

# Sustainable and Flexible Value Chains of Biogas Production in Baden-Württemberg

A Focus Area within the "Bioeconomy Research Program Baden-Württemberg"



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## BACKGROUND

Due to price increases for biomass and a severely remodeled subsidy system for bioenergy, the biogas sector is currently facing considerable challenges. Because numerous biogas plants already exist, biogas research is trying to develop an even more efficient and sustainable biogas production. Biogas plants should in the future be profitable without any subsidies.

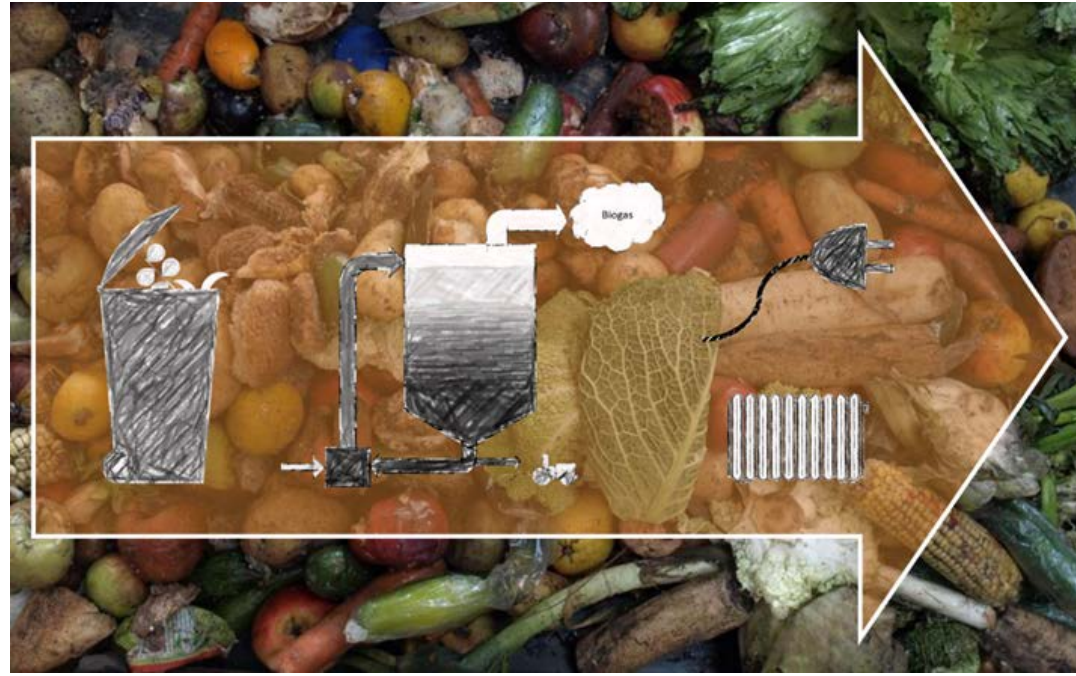
The research area „Sustainable and flexible value chains of biogas production in Baden-Württemberg“ is integrated into the Bioeconomy Research Program Baden-Württemberg. It focuses on research competence existing in the entire biogas value chain in Baden-Württemberg. The research network started in July 2014.

## OBJECTIVES

The biogas research area is subdivided in four research units (RU) representing the whole value added chain of biogas production. Furthermore, two projects of integrative activities of social and ecological research areas are associated.

### RU 1: Substrate production and supply

- Analysis of supply and utilisation of residues and waste materials for biogas production.

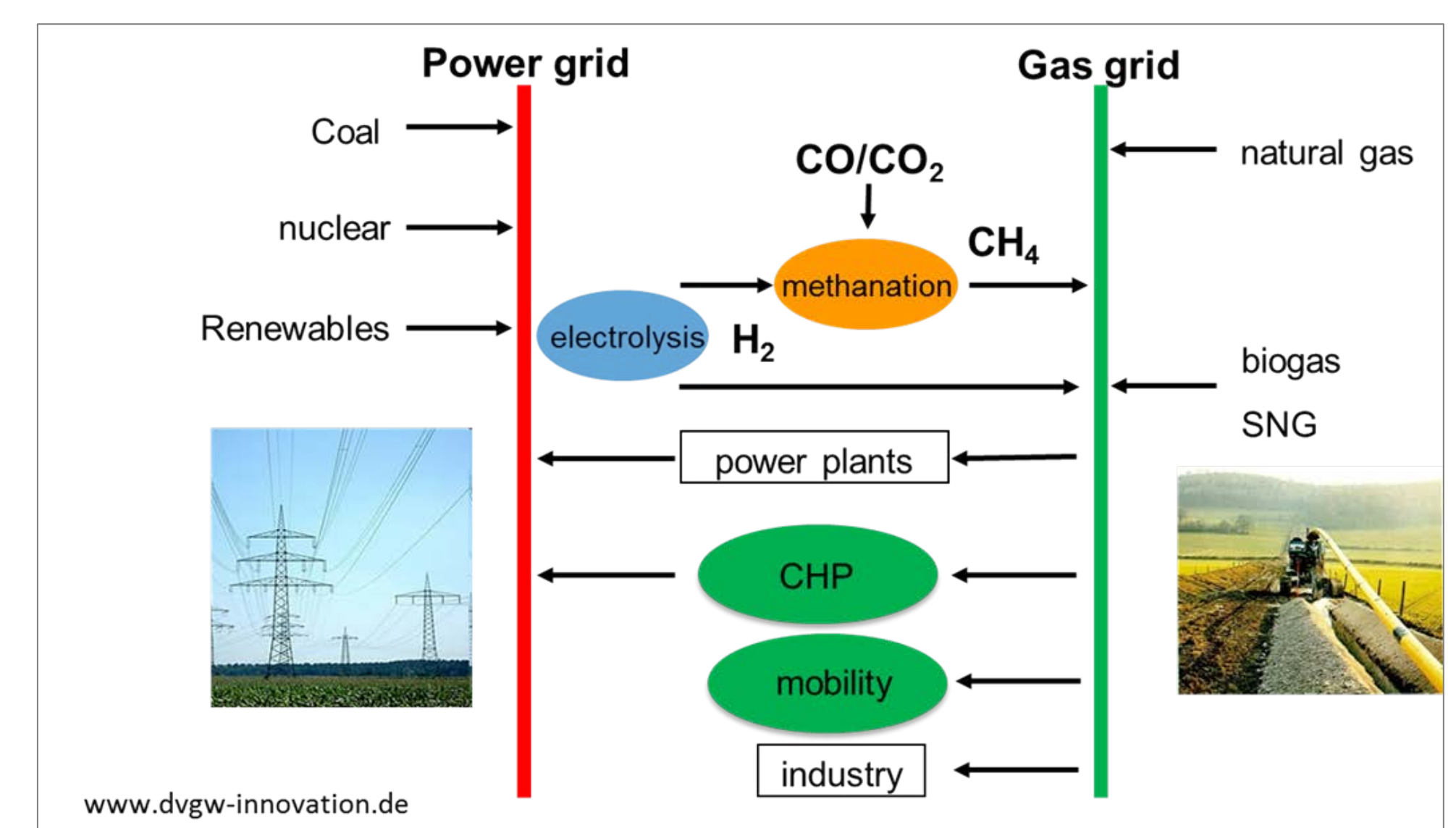


### RU 2: Substrate conversion

- Analyses and development of processing techniques for residues and waste materials usable for biogas production.
- Improvement of techniques to feed biogas into the natural gas grid in combination with Power to Gas (PtG) concepts.

### RU 3: Utilization of conversion Products

- Options of biogas use to support future energy system services in terms of repowering and balancing energy.
- Development of processes for the material use of biogas.



### RU 4: Economic, ecological, social and (ethical) impacts

- Analysing risk and flexibility profiles of substrate farmers as well as biogas plant operators. Derivation of economic and ecologic acceptancy profiles – also in interaction with Research Network Lignocellulose.
- Farm level respectively sector modelling in the context of biomass cultivation (for biogas and lignocellulose) with simulating of different energy scenarios.
- Analyses of the social and (ethic) dimension of biomass utilisation for biogas production, also in interaction with the Research Network "Lignocellulose".

## LESSONS-LEARNED AND RECOMMENDATIONS

As the first year has shown, an interdisciplinary analysis of value chains of biogas production is very important. The collaboration needs a comprehensive platform between the different disciplines. It will lead to an additional value in understanding and results. The results should show how and where to produce comparatively low priced bioenergy from biogas with less negative externalities. The outcome of the research network should be useable for scientists, policy makers and also practitioners.

References: Photo Archive University of Hohenheim and Lothar Henke, Ralf Zierold, Verena N., Jürgen Mees, Wolfgang Discherl / pixelio.de

### Partner:

- **DIALOGIK:** Renn, Scheer
- **DVGW-Research Centre at the Engler-Bunte-Institute of the KIT:** Graf
- **Karlsruher Institute for Technology (KIT):** Kolb, Meyer
- **University of Hohenheim:** Bahrs, Grethe, Lemmer, Oechsner
- **University of Stuttgart:** Eltrop, Kranert, Scheffknecht, Schließmann
- **University of Tübingen:** Potthast

funded by



Baden-Württemberg

MINISTERIUM FÜR WISSENSCHAFT, FORSCHUNG UND KUNST



# Perspectives of a future-proof logistics applied to the natural raw material supply in the Cluster Region (Plan C)

## Background

- Availability and supply of raw material are essential factors in the bio-economy.
- Challenges thereby are the consistent quality, season-independent availability and logistics.

## Objectives

- creating a raw timber potential analysis based on the National Forest Inventory (NFI 3)
- optimizing the treatment of forest stands and timber logistics

## Activities

To ensure the **raw material availability** long-period planning is necessary. Sustainable forest management is only possible if younger age classes are less utilized than their growth. To initiate generation change the utilized timber volume of older age classes has to be greater than their growth.

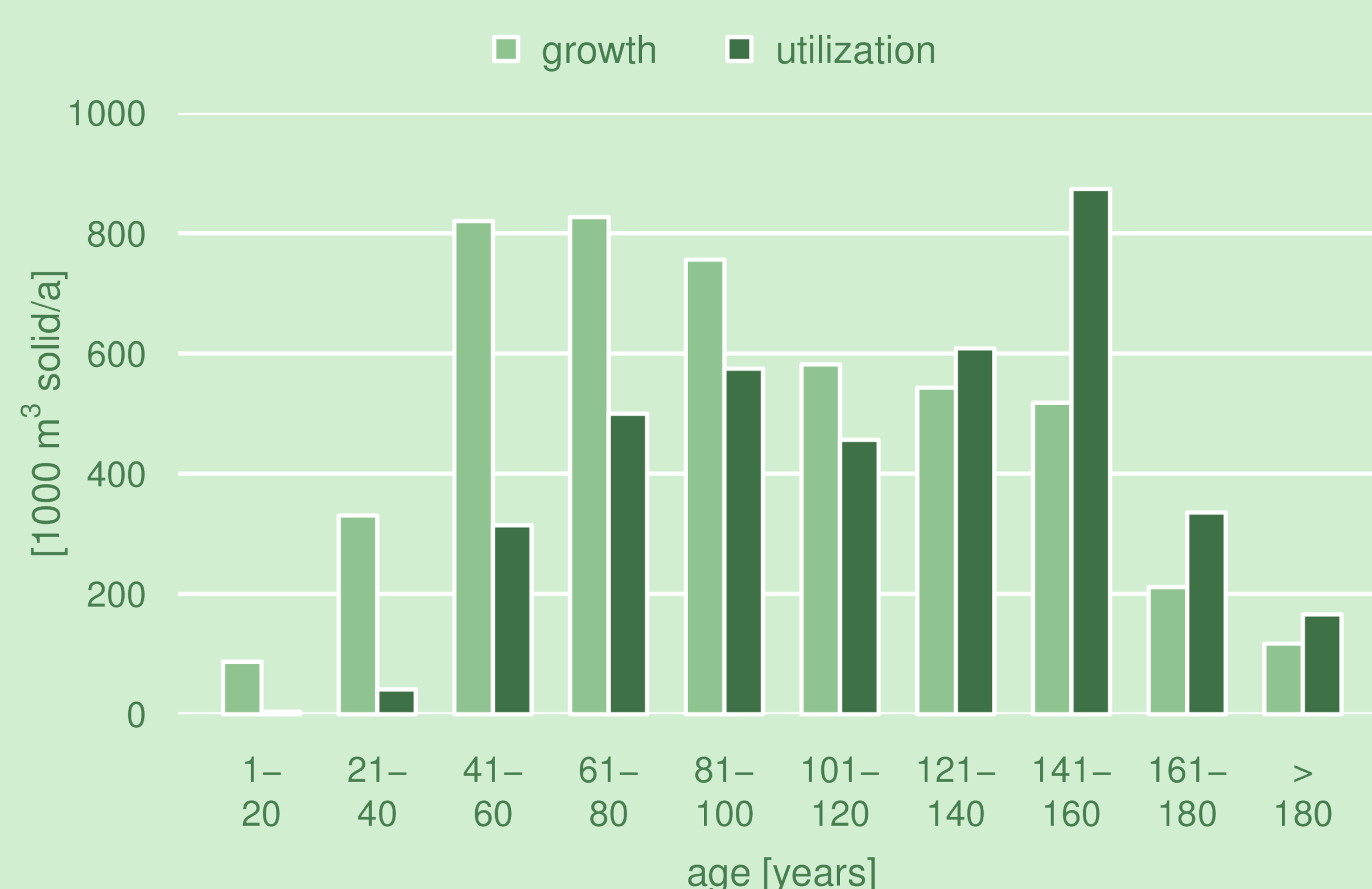


Figure 1: Timber volume growth and utilization in the project region between 2002 and 2012 in age classes.

