



**Stelios Rozakis**

# **New Strategies on Bio-Economy in Poland**

# Workpackage 3

## New interdisciplinary strategy development

**Objective:** Set the grounds for new strategies for research and innovation leading to the development of bioeconomy in Poland taking into consideration the existing potential, the regional development aspect and the needs expressed by Public authorities.

**Task 3.1: Development of an interdisciplinary strategy**

**Task 3.2: Complementing research capacity**

**Task 3.3: Specific issues**

**Improvement of HR strategy**

**Peer review strategy**

**Doctoral training**

# Workpackage 3

## Task 3.1: Development of an interdisciplinary strategy

### Conceptual analysis

- Bioeconomy can be defined as a transition to includes a variety of sectors aiming at a gradual replacement of fossil materials by renewable biogenic feedstock.
- While the objectives pursued are not necessarily conflicting (oil independence, mitigating climate change, food security) there are alternative pathways causing controversy over the achievement of the objectives
- Various bioeconomy strategies range from the identification to biotechnology (narrow) to a broader holistic approach involving a large spectrum of activities

## Task 3.1

# Development of an interdisciplinary strategy

- Biomass from agriculture and forestry is considered the pillar resource for bioeconomy
- Other renewable alternatives exist to respond to energy demand substituting for fossil fuels but when it comes to chemical or material applications, biomass is the unique carbon source
- Given the animated debate on the selection of controversial pathways to bioeconomy one has to determine the key issues on shaping it

Key issues that determine the bioeconomy implementation

- Sustainability postulate
- Future food security
- Availability of sustainably produced biomass
- Increase in agricultural yields
- Perspectives on nature
- Research funding and involvement of stakeholders
- Globality versus regionality
- Behavioral changes

# Workpackage 3

## Task 3.1: Development of an interdisciplinary strategy

The integration of state of the art system modelling of environmental and socio-economic impacts is foreseen, which can answer a range of pertinent bioeconomy-related questions, such as:

- What are the most sustainable uses of biomass: food, feed, fuel, biomaterials, biochemical or carbon sink? How can the land-use mix be optimised in Lubelskie and Poland?
- To which end should biomass be processed into: e.g, energy, bioproducts, biochemicals in a biorefinery?
- What are the most efficient policy instruments that simultaneously achieve a desired level of greenhouse gas emissions and a minimum income to e.g. farmers?
- How much can energy from biomass (e.g. biogas) can contribute to renewable energy targets?
- What options are there for utilizing under-utilized agricultural residues, such as straw and manure? What are the environmental and economic implications of doing so?

# Workpackage 3

## Integrated bioeconomic model for Poland

The building of an *integrated model* would allow Poland to prioritise agricultural resource use, including land, with regard to environmental and economic objectives

The optimisation model with *mathematical programming* will shed light on how to best use agricultural resources, such as land, manure, crop and crop end use (e.g. ethanol, biodiesel, electricity, heat, soil incorporation, etc.) relative to a range of objective functions (e.g. maximising farmer's income or minimising life cycle climate change impacts).

The bioeconomic model can therefore estimate the environmental and socio-economic effects of policy measures, like taxes or subsidies and the trade-offs associated with using competing crops (oil, sugar, starch, lignocellulosic herbaceous and woody).

# Workpackage 3

## Integrated bioeconomic model for Poland

Date	Action
September 2017	Submission of first paper attempting at model integration
July – Dec 2017	FADN data retrieval. Application of model to Poland.
December 2017	Set up research issues in common with industry
March 2018	Biomass resource potentials estimated. Several papers submitted.
July 2018	Strategies identified and characterised.
November 2018	Optimisation modelling performed.
March 2019	Several papers submitted. Pilot projects running.
July 2019	Data collected from industrial partners and included in model.
November 2019	Model run again under different objectives and constraints.
February 2020	Events transferring research outputs performed. Papers submitted.
June 2020	PhD thesis near to completion. Future research funds secured.

 This project has received funding from the European Union's HORIZON 2020 research and innovation programme under Grant Agreement No. 669062

Call: H2020 WIDESPREAD-2014-2015, topic: WIDESPREAD-2014-2 ERA Chairs

## Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

### *Different visions of Bioeconomy put forward in the academic literature*

- A **bio-technology vision** that emphasises the importance of bio-technology research and application and commercialisation of bio-technology in different sectors.
- A **bio-resource vision** that focuses on the role of research, development, and demonstration (RD & D) related to biological raw materials in sectors such as agriculture, marine, forestry, and bioenergy, as well as on the establishment of new value chains.
- A **bio-ecology vision** that highlights the importance of ecological processes that optimise the use of energy and nutrients, promote biodiversity, and avoid monocultures and soil degradation.

## Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

- Whereas the *bio-technology* vision takes a point of departure in the potential applicability of science, the *bio-resource* vision emphasises the potentials in upgrading and conversion of the biological raw materials.
- While the previous two visions are technology-focused and give a central role to RD & D in globalised systems, the *bio-ecology* vision emphasises the potential for regionally concentrated circular and integrated processes and systems.
- while certain actors are predominantly associated with the different visions such as the *OECD* (the bio-technology vision), the *European Commission* (the bio-resource vision), and the *European Technology Platform TP Organics* (the bio-ecology vision), then it is also highlighted that the visions interrelate.

# Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

## Key characteristics of the bio-economy visions

	<b>The Bio-Technology Vision</b>	<b>The Bio-Resource Vision</b>	<b>The Bio-Ecology Vision</b>
<i>Aims &amp; objectives</i>	Economic growth & job creation	Economic growth & sustainability	Sustainability, biodiversity, conservation of ecosystems, avoiding soil degradation
<i>Value creation</i>	Application of biotechnology, commercialisation of research & technology	Conversion and upgrading of bio-resources (process oriented)	Development of integrated production systems and high-quality products with territorial identity
<i>Drivers &amp; mediators of innovation</i>	R & D, patents, TTOs, Research councils and funders (Science push, linear model)	Interdisciplinary, optimisation of land use, include degraded land in the production of biofuels, use and availability of bio-resources, waste management, engineering, science & market (Interactive & networked production mode)	Identification of favourable organic agro-ecological practices, ethics, risk, transdisciplinary sustainability, ecological interactions, re-use & recycling of waste, land use, (Circular and self-sustained production mode)
<i>Spatial focus</i>	Global clusters/ Central regions	Rural/Peripheral regions	Rural/Peripheral regions

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# Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

## Bibliometric analysis

- Quantitative search : keywords below and their variants were selected:

*bioeconomy, bio-based economy, bio-based industry, circular economy and bio\*, bio-based society, bio-based products, and bio-based knowledge economy*

- Qualitative analysis: we included papers that were focusing on conceptual aspects such as innovation and value creation, driving forces, governance, and spatial focus of the bio-economy

# Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

## Bibliometric analysis

Social network analysis (SNA) techniques were applied to measure different types of centrality in the networks, such as degree centrality and betweenness centrality

Visions should not be understood as promoted by the academic writers, but as bioeconomy visions that result from academic analysis of the actions of policymakers, industry actors, etc.

# Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

453 papers identified for 2005-2014 cited 9207 times already

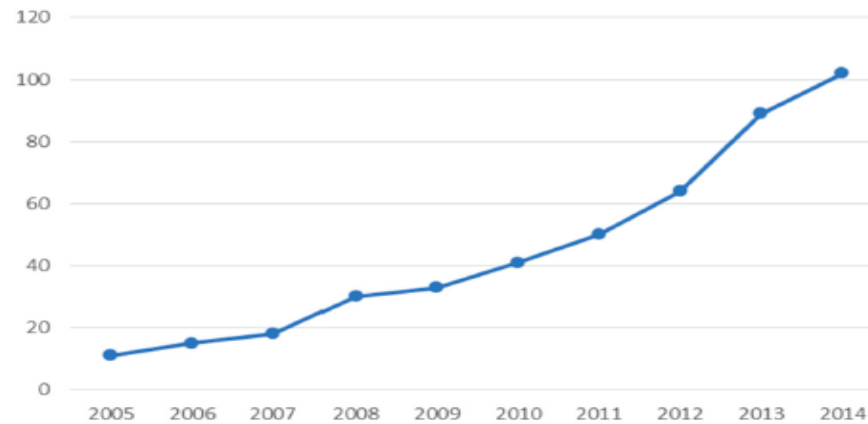


Figure 1. Number of papers per year ( $n = 453$  papers).

Table 1. The 10 most cited papers (491 citations) and the 10 papers with the most citations per year.

Most Cited Papers		Papers with Most Citations per Year	
Reference	Number of Citations	Reference	Average Number of Citations per Year
[15]	760	[15]	127
[16]	509	[16]	51
[17]	351	[17]	50
[18]	344	[18]	49
[19]	234	[20]	37
[21]	230	[22]	36
[23]	211	[23]	35
[24]	209	[25]	35

**Table 2.** Journals with more than seven articles ( $n = 117$ )—number of articles, sum, and share of citations per journal (total  $n = 9207$  citations).

Journal	Number of Papers	Share of Papers	Number of Citations	Share of all Citations
<i>Biofuels Bioproducts &amp; Biorefining-Biofpr</i>	27	6.0%	244	2.7%
<i>Biomass &amp; Bioenergy</i>	18	4.0%	251	2.7%
<i>Journal of the American Oil Chemists Society</i>	15	3.3%	202	2.2%
<i>Journal of Cleaner Production</i>	12	2.6%	204	2.2%
<i>International Journal of Life Cycle Assessment</i>	10	2.2%	164	1.8%
<i>International Sugar Journal</i>	10	2.2%	30	0.3%
<i>Bioresource Technology</i>	9	2.0%	361	3.9%
<i>Applied Microbiology and Bio-Technology</i>	8	1.8%	249	2.7%
<i>Scandinavian Journal of Forest Research</i>	8	1.8%	14	0.2%
Sum	117	25.8%	1719	18.7%

**Table 3.** The five most prominent authors, with more than four papers.

Author	Number of Articles
Sanders, J.P.M.	8
Zhang, Y.H.P.	6
Birch, K.	5
Montoneri, E.	5
Patel, M.K.	5

# Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

**Sanders, Johan P.M.**

Biobased Chemistry and Technology, Wageningen University and  
Research Centre, Netherlands

**Zhang, Yi Heng Percival**

Department of Biological Systems Engineering, Virginia Polytechnic,  
Blacksburg, United States

**Birch, Kean**

Department of Social Science, York University, Toronto, Canada

**Montoneri, Enzo**

Biowaste Processing, Verona, Italy

**Patel, Martin Kumar**

Energy Efficiency Group, Institute for Environmental Sciences and  
Forel Institute, Universite de Geneve, Switzerland

**Table 4.** The 10 countries with the most articles, based on address fraction counts.

Country	Number of Papers
United States	116
Netherlands	45
United Kingdom	43
Germany	27
Canada	22
Belgium	21
Italy	20
People's Republic of China	19
Australia	18
Sweden	14

Type of Organisation	Number of Papers	Share
Higher education institution	327.3	72.9%
Research institute	57.6	12.8%
Company	26.6	5.9%
Public agency	25.0	5.6%
International organisation	6.3	1.4%
Science agency	4.0	0.9%
Cluster organisation	2.3	0.5%



## Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

The most prominent organisations measured in numbers of papers and in **degree centrality** in the co-authorship network are mainly universities.

However, the U.S. Dept of Agriculture has the central position in the network when measuring **betweenness centrality**. That means that the ministry is important for bridging distant networks of expertise.

Degree centrality indicates the centrality of the respective organisation in the network,

Betweenness centrality shows the bridging function of the respective organisation

# Task 3.3: Specific issues Improvement of HR strategy - Peer review strategy

The 10 most prominent organisations in terms of number of papers (n = 99, fraction counts) and Freeman's Degree centrality in co-authorship networks; values for Freeman's Betweenness Centrality are added

Degree centrality is defined as the number of links that a node has while betweenness centrality is defined as the number of times a node acts as a bridge along the shortest path between two other nodes

Organisation	Number of Papers	Degree Centrality	Betweenness Centrality
Wageningen University & Research Centre	19.2	8.200	9471.480
Iowa State University	17.6	1.861	1529.762
U.S. Department of Agriculture	15.4	3.242	11,896.121
Ghent University	12.0	3.003	9493.600
Utrecht University	7.2	2.000	1145.533
University of York	5.8	1.833	933.000
Lund University	5.8	0.833	235.000
Michigan State University	5.5	0.867	0.000
University of Florida	5.3	0.333	0.000
Cardiff University	4.8	0.833	1782.586

# Task 3.3: Specific issues Improvement of HR strategy - Peer review strategy

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Year	title	journal		RP	MB	JK	AS	RB	AF	EK	KM	MK	Dp	MB	LH	AB	soil	Plant Nutrition	Econ	Meteo	other IUNG	tot Poland	international
2016	<a href="#">Policy instit</a>	<a href="#">Nature Climate Char</a>	10,06											1							0	0	6
2017	<a href="#">Quantifying</a>	<a href="#">Renewable and Sust</a>	9,52											1							0	0	4
2011	<a href="#">Agroclimatic</a>	<a href="#">Global Change Biolo</a>	8,75			1															0	0	16
2011	<a href="#">Impacts and</a>	<a href="#">Eur J of Agronomy</a>	8,36			1															0	0	8
2017	<a href="#">Environmen</a>	<a href="#">J of Cleaner Product</a>	5,83												1						0	0	8
2017	<a href="#">Climate-cha</a>	<a href="#">J of Cleaner Product</a>	5,83											1							0	0	0
2017	<a href="#">Hybrid life c</a>	<a href="#">J of Cleaner Product</a>	5,83											1							0	0	2
2015	<a href="#">Joint Life Cy</a>	<a href="#">J of Cleaner Product</a>	5,83					1													0	0	5
2010	<a href="#">Coincidence</a>	<a href="#">Agric Ecosystems an</a>	4,59			1															0	0	15
2017	<a href="#">Estimating 2</a>	<a href="#">GCB Bioenergy</a>	4,52											1							0	0	3
2017	<a href="#">Status and p</a>	<a href="#">GCB Bioenergy</a>	4,52											1							0	0	24
2016	<a href="#">Bioethanol</a>	<a href="#">GCB Bioenergy</a>	4,52	1	1																0	0	2
2013	<a href="#">Straw poten</a>	<a href="#">Biomass &amp; Bioenerg</a>	3,71	1	1				1												0	0	2
1995	<a href="#">Use of soil a</a>	<a href="#">Ecol Engineering</a>	3,45						1											1	1	0	2
2015	<a href="#">Multifractal</a>	<a href="#">Climate Research</a>	1,8			1														1	1	5	1
2009	<a href="#">Geographic</a>	<a href="#">Env Monitor &amp; Asses</a>	1,66	1													2		1	3	6	0	0
2015	<a href="#">Assessing th</a>	<a href="#">Plant, Soil and Envir</a>	1,51				1		1				1								0	0	0
2016	<a href="#">Assessment</a>	<a href="#">International Agropl</a>	1,36				1		1			1									0	0	0
2015	<a href="#">Atmospheri</a>	<a href="#">Source of the Docum</a>	1,36			1														2	2	0	0
2015	<a href="#">Assessment</a>	<a href="#">Polish Journal of Env</a>	1,09		1		1		1												0	1	0
2011	<a href="#">Modeling in</a>	<a href="#">Polish Journal of Env</a>	1,06	1	1	1	1	1	1											1	1	0	0
2012	<a href="#">The suitabil</a>	<a href="#">Zemdirbyste</a>	0,95	1	1															1	1	0	0
2008	<a href="#">Identificac</a>	<a href="#">Zemdirbyste</a>	0,95	1		1														1	1	0	0
2008	<a href="#">Two new to</a>	<a href="#">Polish Polar Researc</a>	0,95	1																	0	0	0
2003	<a href="#">Topographic</a>	<a href="#">Polish Polar Researc</a>	0,95	1																	0	0	0
2008	<a href="#">UAV monito</a>	<a href="#">Italian Journal of Ag</a>	0,94	1														1			1	0	0
2008	<a href="#">The use of r</a>	<a href="#">Italian Journal of Ag</a>	0,94	1		1														1	1	0	0
2016	<a href="#">Water pricin</a>	<a href="#">Water Science and T</a>	0,65			1															0	0	4
2013	<a href="#">Low altitude</a>	<a href="#">Proceedings of SPIE</a>	0,42	1	1	1															0	0	0
2016	<a href="#">Review of sc</a>	<a href="#">Polish Journal of Soi</a>	0,35	1		1											3				3	0	0
2006	<a href="#">Use of spect</a>	<a href="#">Annales Universitati</a>	0,35	1		1														1	1	0	0
2013	<a href="#">An assessme</a>	<a href="#">J of Food, Agricultur</a>	0,3		1		1		1												0	0	0
2012	<a href="#">Simulation c</a>	<a href="#">Journal of Food, Agr</a>	0,3		1		1		1												0	0	0

