Europe en route to the Bioeconomy - Challenges and Perspectives of the Nordic Union

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Dr. Dr. h.c. Christian Patermann
Director ret., EU-Commission
Advisor to the German Land NRW
Member of the 1st Bioeconomy Council of Germany
Bioeconomy in the EU

On 13\textsuperscript{th} February 2012 publication of the first strategy of this kind for Europe:

“Innovating for Sustainable Growth: A Bioeconomy for Europe”
## The Bioeconomy Strategy and Action Plan

### INVESTMENTS IN RESEARCH, INNOVATION AND SKILLS
- Ensure substantial EU and national funding for bioeconomy and innovation
- Increase the share of multi-disciplinary and cross-sectoral research and innovation
- Promote the uptake and diffusion of innovation in bioeconomy sectors; create feedback mechanisms on regulation and policy
- Build the human capacity required to support growth and integration of bioeconomy sectors

### REINFORCED POLICY INTERACTION AND STAKEHOLDER ENGAGEMENT
- Create a Bioeconomy Panel to enhance synergies and coherence between policies; foster participation of researchers, end-users, policy-makers and civil society
- Establish a Bioeconomy Observatory and develop forward-looking and modelling tools
- Support the development of regional and national bioeconomy strategies
- Develop international cooperation to jointly address global challenges (e.g. food security, climate change)

### ENHANCEMENT OF MARKETS AND COMPETITIVENESS IN BIOECONOMY SECTORS
- Provide the knowledge-base for sustainable intensification of primary production;
- Promote the setting up of networks for integrated and diversified biorefineries; establish a PPP for bio-based industries
- Support expansion of new markets; facilitate green procurement for bio-based products
- Develop science-based approaches to inform consumers about product properties

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The Bioeconomy Strategy and Action Plan
Recommendations of the EU in the Recovery report on Europe 2012, 10th oct 2012:

“Europe needs a new industrial policy to regain growth and economic recovery !”

4 Priorities:

Development of new markets for
- Advanced process technologies (“Clean production”)
- 7 so called key technologies, i.e. industrial biotechnology
- Biobased products
- For construction and raw materials
● These recommendations were made more concrete in the Communication „For a European Industrial Renaissance“ of March, 2014.

● Besides „Advanced Manufacturing, Key Enabling Technologies (KET), Clean Vehicles and Vessels, Biobased Products“ are mentioned among the priority areas and activities for such an European Industrial Renaissance.

● Interestingly enough energetic and non-energetic use of biomass should be equally supported according to this communication.
Bioeconomy in the EU

HORIZON 2020 – the new framework programme of the EU 2014 – 2020
Proposed funding (€ million, 2014-2020)

<table>
<thead>
<tr>
<th>Category</th>
<th>Funding (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health, demographic change and wellbeing</td>
<td>7472</td>
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<tr>
<td>Food security, sustainable agriculture and forestry, marine and maritime</td>
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<tr>
<td>and inland water research and the Bioeconomy</td>
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<td>Secure, clean and efficient energy *</td>
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<tr>
<td>Smart, green and integrated transport</td>
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<tr>
<td>Climate action, environment, resource efficiency and raw materials</td>
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<td>Inclusive, innovative and reflective societies</td>
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<td>Secure societies</td>
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<tr>
<td>Science with and for society</td>
<td>462</td>
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<tr>
<td>Spreading excellence and widening participation</td>
<td>816</td>
</tr>
</tbody>
</table>

* Additional funding for nuclear safety and security from the Euratom Treaty activities (2014-2018)
Europe 2020 Priorities

Tackling Societal Challenges
- Health, demographic change and wellbeing
- Food sec., sust. agri., mar. res. & bioeconomy
- Secure, clean and efficient energy
- Smart, green and integrated transport
- Supply of raw materials, resource efficiency and climate action
- Inclusive, innovative and secure societies

Creating Industrial Leadership and Competitive Frameworks
- Leadership in enabling and industrial technologies (Biotechnology,...)
- Access to risk finance
- Innovation in SMEs