Security of **raw material supply** depends on the knowledge and the practical experience to optimize integrated value chains. The consortium explores a method which smartly combines specific forest knowledge and logistics thinking. The aim is to develop a model-based valuation method which enables an optimized raw material supply.

## Results

- The potential of beech timber is very high in the project region. The annual average of growth was about 4.8 m m<sup>3</sup> in 2002-2012.
- The growth simulation showed that this high potential is expected to be constant in the following decade.

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- The comparison of supply and demand showed that timber processing companies used about 2.0 m m<sup>3</sup>/a. 1.3 m m<sup>3</sup>/a were used as fuelwood. These yielded into 3.9 m m<sup>3</sup> solid/a standing volume.
- The difference between growth and utilization cannot be interpreted as unused raw timber potential (Figure 1) and underlies several further restrictions (e. g. for nature conservation) → results showed an utilization of raw timber that largely exhausted the growth.

## Lessons-Learned & Recommendations

- The results still are a reliable basis for large-scale planning after the project.
- The next step is the development of the stand wise planning tool (mapping space-time ratio) which enables the optimization of logistics.

## References & Acknowledgements

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# Where wood meets chemistry – Central Germany as the model region for a bio-based future

## Background & Objectives

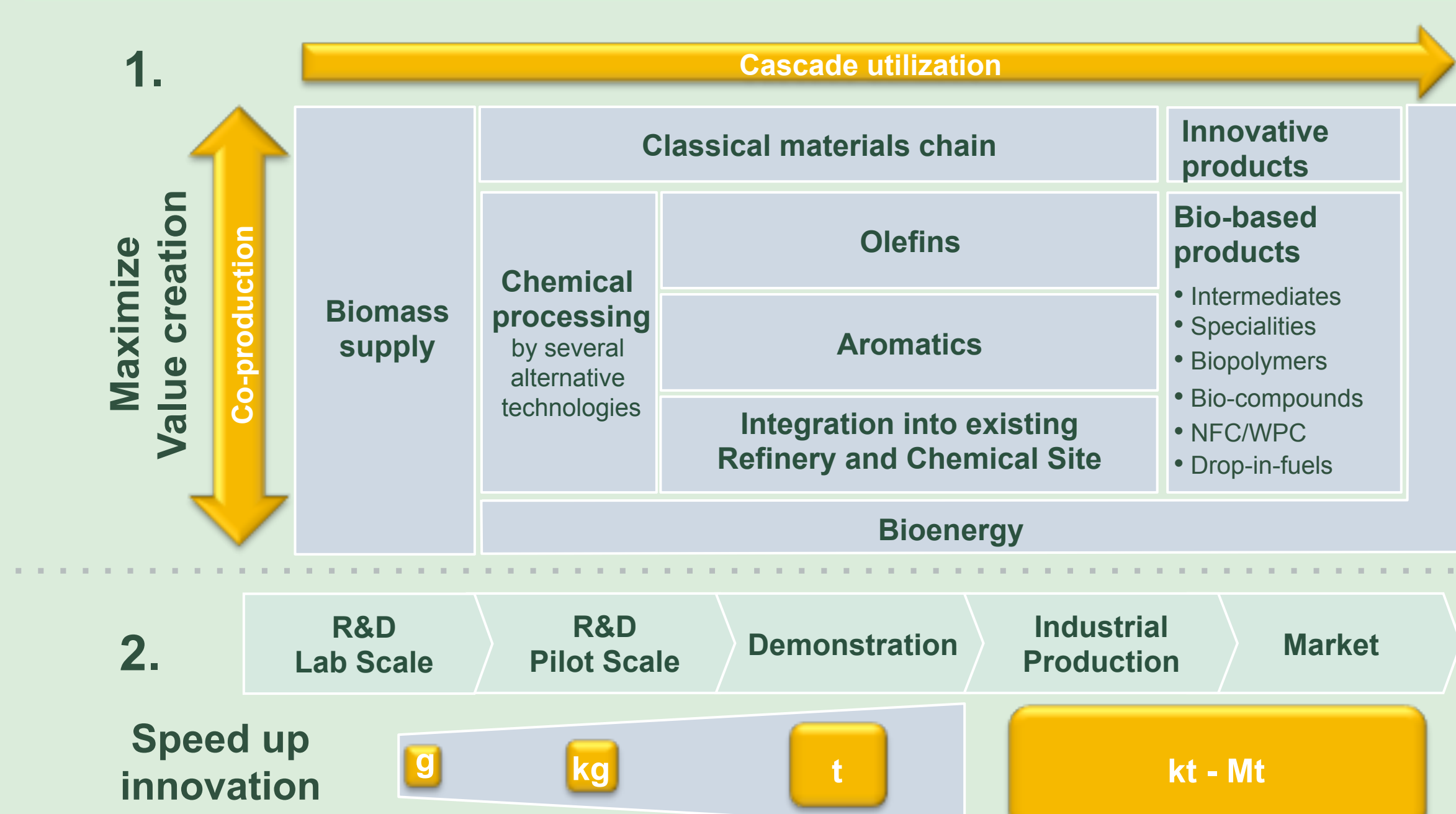
“Bioeconomy” is defined as “the knowledge based production and use of renewable resources to provide products, processes and services to all sectors of a future sustainable economy”. Food security and sustainable production of renewable resources have a high priority in this concept.

A sustainable bioeconomy needs the close cooperation between economical areas which usually do not work together: agriculture and forestry, food industry, chemical industry, plastics and plastic processing industry, wood processing industry, construction industry, energy industry and machinery and plant engineering. The Federal State of Saxony-Anhalt in Central Germany is able to provide this industrial infrastructure and has therefore become the home of the Leading Edge Cluster BioEconomy.

This cluster was set up primarily for optimizing the material usage of wood with high value creation (wood as a material of construction and as a raw material for the chemical industry), supplemented by the energetic usage of the process residues. It operates with the following goals

- Sustainably **maximize value creation of non-food biomass** through coupled production and cascaded utilisation in order to generate chemicals, new materials and energy.
- Speed up innovation through the **integrated and coordinated up scaling of processes and plants** from laboratory to demonstration and industrial scale.

## Strategic approach



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## Activities

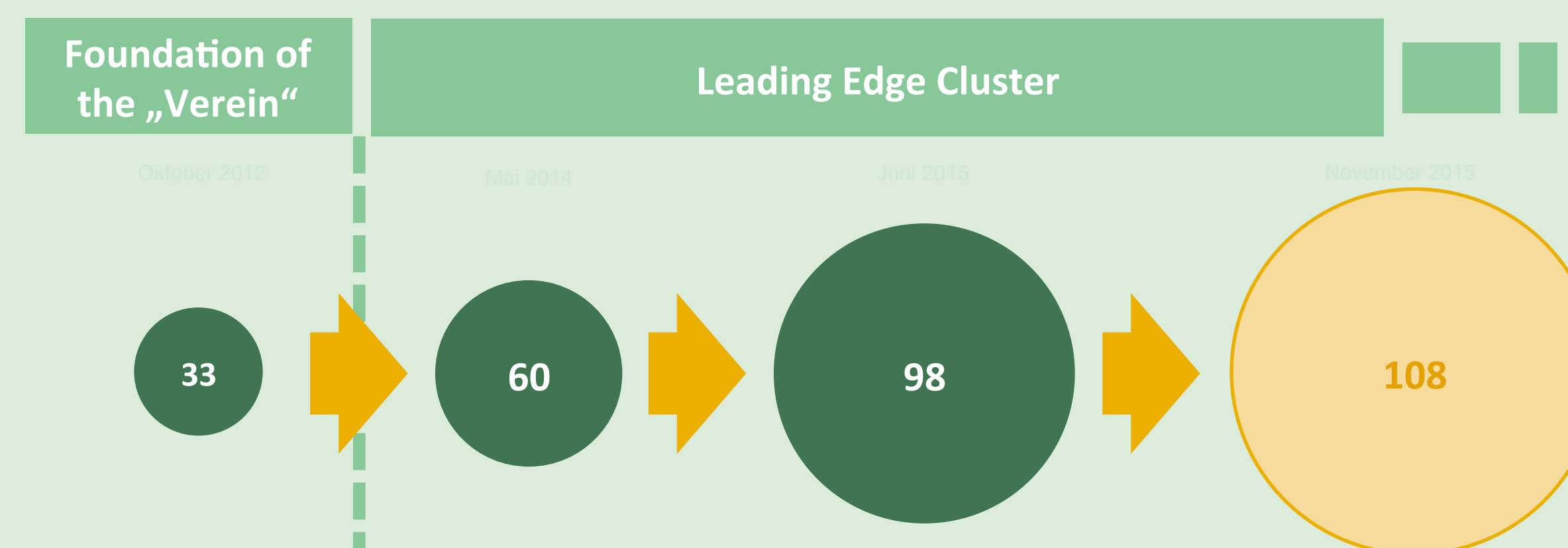
The cluster started up in 2012 as a group of 33 industrial and research partners. It organized itself as a “Verein” (BioEconomy e.V.) and defined its core competencies as the development, scale-up and application of innovative technical processes for the sustainable use of renewable non-food resources, primarily beech wood.

The cluster’s technical centres, where the majority of the R&D projects is carried out, are located in Rottleberode in the Harz, in Leuna at the Fraunhofer Center for Chemical and Biotechnological Processes (CBP) and in Leipzig at „Deutsches Biomasseforschungszentrum (DBFZ)“.

## Results

Between October 2012 and October 2015, the cluster has grown to more than 100 partners. These work together closely in 44 joint R&D projects in the areas of wood logistics, wood construction, biorefining of wood, new chemicals, polymers and materials on the basis of wood and on the energetic use of lignocellulosic residues. The first projects will finish in the second half of 2015.

## Cluster Development – Members & Project Partners



## Current Structure of the Cluster (Members and Partners)

SME	Large-Scale Enterprises	Research-Institutions	Universities/Education	Networks	Total
63	17	15	7	6	108



# Multidisciplinary Transition to a Sustainable Bioeconomy – the Case of The Paper Province 2.0



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**Magnus Lestelius**, professor of Graphic Technology, Faculty of Health, Science and Technology  
Karlstad University, Sweden



## BACKGROUND & OBJECTIVES

Karlstad University has been engaged in bioeconomy R&D with partners for decades. Engineering sciences: FP6-FP7, COST and Marie Skłodowska-Curie projects. Social sciences: research in regional development. With the cluster organization, The Paper Province, activities started 2011 in the ERDF-project *Future Factory*. It showed how engineering and social sciences could contribute to innovation and growth. New scope: a transition of the region to a sustainable bioeconomy in a 10 year initiative of €15M. Co-funded by VINNOVA, TPP and 90+ member companies, Region Värmland, local authorities, The Swedish Forest Agency and Karlstad University.

### Objectives

- A transition to a sustainable bioeconomy of the region, by engaging the whole society.
- How to transform? (Academic objective)



## ACTIVITIES

### Social scientific research

- Service management workshops and courses
- Developing methods for multidisciplinary research
- Researching key academic and policy concepts
- Developing doctoral studies in multidisciplinary research

### Engineering research

- Innovation driven projects
- Industrial PhD student projects
- Innovation workshops with entrepreneur
- MSc student projects

### For the overall project

- Networking
- Engaging in policy making
- Turning triple helix into quadruple helix activities
- Multidisciplinary research projects

## RESULTS AFTER 2 YEARS

Researchers contribute to the Smart Specialization strategy of Region Värmland.

### Social sciences research

- Developing cross-cutting stakeholder involvement for realizing the bioeconomy (Nordic Council of Ministers)
- Developing doctoral studies in multidisciplinary research environments (with Umeå University and Bonn University)
- Transdisciplinary project: Transition to bio-economy, smart specialization and quadruple helix (R. Värmland & TPP)

### Engineering research

- Research project on fossil free drying papermaking (tissue products manufacturing)
- 2 new innovation projects together with SME:s (packaging)
- 3 investment projects for industry production pilot facilities: coating, dewatering and lignin extraction
- 3 InterReg projects (univ., cluster org., business assoc.):
  - Use of wood materials, waste, energy handling and sustainability in pulp and paper industry, IMTRIS.
  - Innovation systems development for the packaging value chain from materials to consumer, SPIN.
  - Nordic Rheology Conference 2015, arranged by Karlstad University and The PaperProvince
- 6 collaborative project applications within bioeconomy (forest industry and pharmaceuticals).



## LESSONS-LEARNED & RECOMMENDATIONS

- Yet no multidisciplinary projects including both Social scientific and Engineering research, but progress is made.
- Multidisciplinary/cross-sector collaboration requires stamina, open mind, tolerance. 10-year project a plus.
- True societal transition to a sustainable bioeconomy requires policy interaction.
- Assess strengths and weaknesses and prioritize, which will give payback in future collaborations.

**ACKNOWLEDGEMENTS:** The Authors would like to acknowledge Mrs. Maria Hollander of The PaperProvince and Mr. Anders Olsson of Region Värmland for the collaborative environment provided by the TPP 2.0-project and the Värmland's Professors and Research Leader programme at Karlstad University (co-funded by RV).