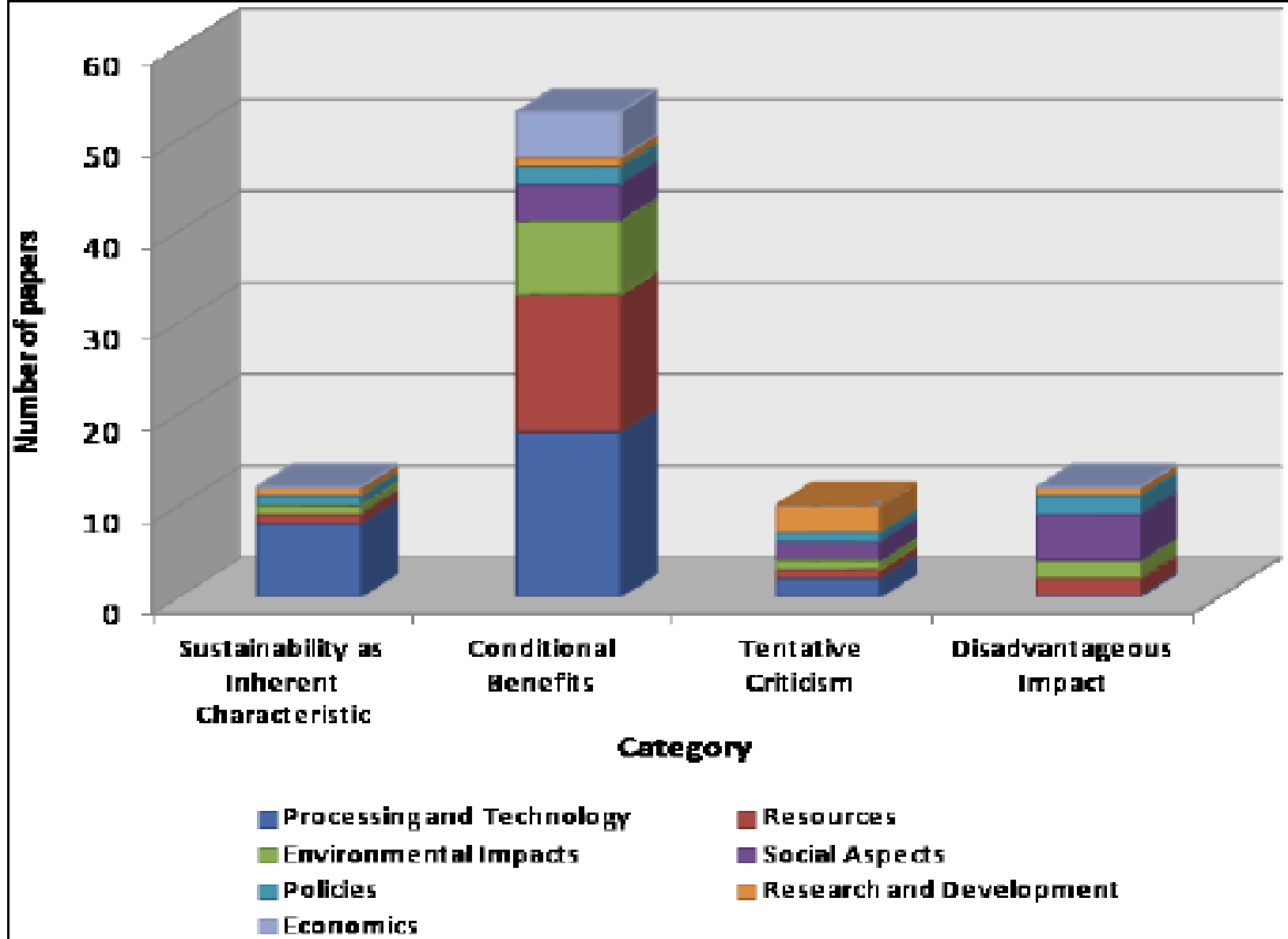
## Task 3.3: Specific issues    Improvement of HR strategy - Peer review strategy