Excellence in the Science Base
- Frontier research (ERC)
- Future and Emerging Technologies (FET)
- Skills and career development (Marie Curie)
- Research infrastructures

Shared objectives and principles

International cooperation

Coherence with other EU and MS actions

Common rules, toolkit of funding schemes

Simplified access

European Research Area
Specific Programme for Societal Challenge 2:

FOOD SECURITY, SUSTAINABLE AGRICULTURE, MARINE and MARITIME RESEARCH and the BIO-ECONOMY

5 Topics:

- Sustainable AGRICULTURE and FORESTRY
- Unlocking the potential of AQUATIC LIVING RESOURCES
- Cross-cutting MARINE and MARITIME RESEARCH
- Sustainable and competitive bio-based INDUSTRIES and supporting the development of an EUROPEAN BIO-ECONOMY
- Sustainable and competitive AGRO-FOOD sector for a safe and healthy diet
How is the Biobased Economy implemented in various EU Member States?

3 Different Stages of Implementation:

- **Integrated concepts and strategies** with different levels of integration (AT, BE (Flanders), DE, IR, NL, DK, NO, SE, SF, E (planned))

- **No integrated strategies** BUT specifically Bioeconomy-related policies and activities (CZ, FR, UK, IT)

- More or less **no specific activities and policies**, but acknowledgement of its political importance and potential (EE, GR, LT, SI, PT)
Bioeconomy in the EU Member States

- When talking about the Bioeconomy expressions like „Green growth“ (i.e. Denmark), „Green Economy“ (i.e. Ireland) or just „Industrial Biotechnology“ are frequently used instead of the notion Bioeconomy.

- Most advanced within the EU: Germany and its „Nationale Forschungstrategie Bioökonomie 2030“ and as the first of its kind their „Policy Strategy of a German Bioeconomy“ of 17th July 2013, and the Netherlands‘ „Biobaseerde Economie 2010-2015“.

- Norway launched a 10 years programme for 300 Mio.€ BIONAER end of last year; very similar to such a programme by Sweden. Both countries have strongly oriented activities along the German model.
Bioeconomy in the EU Member States


- In its 10 years future programme for investments (35 Bill. Euro) **France** mentions Biotechnologies and Bioresources as one of its 11 top topics. France is intensively discussing the launch of strategy and policy on the Bioeconomy of its own in the context of their national innovation strategy.

- In **Austria** a new research initiative „Bioeconomy“, jointly undertaken by research, science and economy has started. The coalition agreement of the new Austrian government supports it, November 2013. 1st Stakeholder Conference in Graz, September 2014.
Members of the European Union

- **Flanders** published in January 2014 „Bioeconomy in Flanders – the vision and strategy of the Government of Flanders for a sustainable and competitive Bioeconomy in 2030“. An action plan, precising the financial outlook of this strategy will follow 2014.

- **Italy** is examining the elaboration of corner stones or even a strategy on the bioeconomy for Italy for the end of 2014.

- **Spain** has formed a task force to work out a national bioeconomy strategy, probably until Easter 2015 under the leadership of the Ministry of Economy etc.
Members of the European Union

- The **Nordic Union**, under Icelandic chairmanship has started at the beginning of 2014 to implement its common bioeconomy strategy (NordBIO) with five projects ranging from wood biomass in the Nordic Bioeconomy to creativity as an educational and scientific tool with an amount of approx. 10 Mill. Danish Crowns. The Nordic Union has also invited the Baltic Regions for a workshop on the bioeconomy to think about pushing this initiative very recently. This trend was confirmed in a conference in Berlin in September 2014.
Members of the European Union

- In **Germany** apart from the National Research Strategy and the Policy Strategy on the Bioeconomy from July 2013, the German regions North Rhine-Westphalia and Baden-Württemberg have issued their own regional strategies, resp. corner stones for such a strategy in Summer 2014. In B-W the priorities of their future research: biogas, lignocelullosic based value chains and integrated use of algae.