# “Smart specialization Weser-Ems 2020” in the Bioeconomy Cluster

Ingo Große-Kracht

Strategic Planning for County of Osnabrück

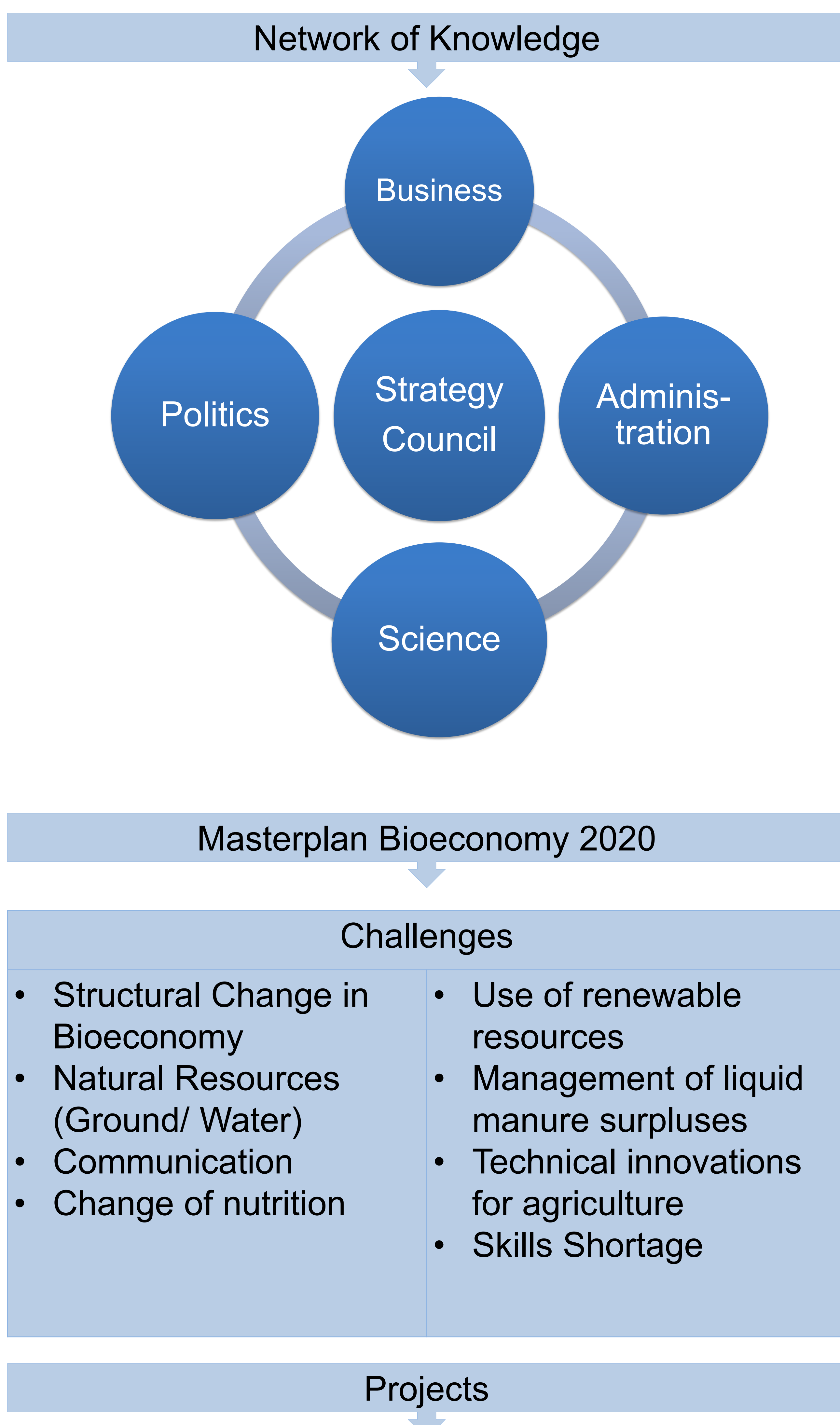
## BACKGROUND & OBJECTIVES

### Economic Potential in the Bioeconomy Cluster in Weser-Ems

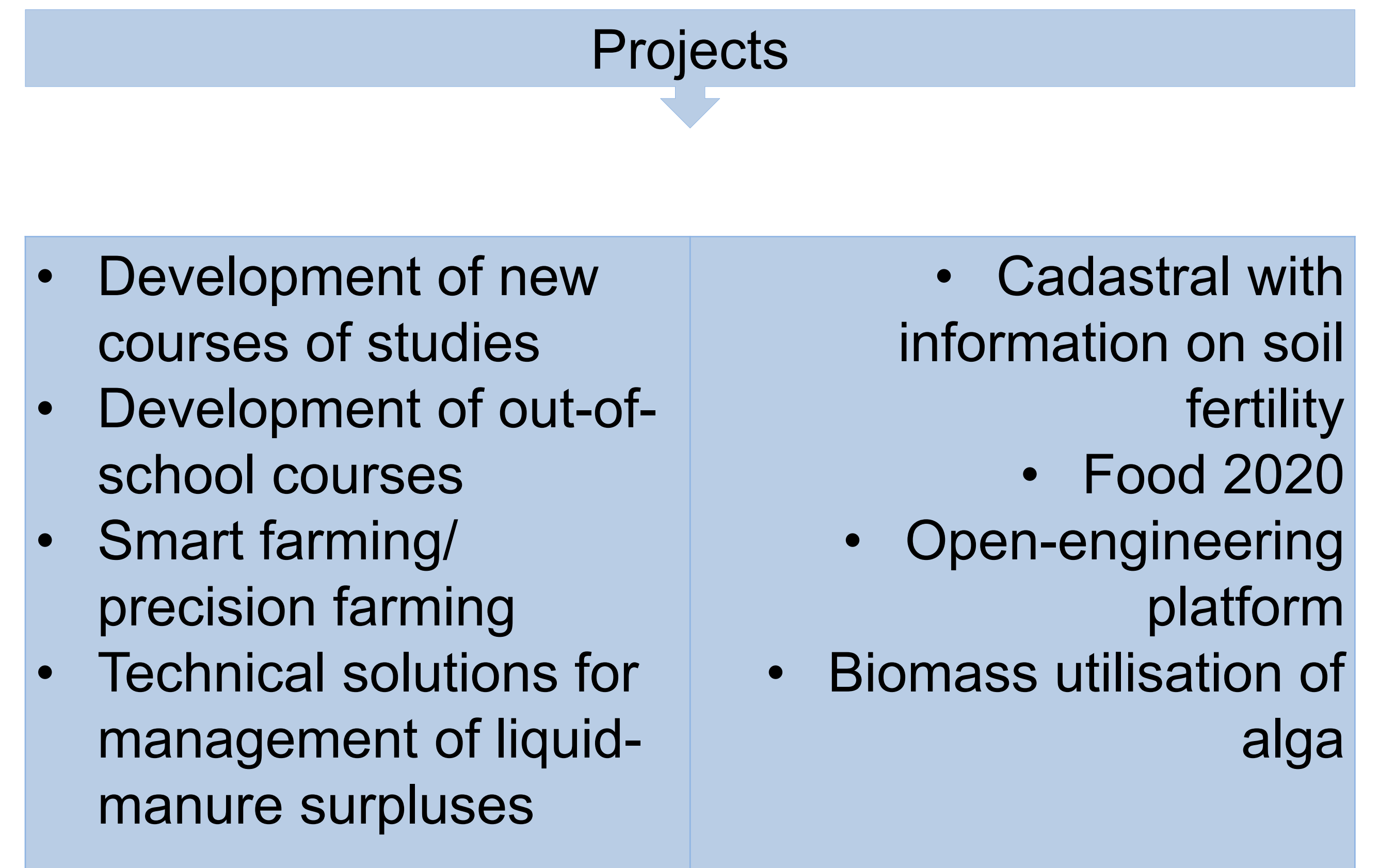
The economic potential in the Bioeconomy in the Weser-Ems Region is very high. You find many SME (often Hidden Champions) and more than 115.000 employees. But this line of business is challenged by several aspects such as: Globalization, ecological challenge, limitation of resources, decreasing consumer acceptance or skills shortage.

The 17 counties and urban municipalities in the Weser-Ems Region started a process of knowledge transfer in order to boost regional innovation and to achieve economic growth and prosperity. This strategy was based on a strong partnership between businesses, public entities and knowledge institutions.

## ACTIVITIES



## RESULTS



[www.weser-ems.eu](http://www.weser-ems.eu)

## LESSONS-LEARNED & RECOMMENDATIONS

- The Weser-Ems Region consist 17 counties and urban municipalities. Overall it's a rural area. In order to compete economically with other metropolises all over the globe it's reasonable to work together as a region. Besides the EU commission demands regional cooperation and smart specialization for the actual Funding Period 2014-2020.
- Knowledge is one of the most important resources at the beginning of the 21<sup>st</sup> century. SME often possess special knowledge but mostly do not have an own research and development department. So it's helpful to bring these companies together with universities and institutes in order to gain innovation.
- It was very fertile to work in interdisciplinary groups of experts from business, science, administration and local politics.
- Some challenges were identified for the Bioeconomy cluster in the Weser-Ems region. The Masterplan focuses on the year 2020 – it's recommendable to think strategic for a process lasting a least several years.

## REFERENCES & ACKNOWLEDGEMENTS

Any questions? Interested in further information?

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# Life in the midst of changes in climate conditions: adoption of sustainable land management practices in the Niger basin of Benin

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## BACKGROUND & OBJECTIVES

Climate change constitutes a serious challenge for the world, especially for developing countries. For the structural transformation of African agriculture, African farmers have to adopt relevant strategies to mitigate the adverse impacts of climate change on their activities such as declining agricultural productivity. However, all these adaptation strategies are not appropriate, because some lead to environmental degradation. Therefore, greater attention is given to alternative models of intensification, in particular through sustainable land management technologies (Branca et al. 2013). To combat poverty and environmental degradation, sustainable agricultural development is very important (Antle and Diagana 2003).

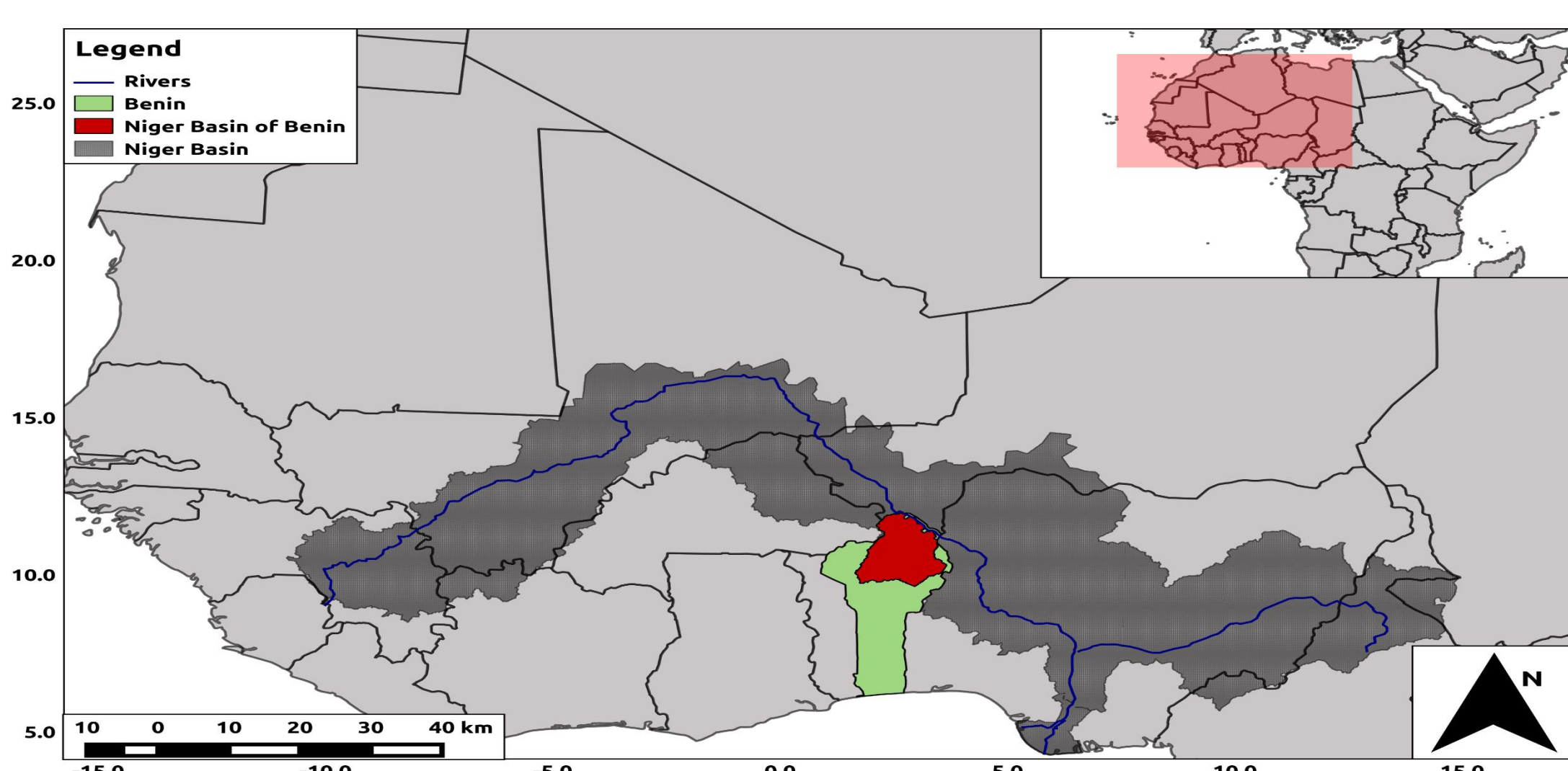
This research aims to analyze the determinants of farmers' perception and farm-level sustainable land management practices in the context of the Niger basin of Benin. Specifically, it aims

- To analyze farmers' perception about climate change;
- To analyze sustainable land management practices adopted by farmers to deal with the impacts of climate change in regards to their perception;
- To find substitutability and complementarity between the various adopted sustainable land management practices.