A broad research question for the reviewing process was chosen: “*How do scientific papers relate the concept of bioeconomy to sustainability?*”

Based on this question, two main topics were identified for this review: *bioeconomy* and *sustainability*.

The bioeconomy was considered as a *primary* and sustainability as a *secondary* topic.





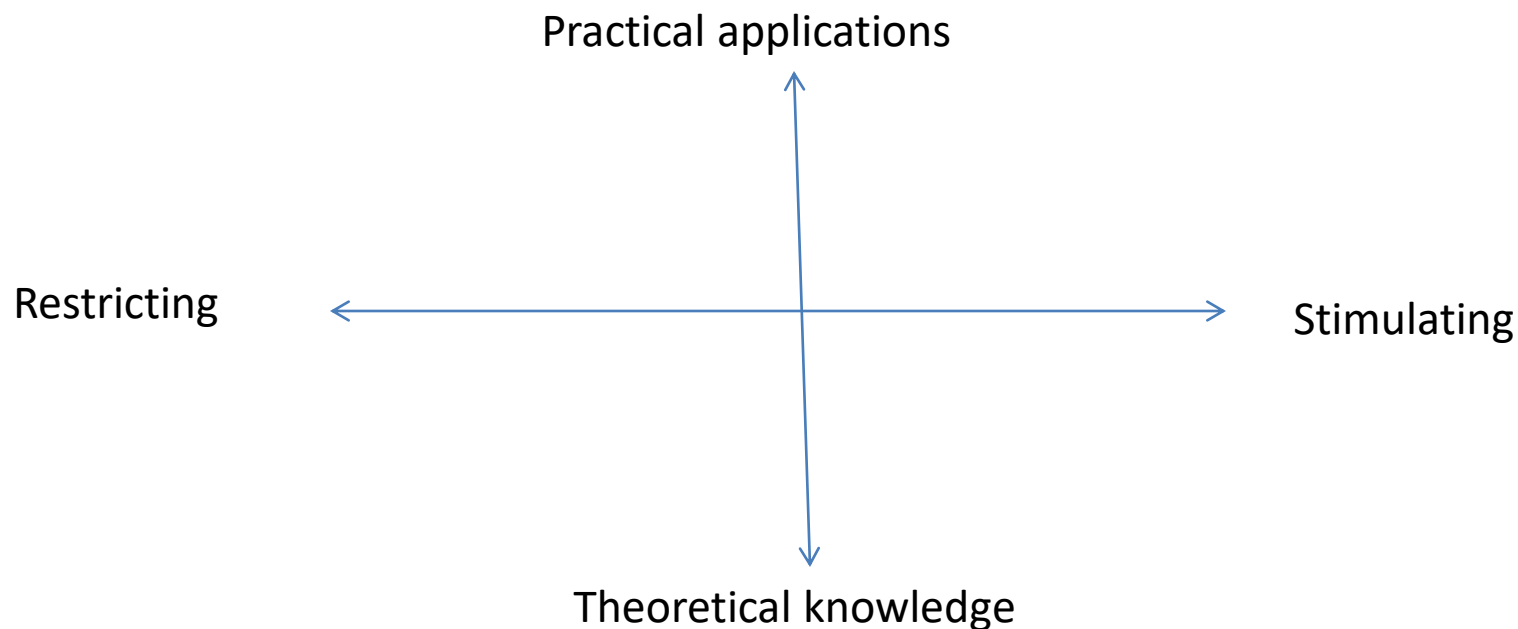
## Research domains regarding the bioeconomy per category



