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BioSC

Bioeconomy Science Center

Global biomass flows in the emerging bioeconomy: A view on the challenges from a technology and innovation management perspective

Prof. Dr. Stefanie Bröring
Dr. Nina Preschitschek

Ravello, 18 June 2015

Agenda

Challenges of the bioeconomy from TIM perspective

Examples from bioethanol

Implications for TIM research in the bioeconomy

Forecast of biofuels feedstock and bioethanol production in 2022

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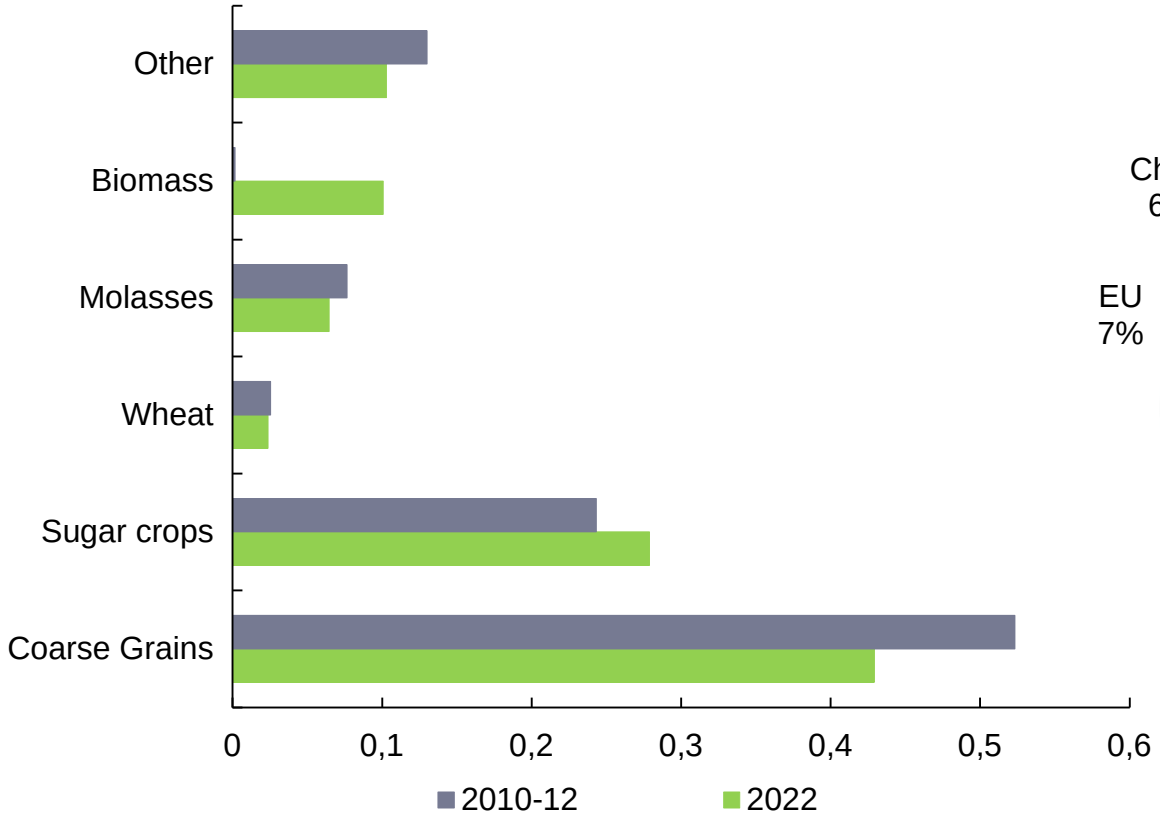
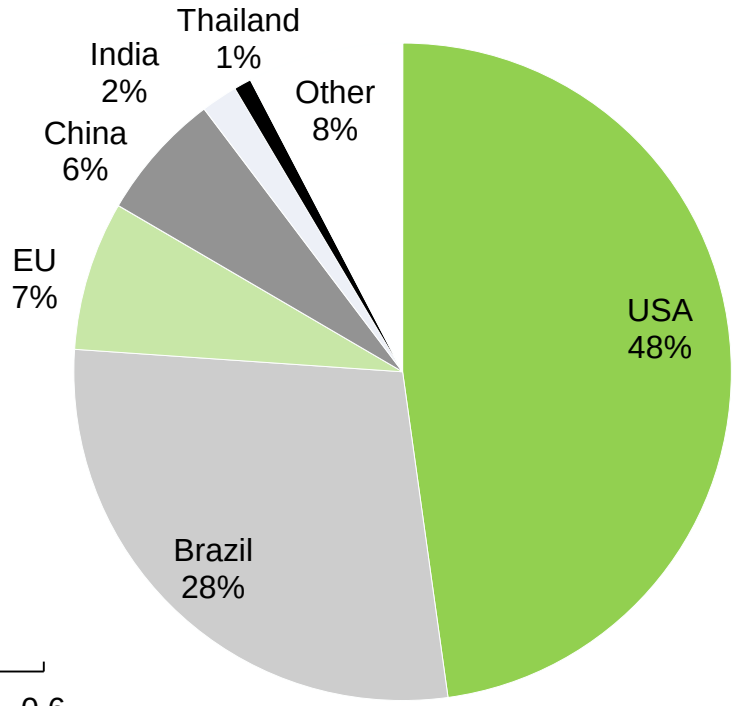
- **Share of feedstock used for biofuels production**



- **Regional distribution of world ethanol production in 2022**



Source: OECD-FAO Agricultural Outlook 2013 .