## ACTIVITIES

The research focuses on farmers of the Niger basin of Benin, which is located in the extreme north of the country, and more specifically between latitudes 11° and 12°30' N and longitudes 2° and 3°20'40 E and has an area of 43,313 km<sup>2</sup> out of the 114,763 km<sup>2</sup> of Benin. It covers five agro-ecological zones (AEZs) (wholly and partially) out of the eight of the country.

Figure 1. Map of the Niger basin of Benin



Source: Authors

A variant of the Heckman two-step procedure, which is composed of a univariate probit at the first stage (perception equation), and a multivariate probit at the second stage was used. This modelling procedure allowed to take into account the two-stage process of adaptation by accounting for the selection bias. This research used cross-sectional data from the farm household survey collected in 2013 in the Niger basin of Benin on 545 farm households relative to the 2012-2013 agricultural year, using three-stage stratified sampling.

## RESULTS

Farmers that perceive at least one facet of climate change represent 85.14%. Five sustainable land management practices are found to be adopted by farmers: planting trees (57.8%), stone bunds (8.07%), less fertilizer application (21.47%), crop rotations with nitrogen-fixing crops (31.56%), and intercropping with nitrogen-fixing crops (9.72%). The results of the determinants of sustainable land management practices are presented in Table 1.

Table 1. Results of the multivariate probit model

Variables	Plant trees	Stone bunds	Less fertilizer	Rotation	Intercropping
...	...	...	...	...	...
Distance from market	-0.010	-0.046*	0.062***	0.007	0.013
Number of relatives	0.014***	0.009	-0.006	-0.009	0.004
Number of close friends	-0.080***	-0.151**	-0.038	-0.042	-0.057*
Access to extension	-0.069	-0.254	0.061	-0.187	-0.311
Access to credit	-0.211	-0.369	-0.100	-0.054	-0.101
Labor sharing groups	0.358**	0.007	-0.157	0.331**	0.141
Farmers' organization	-0.122	0.483**	0.046	-0.056	-0.448*
Inverse Mills Ratio	-0.322	2.552***	1.289***	0.657	-0.271
	Rho1	Rho2	Rho3	Rho4	Rho5
Rho2	0.182*				
Rho3	0.186**	0.182**			
Rho4	0.183**	0.033	0.090		
Rho5	0.99**	0.129	0.161	0.218**	

Source: Authors

## LESSONS-LEARNED & RECOMMENDATIONS

Farmers perceive climate change. The results of the correlation coefficients of the error terms indicate that there are complementarities between different sustainable land management practices being used by farmers. Policies aimed at easing the structural transformation of agriculture, have to provide basic services such as better access to market, to appropriate roads, to education, to relevant extension services and to climate information.

## REFERENCES & ACKNOWLEDGEMENTS

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Branca G, Lipper L, McCarthy N & Jolejole MC, 2013. Food security, climate change, and sustainable land management. A review. *Agronomy for Sustainable Development* DOI 10.1007/s13593-013-0133-1.

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# Master's program in Bioeconomy

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## OUTLINE OF THE PROGRAM

The University of Hohenheim has a strong bioeconomic profile. The faculties of Agricultural Sciences, Natural Sciences, as well as Business, Economics and Social Sciences have combined their expertise in the bioeconomy by establishing the **interdisciplinary Master's program in Bioeconomy**.

### PROGRAM OBJECTIVE

The Master's program in Bioeconomy offers a **comprehensive and systematic overview** of all aspects of the production of (new) biobased products and services. Our students examine the utilization of renewable resources in a **systematic analysis of the biobased value chain**, focusing on the

- sustainable production of resources,
- their properties and means of conversion and processing,
- marketing and consumption of biobased goods and services.

Students acquire the expertise necessary to consider these issues from the perspectives of producers of resources, manufacturers of biobased products and consumers.



## PROGRAM STRUCTURE

During the **first year** of the program students acquire

- fundamental knowledge of all aspects of the bioeconomy,
- its interconnections and interdependencies, and
- the skills necessary for a systematic analysis of biobased economies.

Three **bridge modules** are offered in the first semester, which introduce the basic concepts of the agricultural, natural or economic sciences. This allows students with various disciplinary backgrounds to acquire the qualifications necessary to successfully complete the program.

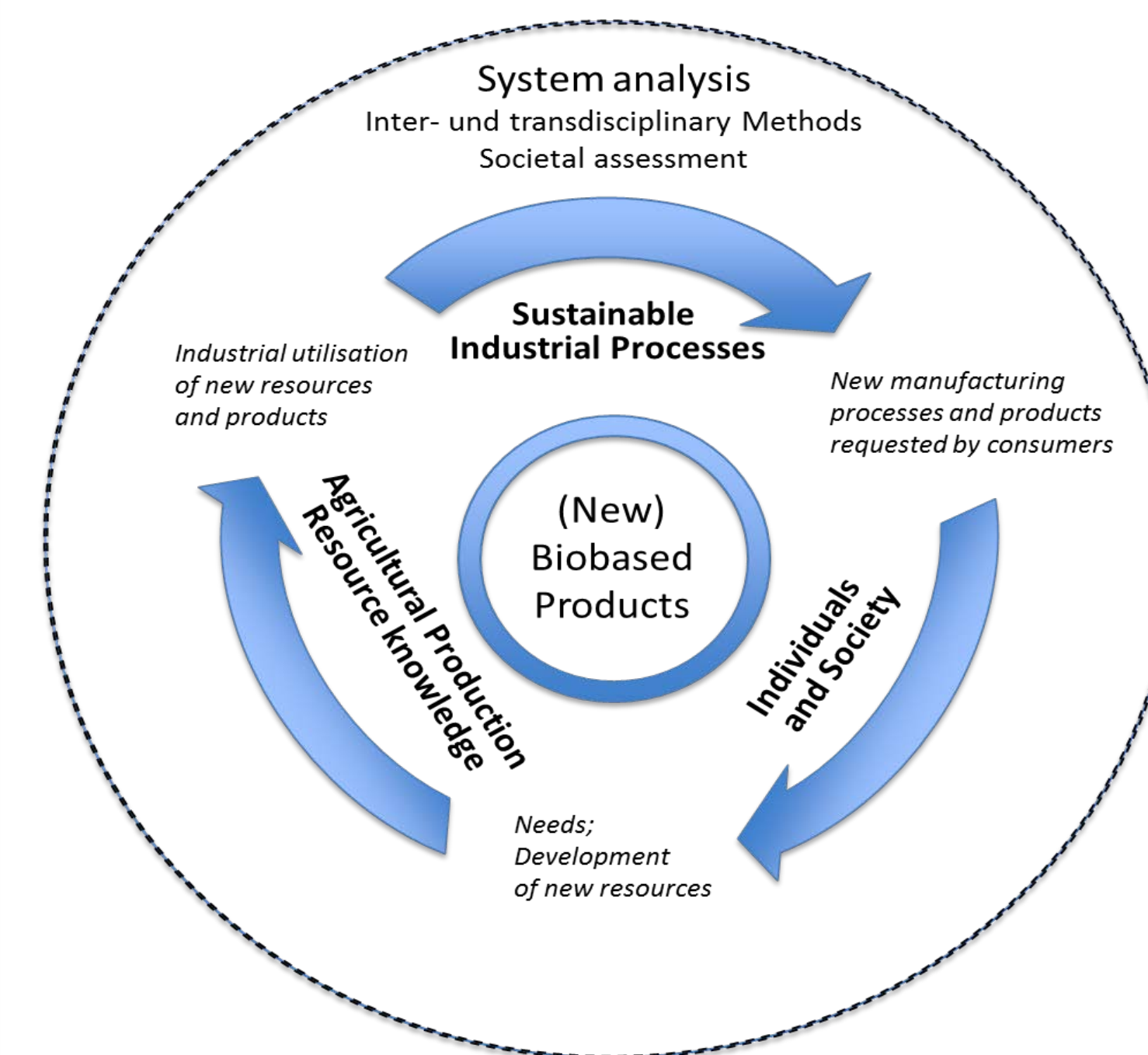
The **second year** of studies allows students to design their own curriculum by choosing from a range of elective modules. In a systematic examination of the entire biobased value chain in the module "Projects in Bioeconomic Research", students put their acquired skills into practice by tracing a specific product from inception to market launch in close cooperation with industry representatives. A research-intensive Master's thesis completes the program.

	1st semester	2nd semester	3rd semester	4th semester
6 credits	Inter- and Transdisciplinary Approaches in Bioeconomics	Sustainable Industrial Processes	Elective modules (30 credits)	Master's Thesis
6 credits	Properties of Biobased Resources and Products	Internal and External Costs and Benefits of Biobased Products		
6 credits	Agricultural Production of Biobased Resources	Markets, Innovation and Social Acceptance of Biobased Products		
6 credits	Economics and Management			
6 credits	Natural Science Concepts	Projects in Bioeconomic Research		

■ Compulsory modules  
■ Bridge modules

## DESIGNING THE PROGRAM

Conceptualizing the idea of the bioeconomy as it is understood and practiced at Hohenheim's three Faculties was the first step in designing the program. The following schematic represents our common research approach:



Central to the bioeconomy are (new) economically, socially and environmentally sustainable biobased products and services. All activities required to create, produce and distribute such products and services are fundamentally **interconnected and interdependent**. Consequently, our approach to bioeconomic production is **inter- and transdisciplinary** as it requires consideration of the entire value chain.

### T-PROFILE

In close cooperation with industrial partners we translated this concept into the competencies required to navigate and productively engage with the entirety of bioeconomic production:



**Systematic, holistic and participative approaches** are taught through problem-based teaching and learning. A three-day **workshop** at the start of the program introduces methods and strategies to engage productively across disciplinary and cultural boundaries. These skills are further developed during a **year-long project work** conducted in small groups. The aim is for students to acquire skills to work across the entire biobased value chain in diverse teams and on a global scale.

Students also expand their **disciplinary expertise** in order to be able to contribute sound expert knowledge to diverse project groups. The **combination of systemic knowledge of the bioeconomy and expert knowledge** enables students to easily adapt their disciplinary training to the dynamic demands of the (emerging) bioeconomy.

### INTENDED OUTCOMES OF TEACHING BASED ON THE T-PROFILE

- A distinctly **collaborative learning culture** has developed among students: they share individual disciplinary or regional knowledge.
- Through the workshop students have quickly adopted the **team and project-based learning mindset**.
- Teachers have started to **more intensely co-operate across disciplinary boundaries** regarding the contents and methodologies of their teaching.

## CONTACT

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# BIOECONOMY AUSTRIA

INNOVATION  
KREISLAUF  
WIRTSCHAFT



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## Background

Austria's bioeconomy related sectors currently generate approximately 8 per cent of GDP and employ 230,000 people. Bio-genic, renewable resources can play a key role in reaching a low-carbon, resource-efficient society and a clean economy. Two cornerstones were crucial for starting the Austrian process:

- In its Strategy for Research, Technology and Innovation (2011) the Austrian Federal Government included the aim to continue developing the potentials of science, research, technology and innovation in order to meet the grand challenges like global scarcities in energy and natural resources or climate change and its threatening consequences.
- BIOS Science Austria and the Austrian Union for Agricultural Research (ÖVAF) presented a comprehensive Bioeconomy Policy Paper in November 2013 and set the impetus for acknowledgment of bioeconomy in the Work Programme 2013-18 of the Austrian Federal Government.

## Objectives

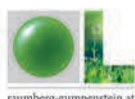
- Use of domestic resource potential and preservation of large parts of the value cycle in Austria.
- Identify and involve all relevant stakeholders and Federal Ministries.
- Develop an Austrian Bioeconomy Strategy within the context of existing strategies and action plans.
- Unite goals and strategies of bioeconomy, in particular with those of energy transition, sustainability and industry 4.0.

## Activities

1. Development of a RTI-Strategy for the sub-area of biobased industries in Austria in 2014.
2. The interministerial RTI-Working Group (Scarce Resources/Climate Change) elaborated a RTI-status-quo-report on bioeconomy-related activities.
3. Online Consultation of the report with more than 400 respondents.
4. Establishment of a virtual information platform "Bioeconomy Austria"
5. Discussion of initial results at the Technology Symposium of European Forum Alpbach 2015 with international bioeconomy experts providing feedback on the Austrian process.
6. Adaptation of the report with respect to consultation results.
7. As a follow-up a comprehensive stakeholder dialogue is scheduled for Autumn 2015.

## Key results & recommendations

- A close co-operation of all relevant ministries is a *conditio sine qua non*.
- Sustainability should be reflected in the definition of bio-economy.
- Boundaries between traditional industries are blurring because of the cross-sectorial nature of Bioeconomy
- The definition of clear long-term goals is necessary in order to increase speed and predictability of regulatory processes and to reduce regulatory barriers.
- The Austrian economy will benefit from synergies between energy transition, bioeconomy, industry 4.0 in coherence with other existing strategies and policies.
- The regionalisation of bioeconomy enables value creation within the scope of a region or within stakeholder communities and enhances rural development.
- Enhanced resilience against climate change but also against economic shocks.
- European coordination of regional strategies is required, taking into account the respective local demands and conditions.







## BACKGROUND & OBJECTIVES

A comprehensive understanding of bioeconomy is an important prerequisite for a future workforce and thus for the development and implementation of sustainable bioeconomy routes. However, today still disciplinary academic and vocational training dominate our education systems.