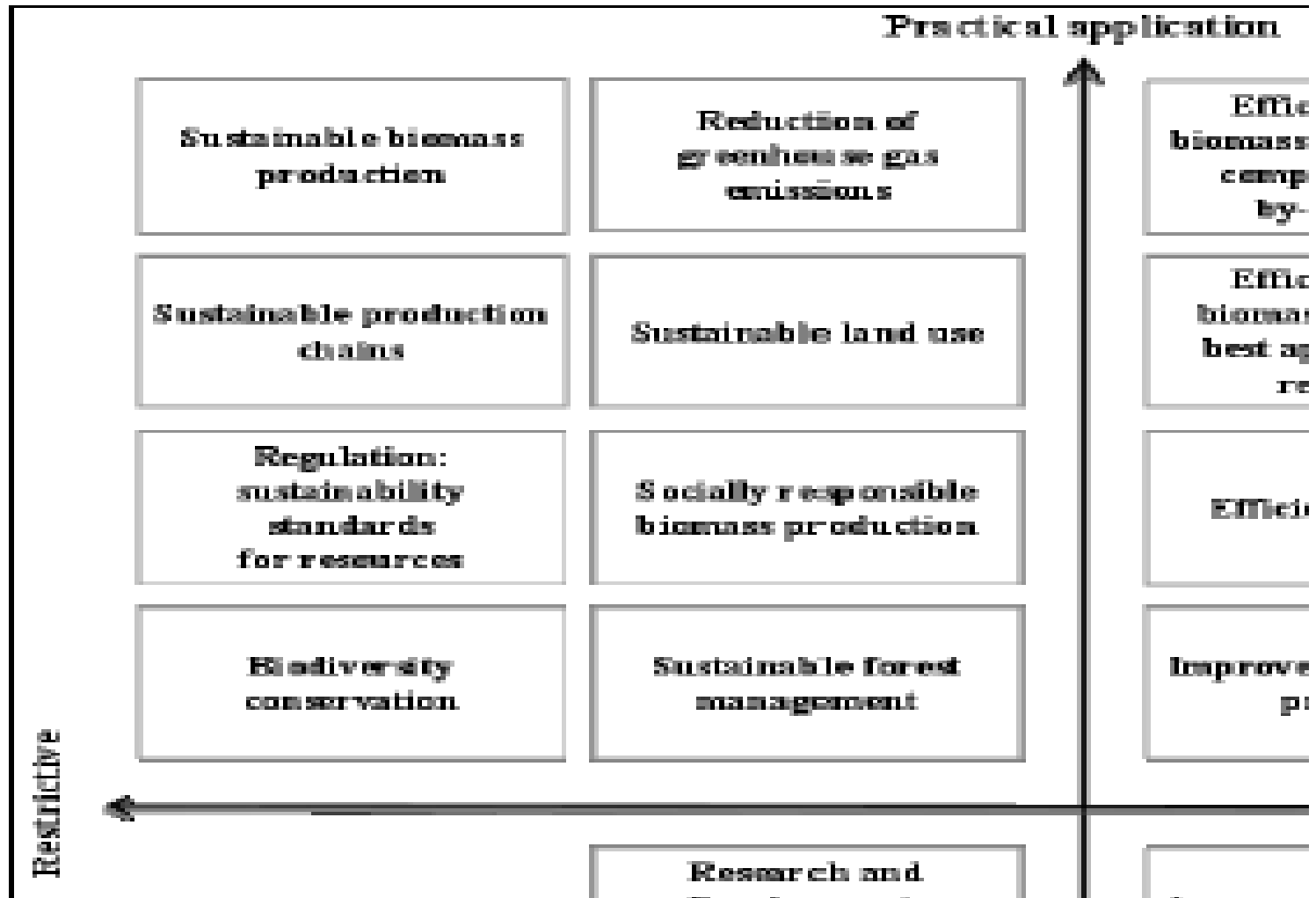
The conditions for a sustainable bioeconomy can be organized on the basis whether

1. they address what one needs to know or do to be sustainable  
(knowledge or practical application)
2. they restrict or stimulate bioeconomic activities (restrictive or stimulating).