Literature analysis on the emerging research landscape of the bioeconomy: TIM perspective

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- Database: SciVerse Scopus (provided by Elsevier B.V.)
- Keywords: ‘bio-based econom* OR biobased economy* OR bio-econom* OR bioeconom*’
- Search fields: title, abstract and keywords of journal articles and reviews
- Clustering of publications according to subject areas provided by SciVerse Scopus

All publications on bio(-)economy and bioeconomic(s)	1,491
Publications in the field of socioeconomic sciences	472
Publications including the terms ‘technology management’ or ‘innovat*’	52
Publications with research questions of technology and innovation management	6

Source: Golembiewski, Sick, Bröring, S. (2015): The emerging research landscape on bioeconomy: What has been done so far and what is essential from a technology and innovation management perspective?, Innovative Food Science and Technology 03/2015.

Challenges of TIM within the process of moving towards a bioeconomy

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Complex knowledge base

- Creation, exchange and application of (new) knowledge
- Concept of ‘knowledge-based bio-economy’ *(KBBE)*
- Knowledge management as part of TIM research

Value chain/discipline crossing technology development

- Barriers like ‘industry recipes’ and cognitive distances
- Innovation causing spillovers between so far distinct disciplines
- Enabling resource allocation and biomass flow as major challenge for TIM

Commercialization and market diffusion

- High risk perception instead of seeing potential advantages
- Low acceptance rates of new technologies and products on B2B- and B2C-level
- Modification of standard TIM tools like the technology acceptance model

Innovation process and challenges – Complex knowledge base

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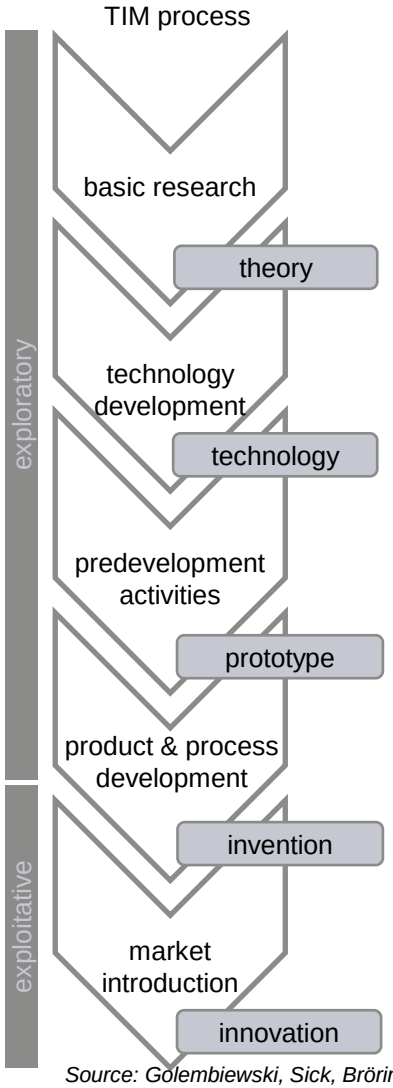

Emerging challenges for TIM deduced from literature	exemplary topics for TIM research
complex knowledge base	• anticipating new knowledge areas with publications and patent analysis • technology foresight • dynamic capabilities to adapt to changing environments • open innovation
value chain / discipline crossing technology development	• process of technology convergence • technology transfer (academia-industry) • collaborations across different subsectors • cross-industry innovation • convergence of value chains
commercialization and market diffusion	• technology adoption and diffusion (in B2B) • technology acceptance model (B2C) • food technology/raw material neophobia

Source: Golembiewski, Sick, Bröring, S. (2015): The emerging research landscape on bioeconomy: What has been done so far and what is essential from a technology and innovation management perspective?, Innovative Food Science and Technology 03/2015.