The demand of interdisciplinary-trained young people with excellent basic knowledge and additional bioeconomy competences and skills, be it in the academia, industry or the primary production sector, will increase in the future.

**AIM** Inter- and transdisciplinary education of young people at a top quality level involving research, economy, industry and society.

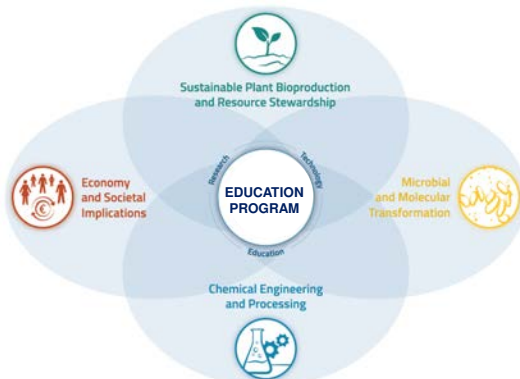
## ACTIVITIES

Analysis on existing bioeconomy related education activities on all career levels in NRW and EU

Bioeconomy company survey on skills needed for bioeconomy

Identification of stakeholders and key players in bioeconomy education in NRW and EU

### Top-down



### Bottom-up

Survey among PhD students and BioSC members

Constant evaluation of BioSC education activities

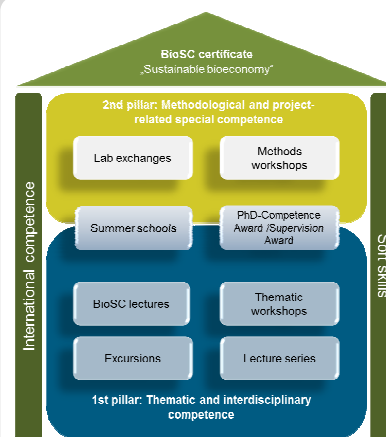
Dialogue with society



## RESULTS

### Graduates

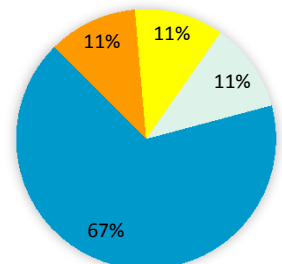
A structured education program "Sustainable bioeconomy" was developed and is improved constantly using two different approaches.



### Company expectations for the future workforce?

- Cross disciplinary thinking and multi-disciplinary team skills
- Holistic understanding of bioeconomy challenges
- Disciplinary excellence

Other - Please specify



\*Survey among 13 bioeconomy companies

### Undergraduates

A first **Bioeconomy Academy** – a one week holiday course for secondary level pupils was successfully tested.



### Society

To bridge the gap between experts from science, industry and society, the BioSC implemented the public lecture series "**Grand Challenges of bioeconomy – Basics and integrative solution approaches**".

### Topics (e.g.)

- Innovations for the bioeconomy – The long way from idea to consumer
- Global food security – a challenge for bioeconomy

## LESSONS-LEARNED & RECOMMENDATIONS

- Cross-disciplinary thinking and an holistic understanding of the bioeconomy concept is needed
- International integration of education activities becomes more important
- Intensification of collaborative cooperation in bioeconomy education is essential
- Bioeconomy concept must be educated at an early career level (at school)
- Keeping society informed is an important prerequisite for acceptance and adaptation

## REFERENCES & ACKNOWLEDGEMENTS



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# Bioeconomy Council Bavaria

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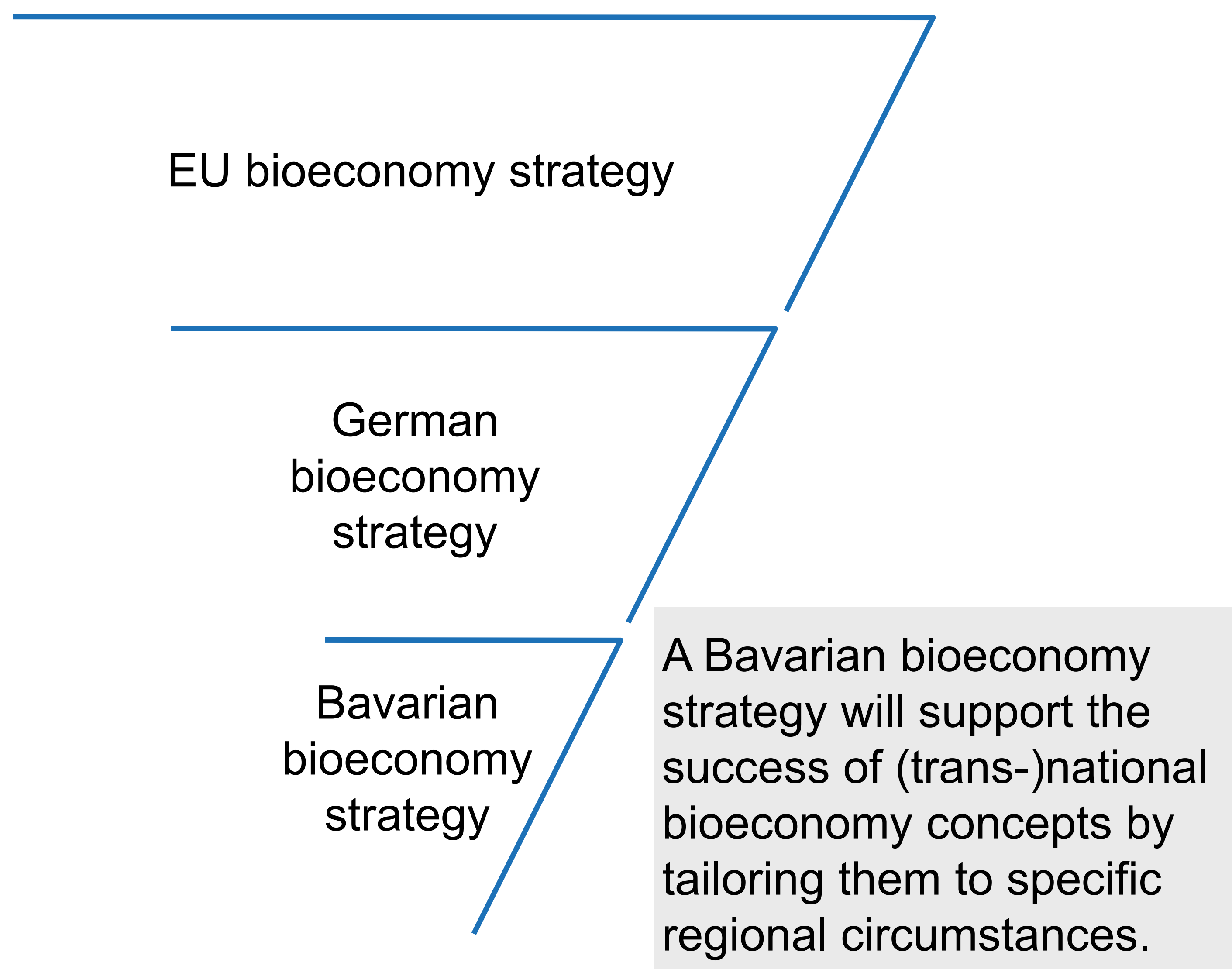
## BACKGROUND & OBJECTIVES

Bavarian State Ministry for Food, Agriculture and Forestry aims to develop a bioeconomy strategy for Bavaria

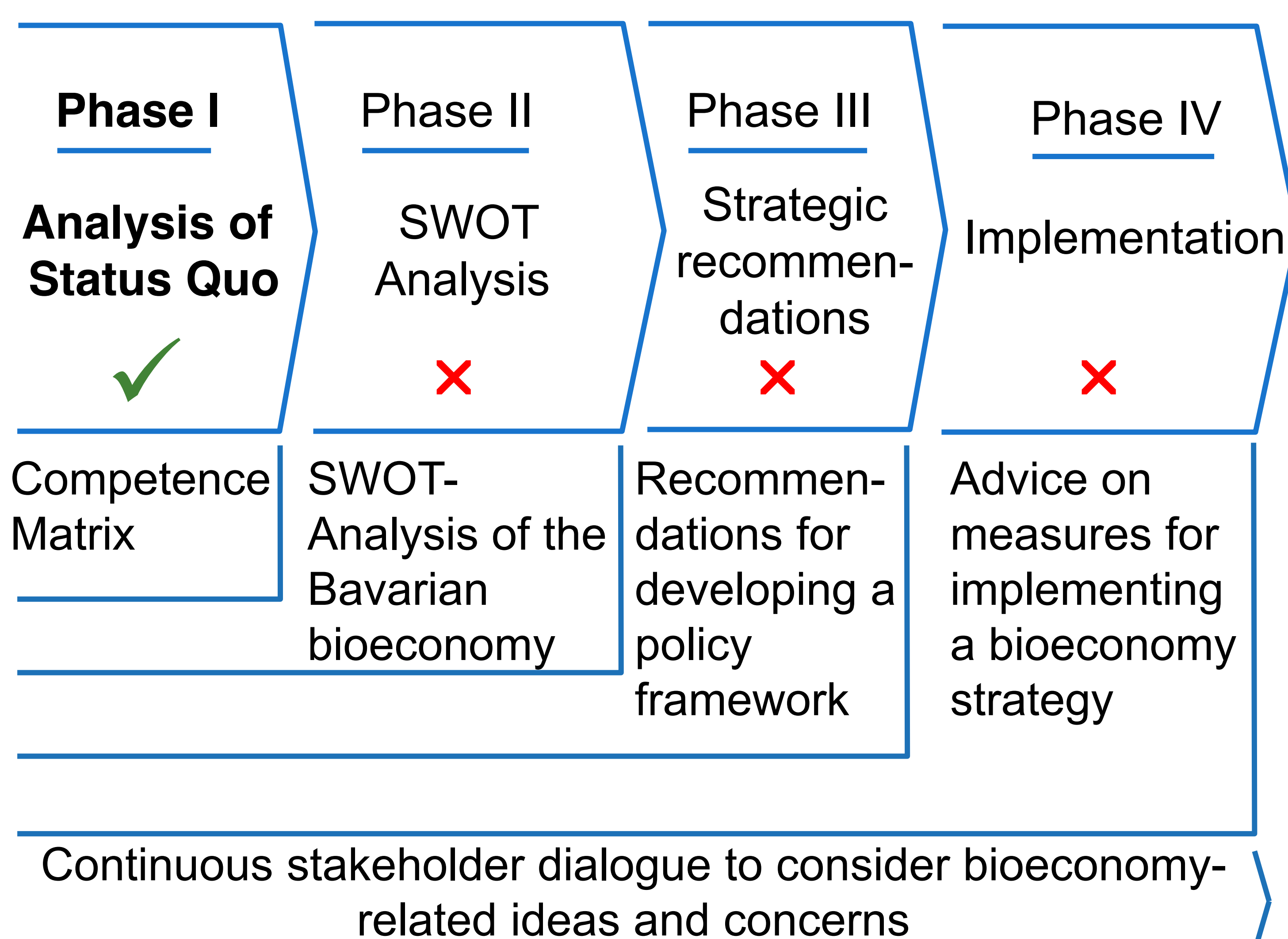
- Bioeconomy Council Bavaria appointed as an **independent advisory council**
- Council members cover a broad field of expertise by equally representing **industry and science**

Tasks:

- Develop recommendations for designing and implementing a bioeconomy strategy
- Promote/support a social dialogue about the bioeconomy



## ACTIVITIES

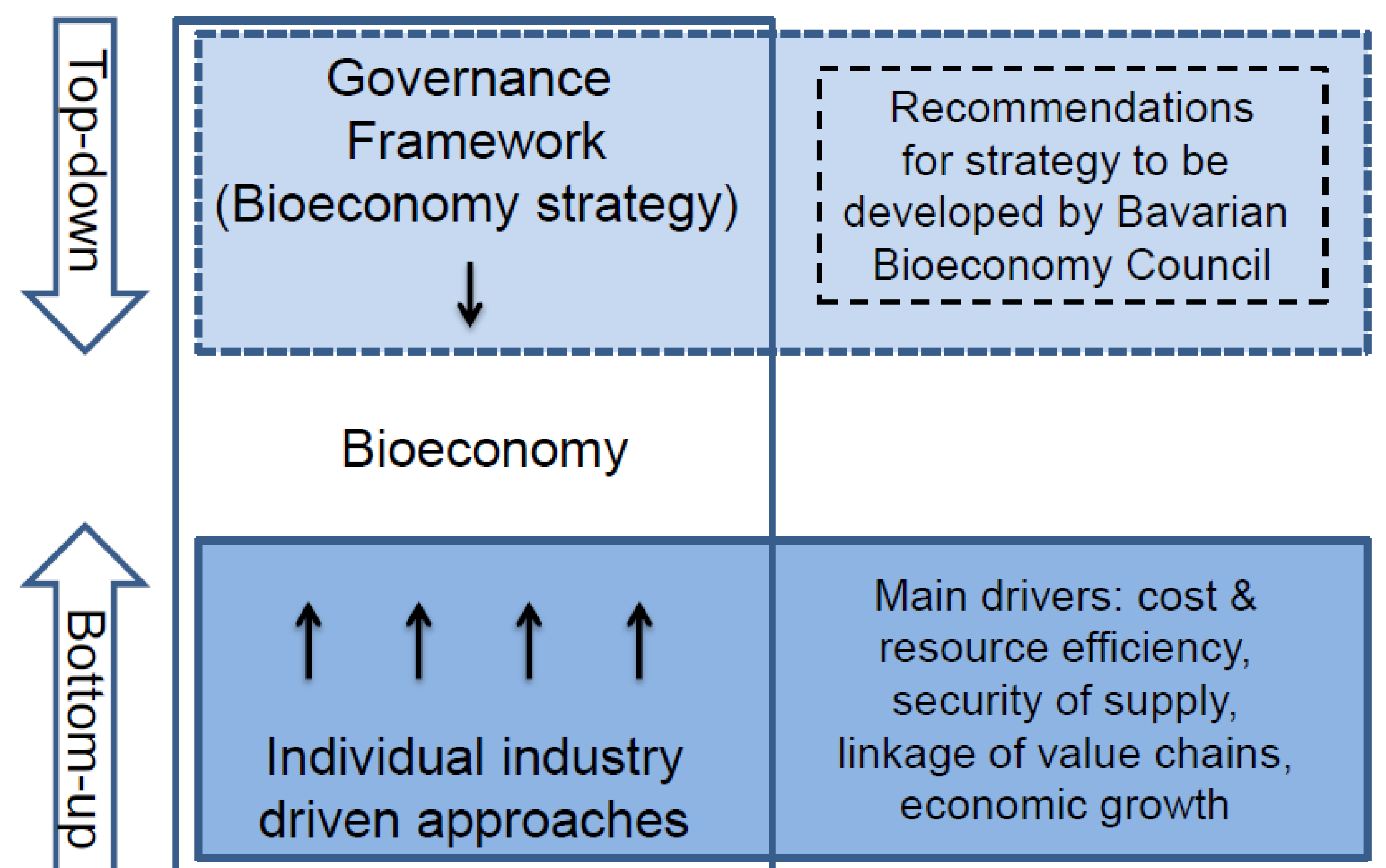


## FIRST RESULTS

The importance assigned to the bioeconomy concept differs across sectors:

- Bioeconomy is a part of corporate sustainability strategies
- Broad spectrum of regionally produced renewable resources is primarily processed in the traditional food sector and the energy industry
- Material use of renewable resources depends on availability (quality, quantity, price) and technical feasibility

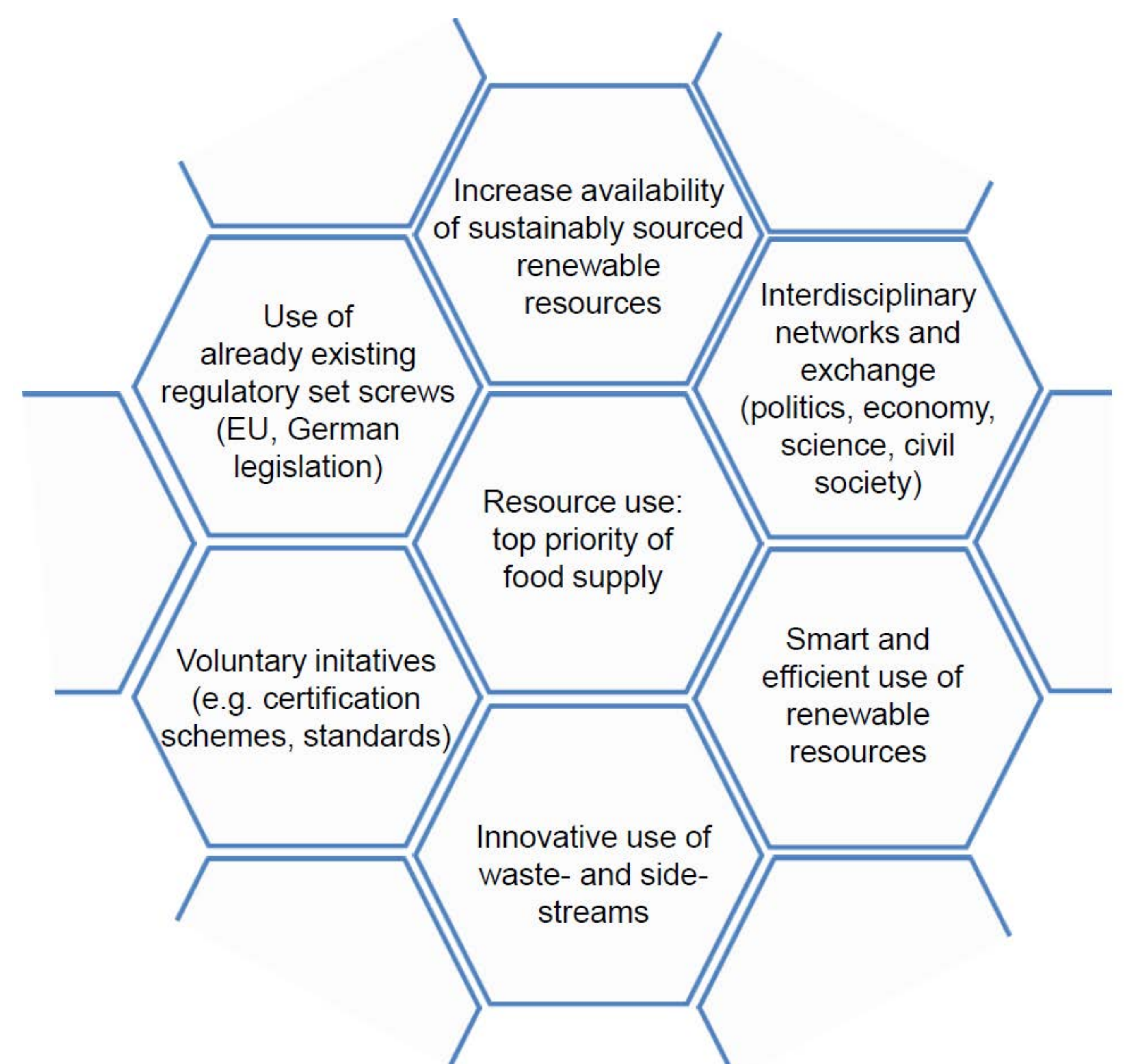
The Bavarian bioeconomy is driven by a bottom-up approach mainly based on individual activities of economic actors.



## LESSONS-LEARNED & RECOMMENDATIONS

A complementary holistic bioeconomy strategy can help to integrate these activities and to further develop a sustainable bioeconomy.

An emphasis could be placed on the following factors:





# Sustainable Bioeconomy Regions getting the balance right?

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## Background & Objective

Large globalised fossil configurations are shifting towards relatively smaller regionalised biomass-based configurations. This transformation towards a biobased economy will induce effects on the environment and communities within and across different regions. In general life cycle methods assess across a global scale. However, with many of these biobased transformations taking place on a regional scale, there is a greater need to also determine the associated regional effects. Therefore, how can we balance decentralised biomass processing for a region, while nurturing environmental and socio-economic conditions?

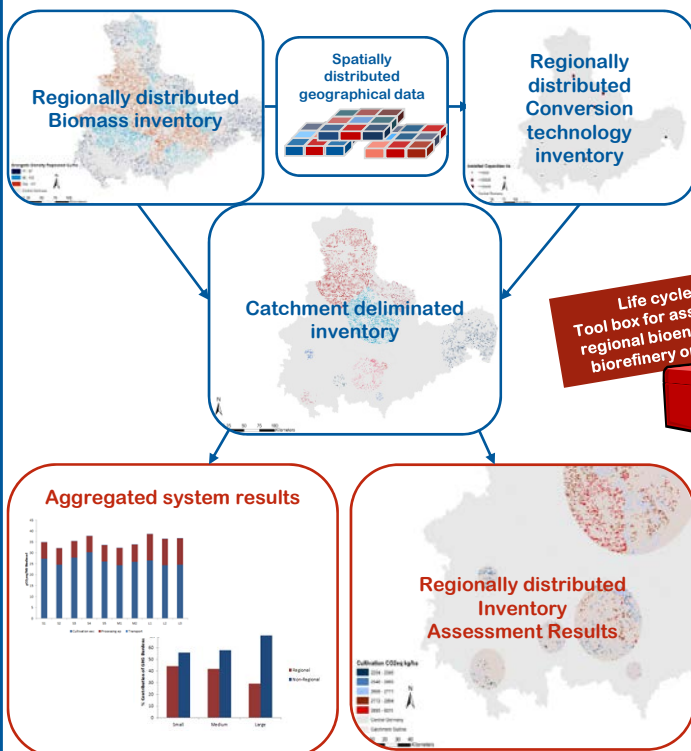
## Activities

Work conducted at the Bioenergy Department (UFZ) aims to begin answering such questions, enabled through the adaption and expansion of traditional life cycle approaches, in order to integrate more sustainability considerations in the evaluation of bioeconomy systems, with a particular focus on the bioeconomy regional foreground.

## Environmental Performance

“RELCA” – a Regional Life Cycle inventory Assessment

RELCA is a combination of modelling approaches to enable the assessment of regionally distributed burdens related to activities of biomass production and conversion in the regional foreground, while also linking to burdens relating to non-regional activities.

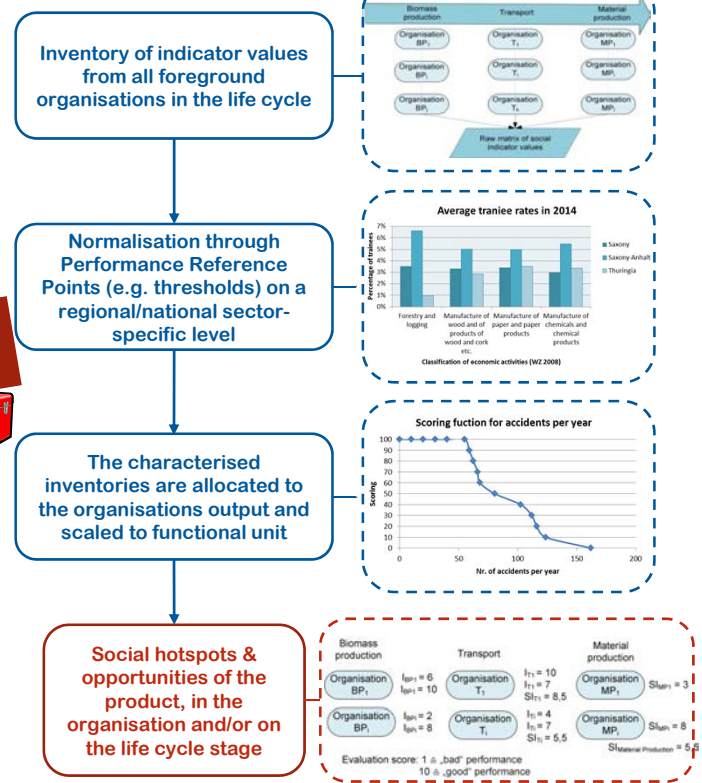


It is a powerful scoping approach which can provide valuable insight into the environmental performance of regional biomass based configurations.

## Socio-economic performance

“RESPONSA” – a Regional SPecific cONtextualised Social life cycle Assessment

RESPONSA is a social Life Cycle Assessment approach that evaluates through social indicators, the socio-economic effects of products on stakeholders along the life cycle.



By evaluating the social performance we can identify social hotspots, opportunities for single organisations, as well as opportunities along the value chain of biobased products.

## Lessons Learned and Recommendations

- ❖ Assessing the sustainability of biomass chains in a regional context should be done with a life cycle perspective encompassing both direct regional burdens and indirect non-regional burdens and addressing more than one sustainability dimension (e.g. social and environmental)
- ❖ The development of decision tools to assess the sustainability options of a regional biobased economy from a social and environmental perspective therefore, enables the identification of potential issues relating to the different dimensions

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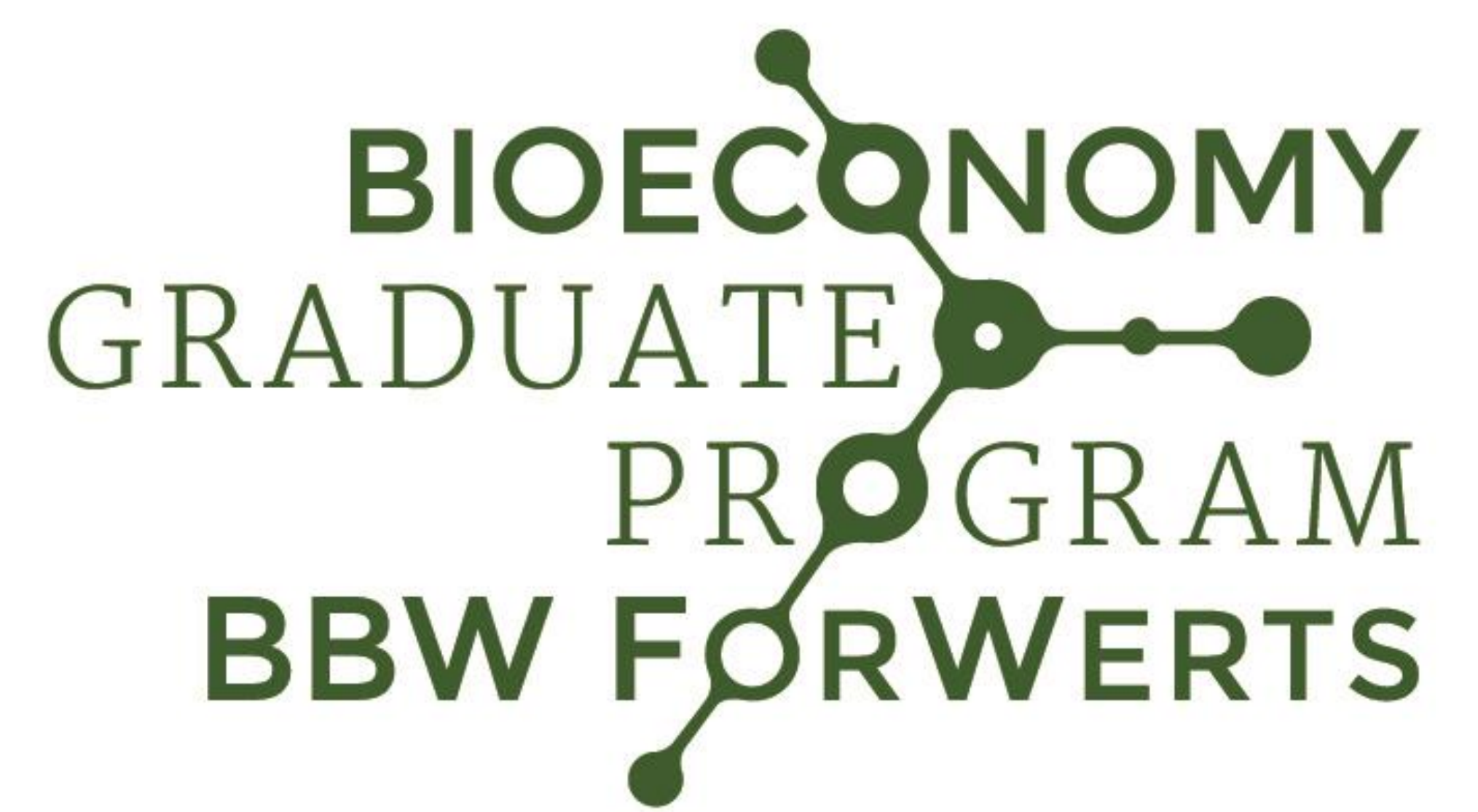
In Cooperation with