**The **matrix** of conditions of sustainable bio-economy**



## The north-west quadrant



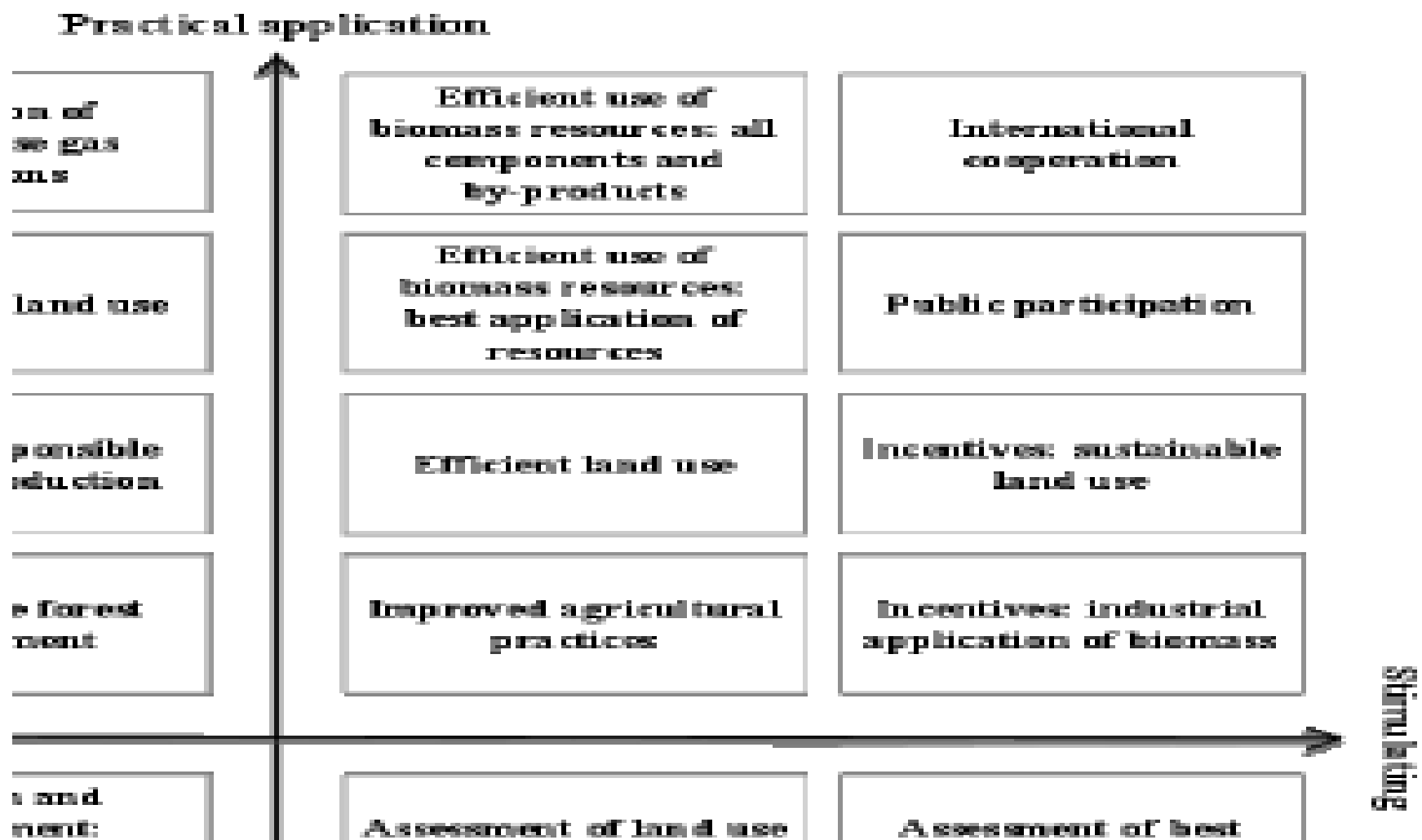
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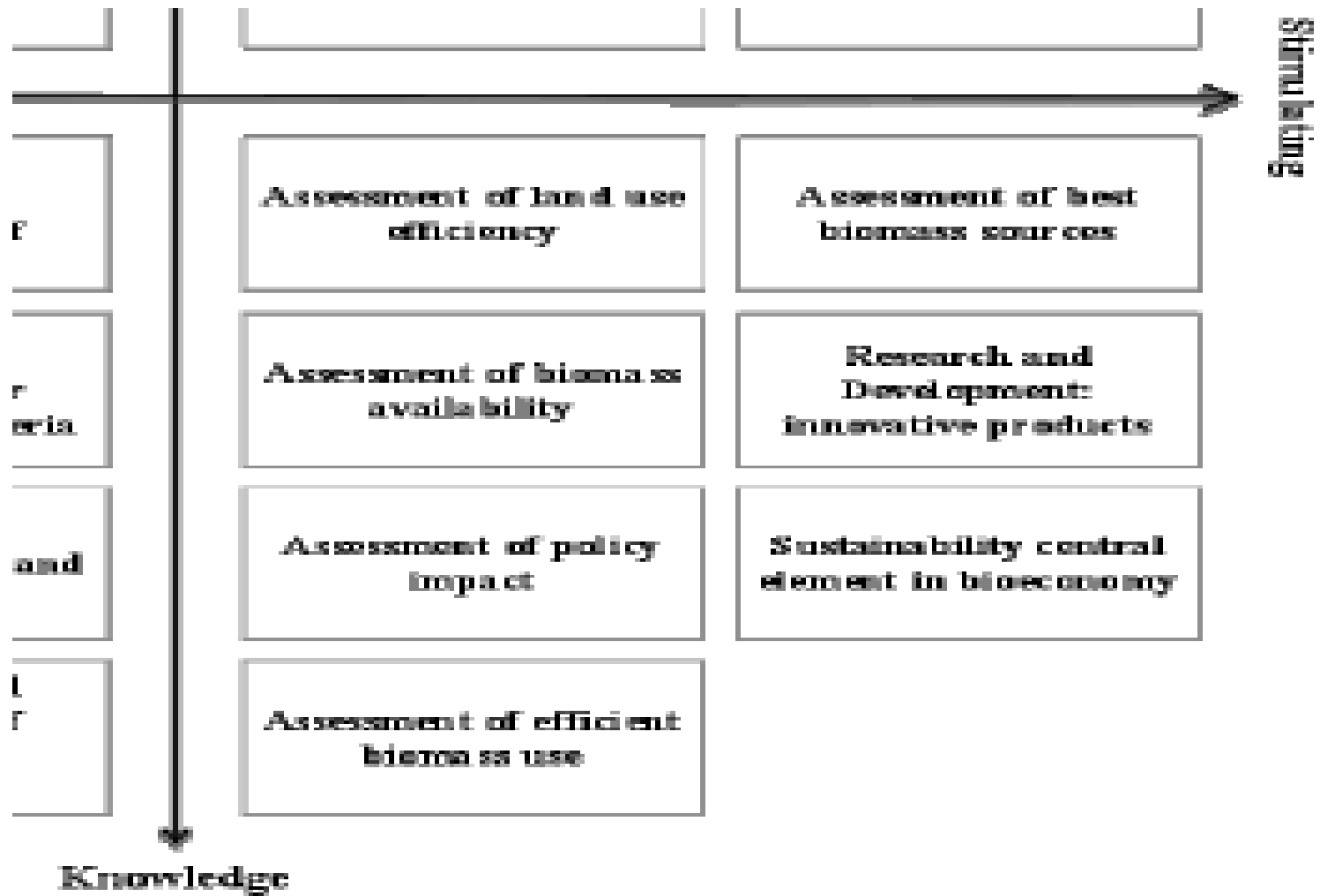
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## The north-east quadrant