- Other German regions or Länder like Mecklenburg-Vorpommern or Hessen might follow very soon.
Bioeconomy in the US, Russia, Malaysia etc.

National Bioeconomy Programme of Malaysia, Oct./Nov. 2012

BIO-2020
STATE PROGRAM OF BIOTECHNOLOGY DEVELOPMENT IN THE RUSSIAN FEDERATION TILL 2020
Outside Europe

- **South Africa** has published her own bioeconomy strategy in November 2013 with a strong emphasis on the potentials of South Africa using in particular the advantages of the functional biodiversity of biological resources there.

- In the **U.S.** in addition to the biopreferred programme and the Blueprint Bioeconomy Strategy amendments to the Farm Bill are being finalised. This will lead to an equal treatment of energetic and non-energetic use of biomass also with respect to available funds. A target which Europe is still far away from.
The development of the Bioeconomy in GERMANY
Integrated KBBE Concepts – Germany-1

• “Cologne“-Paper - „En route to the Knowledge-Based Bio-Economy (KBBE)“ during the German EU presidency in 2007

• High-Tech Initiative of the German Federal Government, linking with the KBBE-concept

• National Bio-Economy Council, now already in its second formate.

• Explicit reference to the KBBE and the need for its establishment with the support of the National Bio-Economy Technology Council in the Coalition Agreement of the former and now new German government 2013.
• Approval of the first **National Strategy on the Bioeconomy for Germany** in the format of a Framework Programme by the Federal Government on the 10\(^{th}\) of November 2010 (2.4 Bill.€ for 6 years)

• Foundation of the **Bioeconomy Science Center (BioSC)** in North-Rhine Westphalia in autumn 2010 which integrates all relevant scientific disciplines for a sustainable supply of biomass and bio-based products and processes within the Bioeconomy

• Establishment of a new **Science Campus „Plant-based Bioeconomy“** in the German state Saxony-Anhalt, Halle, jointly established by the university of Halle-Wittenberg and Leibniz Association in March 2011

• Publication of the first of its kind Policy Strategy of July 2013
• Study about the potential of a region, Land NRW, for the Bioeconomy in 2011.

• Awarding 40. Mio. € for the establishment of biomass- oriented cluster „Bioeconomy Saxonia-Anhalt and Saxony“ as one of the 5 winners in the recent top cluster competition in Germany in January 2012

• Finalisation a roadmap biorefining for Germany jointly by industry, academia and policy in June 2012
Bioeconomy lives in the regions

- Further studies on the impact of the Bioeconomy on their regions are on their way in the German Länder like Brandenburg, Mecklenburg-Pommerania and maybe Saxonia-Anhalt

- Approval of corner stones for regional strategy of North-Rhine Westphalia in the Bioeconomy in July 2013
Bioeconomy lives in the regions

- Baden-Württemberg launched its own research initiative “Bioökonomie im System aufstellen” with 3 priorities in summer 2013:
  - Biogas
  - Lignocellulosic based value chains
  - Integrated use of algae
RECENT INDUSTRIAL BIOECONOMY DEVELOPMENTS IN EUROPE
Practical examples for innovative biobased products out of the C-toolbox of nature

- Polyethylenfuran (PEF) bottles by YXY-technology, replacing hitherto used PET bottles, 100% biobased, reaching the market until 2017.

- spectacular competition Coca-Cola – Pepsi.

