denmark, Finland, Belgium, and The Netherlands) made a larger effort in preparing the answers to the survey. While, further, the response rate has been above expectations, it is recommended to approach countries that did not (yet) submit directly as the SCAR list of contact points is not likely to be the best opportunity to obtain the missing questionnaires.

Large differences exist with respect to the implementation of a Bioeconomy policy. A limited number of countries installed such a policy, a bioeconomy advisory board or an implementation agency. In some other cases, one or two ministries have been assigned the lead in the development of a Bioeconomy policy. Generally, a small number of countries seem to implement a full package (strategy, board, agency, policies, and dedicated R&D programmes).

There is, however, room for optimism. While Bioeconomy oriented policies and R&D infrastructure are developing, both at the national and the EU level many initiatives are taken. There is a substantial budget for Bioeconomy related research, with annual expenses exceeding 2.3 billion Euro.

A large number (108) of regional/cluster or national initiatives has been listed in the survey, and more may be expected. The recent publication of National Bioeconomy Profiles in the Bioeconomy Observatory (https://biobs.jrc.ec.europa.eu/), combining data from national and EU statistical bu-

reau's with industrial key figures and data generated by the survey, is another milestone.

How, then, to evaluate these figures? We compare results presented above to a list of enabling factors for the development of new biotechnological innovations as presented by the Pugatch Consilium (2014)[9]. Enabling factors for innovative technological development include:

1. **Human capital** – A basic and fundamental building block is the availability of high skilled and technically trained human capital.

2. **Infrastructure for R&D** – R&D capacity is critical to fostering innovation and activity in high tech sectors including biotechnology and is reflected by country-level indicators including total R&D expenditure; patenting intensity; life science investment levels; public-private partnerships; and academic and scientific citations.

3. **Intellectual property protection** – Intellectual property rights such as patents and regulatory data protection are historically of real importance to the biotech and biopharmaceutical innovation process as they incentivise and support the research and development of new biological technologies and products.

4. **Regulatory environment** – The regulatory and clinical environment in a given country plays a significant role in shaping incentives for innovation and establishing adequate levels of quality and safety for biotech products, particularly biopharmaceuticals.

5. **Technology transfer frameworks** – Technology transfer is an important mechanism for the commercialisation and transfer of research from public and governmental bodies allowing private entities to develop commercially applicable technologies.

6. **Market and commercial incentives** – Market and commercial incentives can be realised *via* different formats including as tax incentives, support for basic research and R&D credits for investments in plant, equipment and other R&D infrastructure.

7. **Legal certainty** (including the rule of law) – The general legal environment as it relates to the rule of law including legal business context is crucial to commercialization and business activities.

Five of the enabling factors are addressed by the survey: human capital, R&D infrastructure, the regulatory environment, technology transfers, and legal certainty. Market incentives are not addressed directly, but it may be expected that emphasis on a proper legal framework and – especially – budgets for Research & Development, as well as international cooperation in R&D, help to develop an environment where economic conditions for commercial development is favourable. The survey provides a good coverage of the factors that need to be addressed in the Bioeconomy.

[9] Pugatch (2014). The bioeconomy. http://www.pugatch-consilium.com/reports/Building_The_Bioeconomy_PugatchConsiliumApril%202014DD.pdf . Accessed 12 June 2014

The recommendations presented by Pugatch with respect to technology development are in line with results of other studies. Compare, for example, to a listing by the Milken Institute (2013)[10]. According to this study, prequisites for bioeconomy development in the USA include:

- Consistent government policies
- 'Green banks'
- Public, private procurement programs
- Legel regulatory playing field
- Use agricultural, rural development programs
- CAP, Cohesian funds
- Use existing infrastructure

The list provided by Pugatch is also in line findings of other theoretical frameworks like the *Functions of Innovation Systems Theory*[11], that was developed for analysing the implementation of innovations in the Netherlands. As a rule, succesful innovations require a combination of availability of robust technology development, knowledge diffusion, enterpreneurship, availability of credit, market development and political frameworks (Langeveld 2010[12]).

Not all elements are equally well covered in the JRC-SCAR survey or – more in general – the Bioeconomy Observatory. Basically, these focus on the identification of the Bioeconomy as a strategic development area, the stimulation of national Bioeconomy strategies, the measurement and evaluation of performance including the identification of best practices, the leverage of national capabilities and enhancement of international cooperation.

[10] Milken Institute (2013). Financial Innovations Lab Report. Unleashing the power of the Bio-Economy.

[11] Hekkert, M., Negro, S., Heimeriks, G. and Harmsen, R. (2011). Technological Innovation Systems Analysis. A manual for analysts. Utrecht, Copernicus Institute for Sustainable Development and Innovation.

[12] Langeveld, J.W.A., Kalf, R. and Elbersen, H.W. (2010) Bioenergy production chain development in the Netherlands: key factors for success. Biofuels, Bioprod. Bioref. 4:484–493. DOI: 10.1002/bbb.240