# BBW ForWerts Graduate Program

## Moving Bioeconomy Research Forward



Ines Petersen, Anni Mandel, Thomas Rausch

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### BACKGROUND / INTRODUCTION

The BBW ForWerts Graduate Program is part of the “Bioeconomy Research Program Baden-Württemberg” which aims to establish a research strategy along value chains by integrating the different bioeconomy research groups within the German federal state of Baden-Württemberg into an active network. The graduate program receives funding from the Ministry of Science, Research and Arts of Baden-Württemberg (MWK-BW) and started operating in July 2014. To date, more than 40 graduate students have been admitted into BBW ForWerts and are conducting their thesis research activities at one of nine participating research institutions in Baden-Württemberg. The graduate program has also been able to successfully attract international students, thereby strengthening international collaboration about bioeconomic issues.



#### **Participating research institutions:**

University of Freiburg  
University of Heidelberg  
University of Hohenheim  
University of Stuttgart  
University of Ulm  
KIT Karlsruhe  
FVA Freiburg  
ICT Pfinztal  
ZEW Mannheim

### ACTIVITIES

The BBW ForWerts Graduate Program organizes summer schools, workshops, method courses, and excursions for its graduate students. In addition to the scientific content, networking and communication are important goals of these activities.



BBW ForWerts graduate students at the 2015 summer school

### OBJECTIVES

The BBW ForWerts Graduate Program aims to educate excellent young academics who will take on the task of connecting the natural sciences to current economic demands and solving global problems. The program offers a three-year curriculum during which the graduate students have the opportunity to participate in a structured educational program in order to gain not only in-depth insight into their own research fields, but also obtain an overview of the other bioeconomy research areas. This interdisciplinary approach is supposed to enable the students to gain extensive knowledge about a variety of bioeconomic issues. Networking with fellow students, industrial partners and research institutions is also a crucial part of the BBW ForWerts Graduate Program. Another focus of the program is to support the students in learning to communicate effectively about their research to fellow researchers as well as to the broader public.

### RESULTS

Since July 2014, BBW ForWerts has admitted 43 graduate students into the program, 13 of which come from outside of Germany. The graduate program has organized one summer school and two workshops; one additional workshop was organized by the Bioeconomy Research Program and three method courses and three excursions have been offered by BBW ForWerts project leaders. In addition to the 35 graduate students who are funded by the MWK-BW, BBW ForWerts has also succeeded in receiving funding from the “China Scholarship Council” for eight additional Chinese graduate students who were admitted to the program in spring 2015 and will begin their research in fall 2015.

### LESSONS-LEARNED & RECOMMENDATIONS

The biggest challenge for the graduate program has been the distribution of the graduate students across multiple institutions making the supervision and monitoring of the students difficult. However, due to the high level of support from both project leaders and graduate students, this challenge could be overcome. Next to the professional education the young researchers are receiving, the networking opportunities offered by the graduate program are widely appreciated by the graduate students. In general, efficient communication and the strong support of its participants have been key for a graduate program with graduate students distributed across multiple locations.





### BACKGROUND & OBJECTIVES

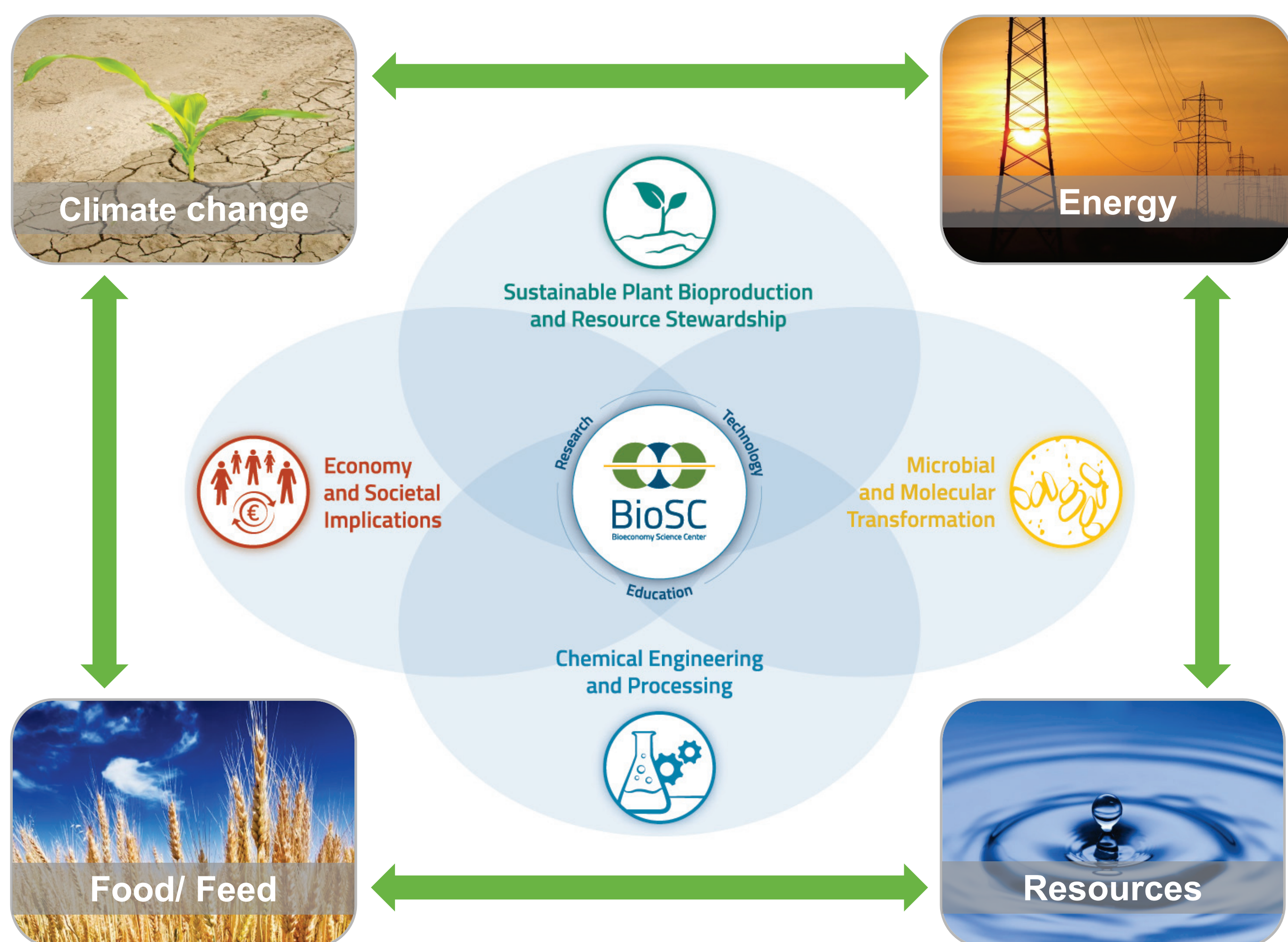
The integration of knowledge about biological systems for the sustainable production of renewables and their use for food, feed, materials and energy is an essential and emerging field of research for an integrated and circular bioeconomy.

Therefore, RWTH Aachen University, the Universities of Bonn and Düsseldorf and the Forschungszentrum Jülich established in 2010 a competence center for bioeconomy research and education, the **Bioeconomy Science Center**.

### Research for a Sustainable Bioeconomy - From Idea to Implementation

### ACTIVITIES

- Integrated bioeconomy research and education
- 63 Core Institutes, > 1500 Co-workers
- Four main research areas



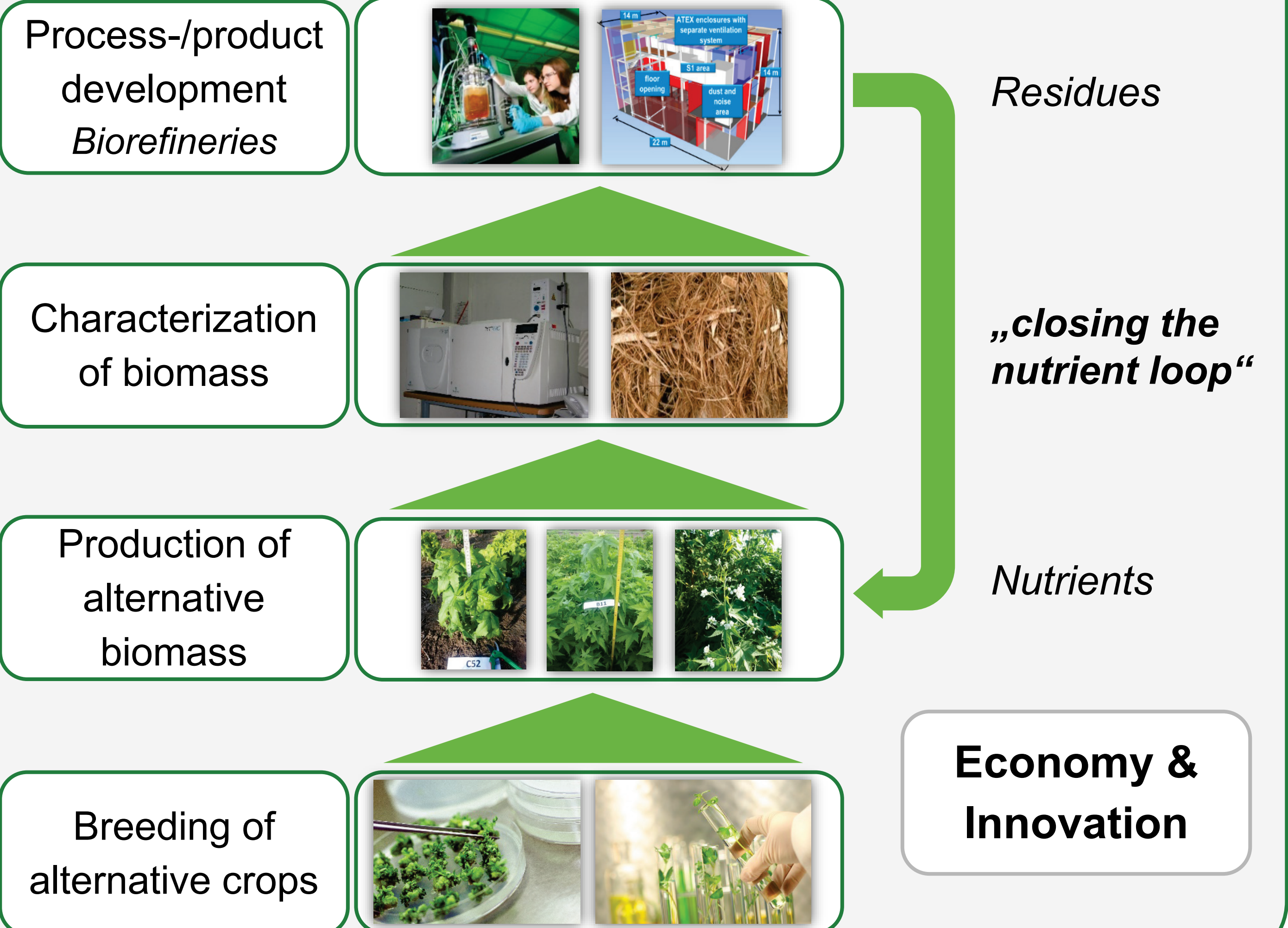
### International cooperation



### RESULTS (e.g.)

#### Integrated process development – Biomass & Biorefineries

**Products:** Food, Feed, Chemicals, Materials, Concepts



#### 30 cross-disciplinary projects (~ 13 Mill. Euro), e.g.

- Valorization of lignocellulose from perennial plants
- (Bio)catalysis and expression platforms
- Recovery of nutrients from agricultural production systems
- Modeling of innovation pathways & scenarios in bioeconomy

### LESSONS-LEARNED & RECOMMENDATIONS

- Cross-disciplinary cooperation and a systemic understanding of bioeconomy challenges are essential.
- Long-term strategy and (funding) perspective is needed.
- New concepts of cooperation and knowledge transfer between academia, industry, society and policy on national & international level are key to bring bioeconomy to reality.
- Regional clusters like BioSC can act as important bioeconomy hubs.
- Bioeconomy is a global challenge - its implementation needs sustainable regional routes and international cooperation.