## The south-east quadrant



## References

- Brandão M, A Bartolli, M Borzęcka, L Hamelin, J Kozyra, ***New Strategies on Bio-Economy in Poland***, Deliverable 3.1 - Bioecon project, 2017 (month 18)
- Bugge – Hanssen-Klitkou, 2016. ***What is Bioeconomy? A review of the literature***, Sustainability
- Meyer R., 2017. ***Bioeconomy Strategies: Contexts, Visions, Guiding Implementation Principles and Resulting Debates***, Sustainability
- Priefer C., J Jorissen, O Fror, 2017. ***Pathways to Shape the Bioeconomy***, Resources

# Task 3.3: Specific issues    Improvement of HR strategy – Doctoral training

The Institute of Soil Science and Plant Cultivation- State Research Institute in Puławy offers doctoral studies in **agronomy** and **environmental protection**, leading to a degree of **doctor of agricultural sciences**, in compliance with the Art. 11 paragraph 1 of the Act of 14 March 2003, Law on Academic Degrees and Title and Degrees and Title in the Arts.

## During their doctoral studies, students:

- Conduct research under the supervision of experienced research scientist, in the framework of the statutory activity or research projects;
- Attend obligatory classes provided in the study programme;
- Prepare scientific publications;
- Present research results at conferences and workshops;
- Attend trainings and courses improving students' competencies;
- May apply for scholarships, projects for young researchers, and participate in collaborative research.

# Task 3.3: Specific issues    Improvement of HR strategy – Doctoral training

## PhD studies –changes since 2014

- New regulations for doctoral studies (October 2014):
  - Regulations of doctoral studies at IUNG-PIB,
  - Rules of financial assistance for doctoral students in doctoral studies (social fellowships, scholarships for the best doctoral students, grants)
  - Conditions and procedures for the recruitment of candidates for doctoral studies.
- Starting part-time studies (October 2014)
- The new program of doctoral studies (March 2016):
  - PhD studies (separate for agronomy disciplines and environmental protection), compulsory and optional education modules, - learning outcomes, ECTS credits,
  - Doctoral seminars, also in English,
  - Classes of commercialization of research results, bio-economics and others apprenticeships.

# Task 3.3: Specific issues    Improvement of HR strategy – Doctoral training

**Doctoral Program structure after survey conducted in main HEI offering similar courses**

**A) Background, concepts and analytical frameworks** (5 ECTS, choice of any one course).

**B) System Methodologies and tools** (mandatory)

**C) Applications** (10 ECTS, choice of any one sector). *Each one is 10 ECTS (250-300 hours).*

**D) Complementary Environmental Systems Analysis tools/indicators/indices** (10 ECTS, choice of any one sector). *Each one is 10 ECTS (250-300 hours).*

# Task 3.3: Specific issues    Improvement of HR strategy – Doctoral training

A) Background, concepts and analytical frameworks (5 ECTS, choice of any one course).

Ecology and Society  
Sustainability Policy and Communication  
Sustainable Development  
Systems thinking  
Decision Analysis  
Analytical frameworks

## **B) System Methodologies and tools (mandatory)**

Life Cycle Sustainability Assessment  
Goal & Scope definition  
Life Cycle Inventory Analysis  
Life Cycle Impact Assessment  
Interpretation  
Methodological issues  
ISO standards and ILCD Handbook  
Case-study

# Task 3.3: Specific issues    Improvement of HR strategy – Doctoral training

C) Applications (10 ECTS, choice of any one sector). *Each one is 10 ECTS (250-300 hours).*

Energy systems

Bio- vs fossil-based products (fuel, materials, chemicals, etc)

Agroecology (food & farming systems)

Waste Management

Construction

D) **Complementary Environmental Systems Analysis tools/indicators/indices**  
(10 ECTS, choice of any one sector). *Each one is 10 ECTS (250-300 hours).*

Economic-equilibrium modelling

Integrated Assessment Modelling

Gross Domestic Product

Human Development Index

Index of Sustainable Economic Welfare

Ecological Footprinting, Water Footprinting, Carbon Footprinting

Environmental Impact Assessment

Risk Assessment (ERA and HERA)

Strategic Environmental Assessment

European Commission's Sustainability Dashboard

# Thank you

Please visit our website:

<http://bioecon.iung.pulawy.pl/>

email: [bioecon@iung.pulawy.pl](mailto:bioecon@iung.pulawy.pl)

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**BioEcon**

 **IUNG**