- also ALPLA plant Alwin Lehner GmbH together with Avantium (NL), Coca-Cola and Danone are in the development team

-> RESULT: improvements of quality, weight, capture of CO$_2$ etc.
Practical examples for innovative biobased products out of the C-toolbox of nature

**Succinic Acid:** basis for the multitude of bioplastics, plastizisers, biosolvents, polyethene

- Strong competition who built the first and largest demonstration facilities (DSM, Roquette, BASF, Lanxess (Sarnia location in CA and others))
- Opening of the first commercial production plant of 10,000 tons/y by BASF and Puray in Montmelo, Spain in January 2014
- Planned: commercial start of a plant of 30,000 tons/y by BioAmber and Mitsui in Sarnia, CA, Beginning of 2015
Practical examples for innovative biobased products out of the C-toolbox of nature

- **Biobased phthalate-free plastizizers** for plastics, construction, automotive industries by Evonik

- **Essential amino acids** as feed additives (methionine, lysine) by Evonik

- **Acrylic acid**: BASF, Cargil, Novozymes: 1st successful production of superabsorbent polymers from biobased acrylic acid at pilot scale in Sept 2014

- New fibres („Cellulocis chemicals“) for cloth industries, adhesives and other purposes
Practical examples for innovative biobased products out of the C-toolbox of nature

- Biobased BDO (1,4-Butandiol und Butandien) for automotive and chip industries (BASF, Genomatika).

- Biokerosine (biobased marine diesel and aviation gas) and Biorubber (Russian dandelion), other option: Usage of Guayule by Versalis, subsidiary of Eny, Italy.

- Biopolymers and Biomonomers as basic chemicals

- Lauric acid as replacement for fossile polyamides. Evonik, demo plant in Slovenia.
Larger portfolio for feedstocks and products in biorefineries

Bran, new fibres, lignin, even glycerine as feedstock

- Innovative resins
- Plastizisers
- Biosurfactants
- Sponges
- New cosmetics
- De-icing materials for aviation
Practical examples for innovative biobased products out of the C-toolbox of nature

- **Arkema**, subsidiary of Total, F, started usage of castor oil for the replacement of fossil polyamides for the production of several consumer goods, like skiing boots, sun glasses, electronics etc.

- **Fischer Bio-PA Plugs**: first 100% biobased Fischer-plug Universal UX) on the market made out of biobased polyamides out of castor oil, as well as first biobased mortar.

- **Essential amino acids** as feed additives (methionine, lysine)
  - -> Evonik
Practical examples for innovative biobased products out of the C-toolbox of nature

- First biobased closures for gabled roof packaging by TetraPak made out of sugar cane residues.

- **Ford and ketchup producer Heinz:** residues of tomato skin as basis for biological plastics for wiring brackets and storage bin in cars.
INTERIM CONCLUSIONS

- Biomass is the primary natural resource of the bioeconomy, be it a carrier for energy, or a modular part for chemicals, biochemicals, proteins or nutrients etc.

- Biotechnologies and focused new knowledge stemming from converted technologies, like nano-, info- or cognitive sciences will be the technology drivers of this new form of economy,

- Aspects on Health (“one health“) will play a growing role in this context.
Recyclability and/or multiple reuse of biomass in diverse forms including cascades, will be the prime elements along new value chains like „from fork to farm“ oder „farm to fork“, „gate to plate“ etc. They will represent the nerve strains of this new concept of economy.

Biorefineries will be the central production facilities of the bioeconomy. Their primary but not exhaustive feedstock will be biological waste resources and biomass: both of renewable nature.
INTERIM CONCLUSIONS

- For the economics and the successful implementation of biorefining, diversity and flexibility within the choices for feedstock will be essential, ranging from lignocellulosic glycerine over black liquor to bran. There are no limits for fantasy in identifying the relevant new value chains as the „Autobahnen“ for this new economy.

- The involvement of SMEs in these highly diversified value chains should go without saying, provided SMEs grasp the unique occasion of cooperating with hitherto unusual partners in science and economy. This requires however a certain preparation and shaping of markets with a certain assistance of public hands, i.e. with respect to norms, standards and procurement policies etc.
INTERIM CONCLUSIONS

Looking exclusively of the high potentials of new technologies will not be sufficient!

This a true challenge for everybody and a success is not at all guaranteed. Openess towards new ways of funding and the need for longer periods of planning security for all stakeholders will also be important requisites for the bioeconomy as a new formate of our economic development worldwide.
What are the main paradigm changes now for Europe, nine years after the launch of the Bioeconomy by the EU Commission?
Bioeconomy is no more limited to research but has developed into a strategy and policy with heavy emphasis on innovation.