### REFERENCES & ACKNOWLEDGEMENTS

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For more information see [www.biosc.de](http://www.biosc.de)





# The Baden-Württemberg Research Strategy - Shaping the Future with Bioeconomy

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## BACKGROUND AND OBJECTIVES

The development of new bioeconomic strategies which use biomass instead of fossil fuels and at the same time ensure global food security is an issue of global importance. Baden-Württemberg is characterized by an excellent research environment in the life sciences, agriculture, forestry and technology and therefore can play an important role in future developments.



In 2013 the government decided to strengthen local bioeconomy research and the interactions between the various players in Baden-Württemberg. One objective was also to enhance the visibility of Baden-Württemberg's bioeconomy research and to strengthen participation in national and international networks.

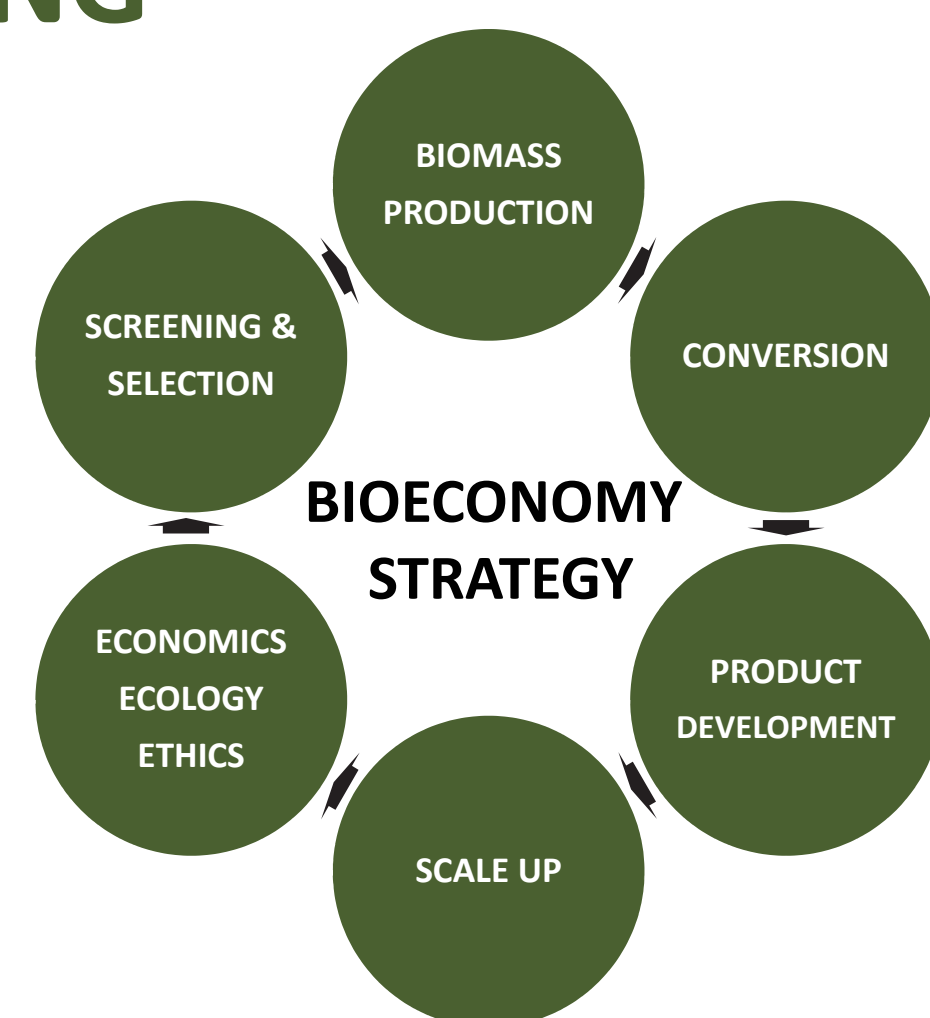
## ACTIVITY

A strategy circle of scientists from all relevant disciplines was assigned to develop the Baden-Württemberg bioeconomy research strategy. The program was then launched in summer 2013 with a call for proposals in dedicated research areas. 50 projects were selected for funding based on peer review and started working in 2014/2015.

## RESULTS

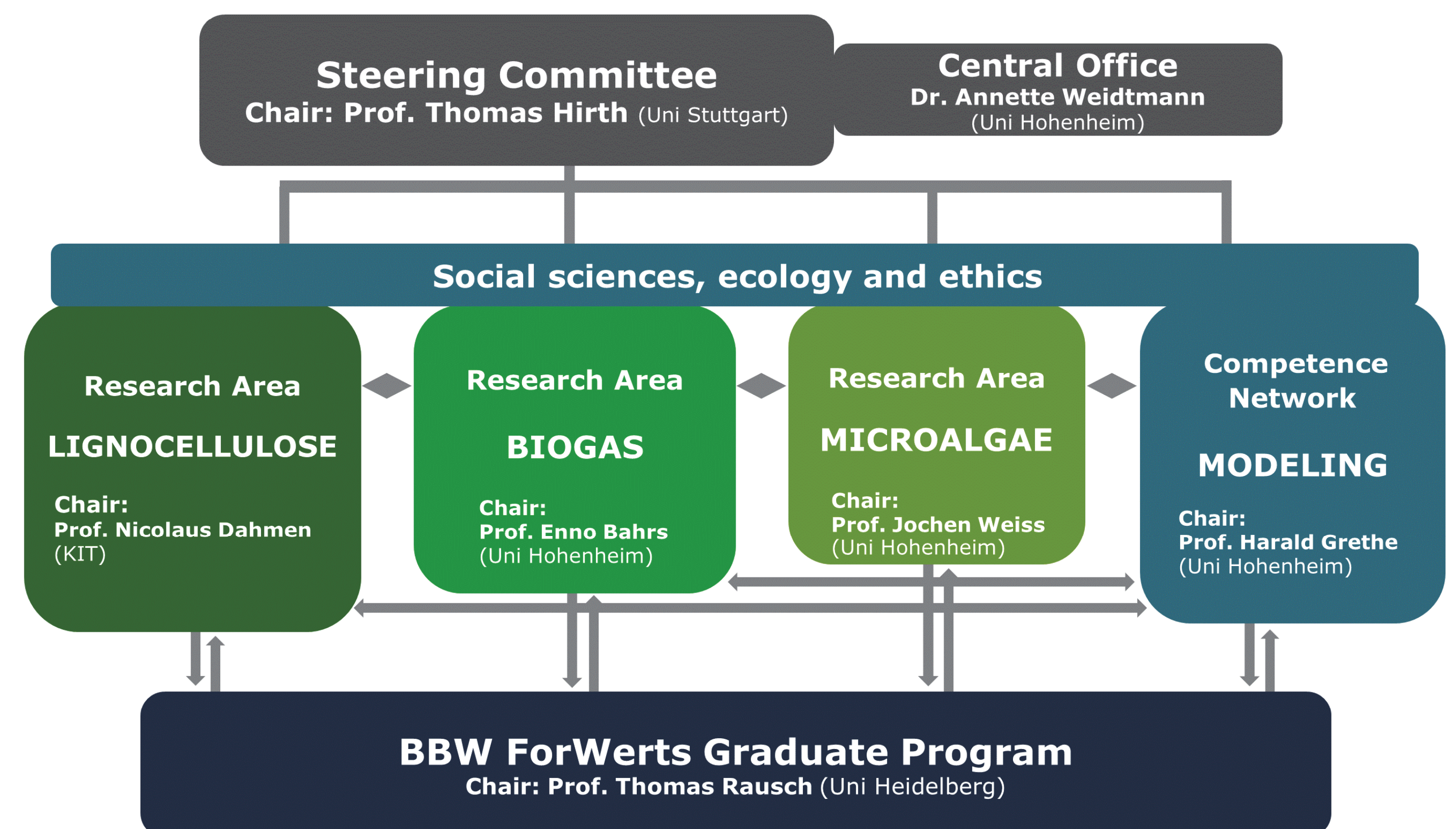
### INTERDISCIPLINARY RESEARCH ALONG INNOVATIVE VALUE CHAINS

The strategy circle concluded that an interdisciplinary systemic approach is necessary to analyze entire value chains and develop sustainable products and processes. Therefore it was necessary to establish new networks between disciplines and institutions.



Three focus areas with different timelines were selected based on their excellence and future potential. As a general principle these research areas integrate biomass production and conversion, product development as well as economic, ecologic, ethic and societal aspects. The research areas are complemented by integrative research activities and a joint training concept for young researchers (BBW ForWerts). The program is coordinated by a steering committee including members from the different research areas, the competence network, BBW ForWerts, the ministry and the local service agency for the biosciences (BIOPRO GmbH). A central coordination office has been established to support with project management and internal and external communication.

## STRUCTURE



## FOCUS AREAS

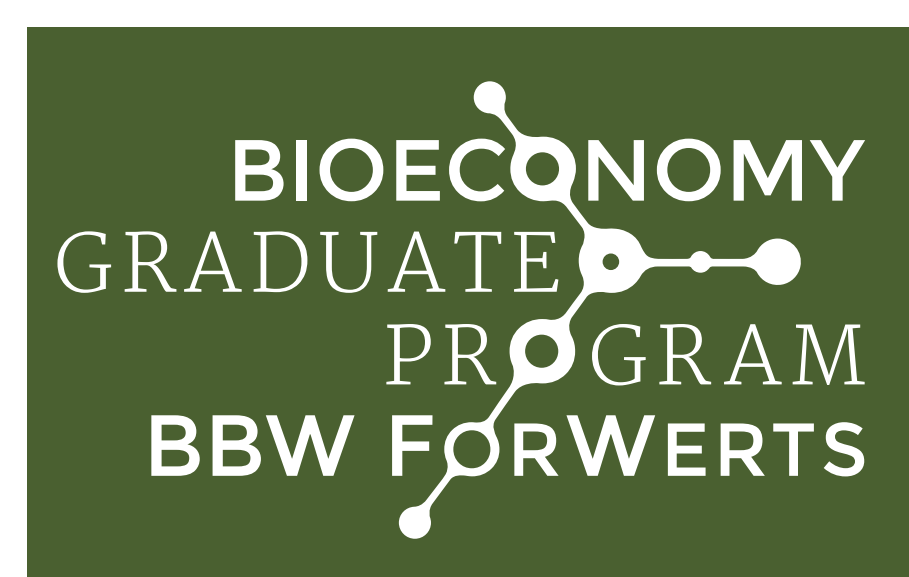
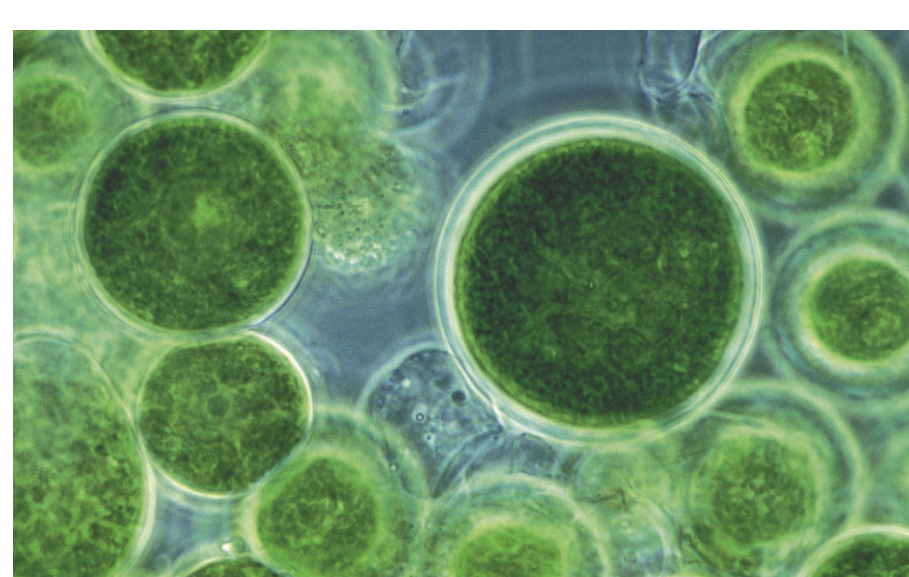
- Research Area "Biogas" - Sustainable and flexible value chains for biogas in Baden-Württemberg (short term)
- Research Area "Lignocellulose" – Lignocellulose as an alternative resource platform for new materials and products (intermediate term)
- Research Area "Microalgae" - Integrated use of microalgae for food and feed (long term)

## INTEGRATIVE ACTIVITIES

- Competence Network Modeling the Bioeconomy (economic and technological simulation models)
- Social-Scientific and Ecological Accompanying Research
- Graduate Program BBW ForWerts

## LESSONS-LEARNED AND RECOMMENDATIONS

- Interdisciplinary collaboration and coordination needs time and effort but raises the most innovative questions.
- The concentration on certain value chains as focus areas supports interdisciplinary interactions between scientists since their projects are focused on a common goal.
- The bottom-up approach ensures high quality research.



funded by



Baden-Württemberg

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- University of Ulm
- BIOPRO Baden-Württemberg GmbH
- Dialogik gGmbH
- DVGW-Research Centre at the Engler-Bunte-Institute of the KIT
- Max Rubner-Institute
- Forest Research Institute Baden-Württemberg
- Fraunhofer Institute for Chemical Technology (ICT)
- University of Applied Forest Sciences Rottenburg
- Centre of European Economic Research GmbH (ZEW)