This has not yet been successfully acknowledged by all stakeholders and policy makers.

The production parts of the various value chains need to be closer linked to the processing and back end of the value chains like norms, standards, markets, etc.

There is still a lack of coordination all over Europe so that the dangers of double work and double developments are evident.
Paradigma Changes -2

- The Bioeconomy is still an important, but rather limited activity and has not reached the level of mass acknowledgement.

- There is a thread that outside Europe, in particular in North and South America but also parts of Asia, the Bioeconomy will be quicker implemented than in the old continent, in particular because of more courageous and more speedy decision taking in building up industrial bioeconomy complexes.
No other region in Europe is better prepared or apt to work out and implement a common Bioeconomy strategy with a lot of hitherto untabbed potentials than the Nordic Union.
What makes the difference for the Nordic Union regions? (2)

- Highest concentrations of states and regions which own already today a Bioeconomy strategy or a similar institutional approach: Finland, Sweden, Denmark, Norway, Iceland, the Nordic Union

- Strong advanced agriculture and even strongest forestry economy in Europe, in particular Sweden and Finland, with strong impact on cellulosic derivates

- Highly developed food and feed industry, including fish and aquaculture feed

- Location of largest European enzyme producers
Strong high-tech industries in general, also in neighboring areas, like pharma, health, IT, biotechnologies!

Long coastal lines with hitherto untabbed potentials for aquaculture cultivation

Large off-shore regions which might offer new perspectives for renewable energy production but also aquaculture and fishing in compliance with sustainability
What makes the difference for the Nordic Union regions?

- Particular living conditions in rural areas including islands and coastal zones which might offer new solutions for small retail agriculture and fisheries also to be transferred to similar fragmented regions and societies outside Europe.

- Particular challenge by the arctic regions with their extreme living and climate conditions with the potential of achieved results to be transferred to other regions in the world.
What makes the difference for the Nordic Union regions?

- Strong ecological awareness in the public and strong support for sustainability
- Leading role in public private partnerships, like BBI
- Open for renewable energies, in particular based on wood
- Very high level of training and education in academia and for vocational and professional training
A further developed common strategy including a detailed action plan worked out and implemented, based on the principle of distribution or division of work, talents and resources might lead to an optimized exploitation of biological resources, a most efficient built-up of the bioeconomy, including the market entry of a panoply of bio-based products and services.

This might lead to a win-win situation for all the various regions of the Nordic Union.
What could be elements for such a win-win strategy?

- exchange of information and best practices, building up biobased value chains, including biorefining, based on a high variety of feedstock
- contributing to an uninterrupted supply of biomass around the Nordic Union.
A new common strategy is required! (3)

- exchanging knowledge and experiences on so-called soft skills, including the exchange of academic and vocational personnel

- Joint appearances as a pressure group in international Fora, for better exploiting financial promotions, in particular in the European Union

- Making the Bioeconomy in the Nordic Union a model for other regions, like the Baltic, the North Atlantic, the Caspian Sea and maybe even the Mediterranean.
A new common strategy is required! (4)

- Joint appearances as a pressure group in international Fora, for better exploiting financial promotions, in particular in the European Union.
- Making the Bioeconomy in the Nordic Union a model for other regions, like the Black Sea, the North Atlantic, the Caspian Sea and maybe even the Mediterranean.
A new common strategy is required! (5)

Following the proposals of the EU Bioeconomy Strategy to establish:

- A Nordic Union Bioeconomy Panel, with a convincing governance structure along the described lines above.
- Regular regional stakeholder meetings and action plans, in close cooperation with the activities of such a panel.
Elaboration of a common political Bioeconomy strategy, including RTDI activities, based on the will to learn from each other, to support each other and mutually benefit from each other’s good and bad practices.
GOOD LUCK AND CONGRATULATIONS!