Anticipating new knowledge areas via patent analysis: Patent Mapping Approach

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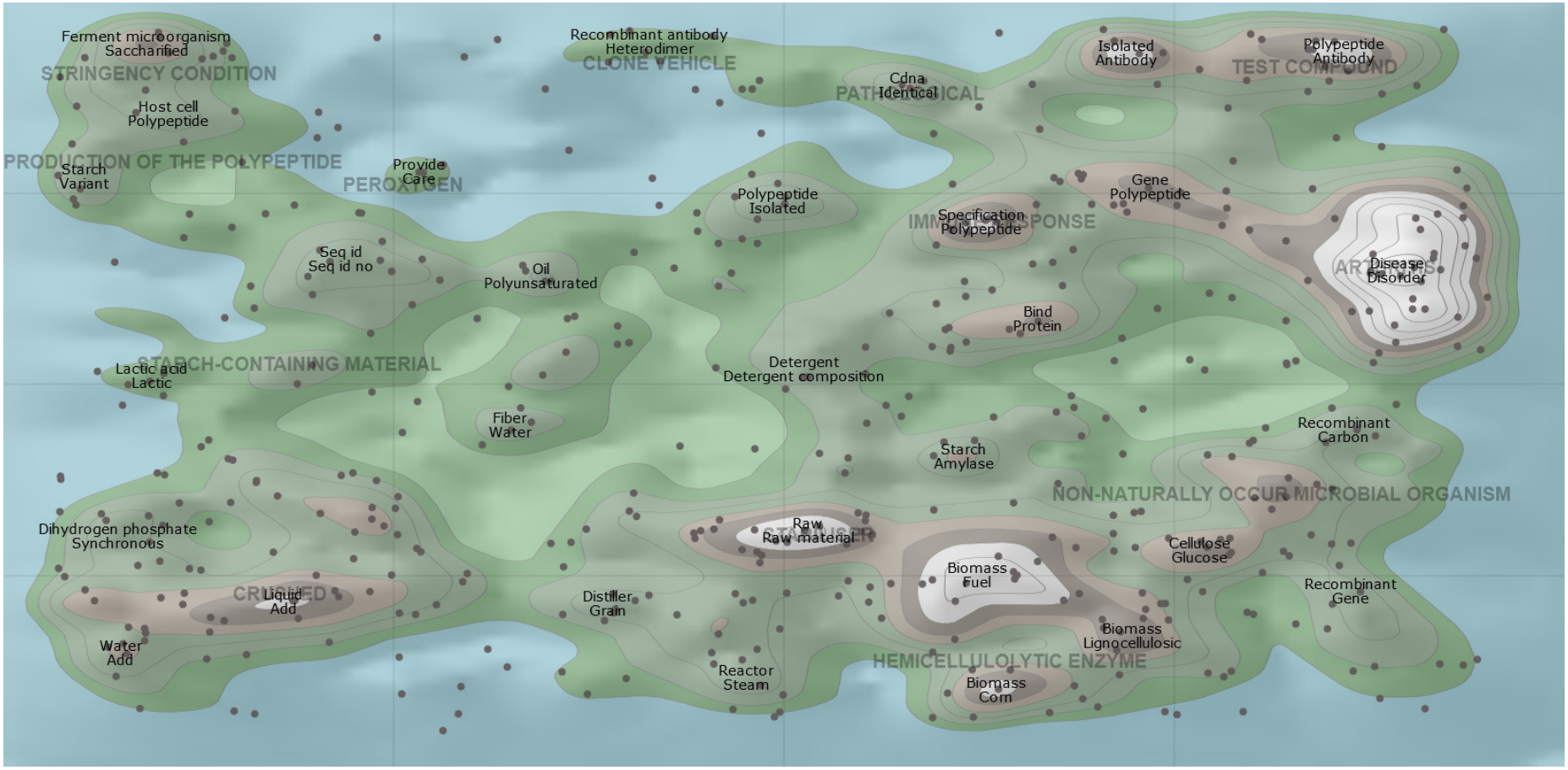
- **Keyword-based search on cellulose and ethanol for 2000 – 2010 in *Thomson Innovation***
- **"ThemeScape Map" based on DWPI families and IPC-grouping**



Note: We thank Thomson Reuters for providing a free trial on Thomson Innovation.

Innovation process and challenges – Value chain / discipline crossing technology development

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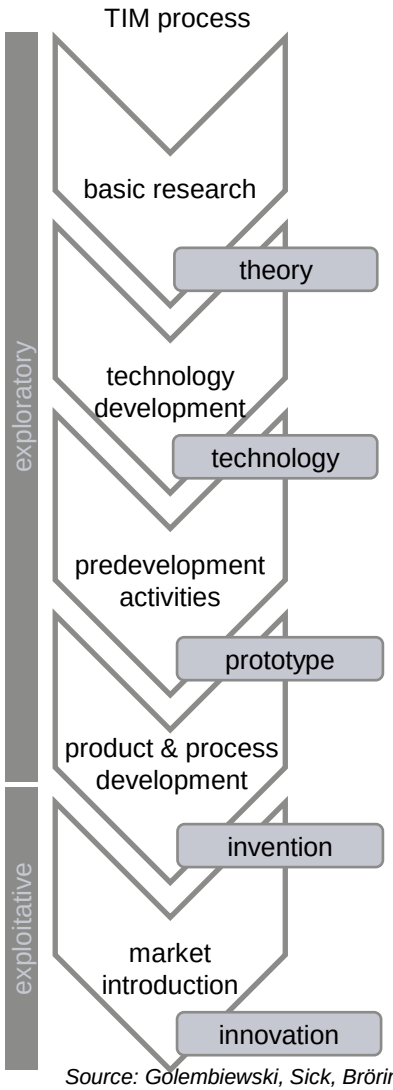

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Emergence of new production systems, technology platforms and complete new value chains

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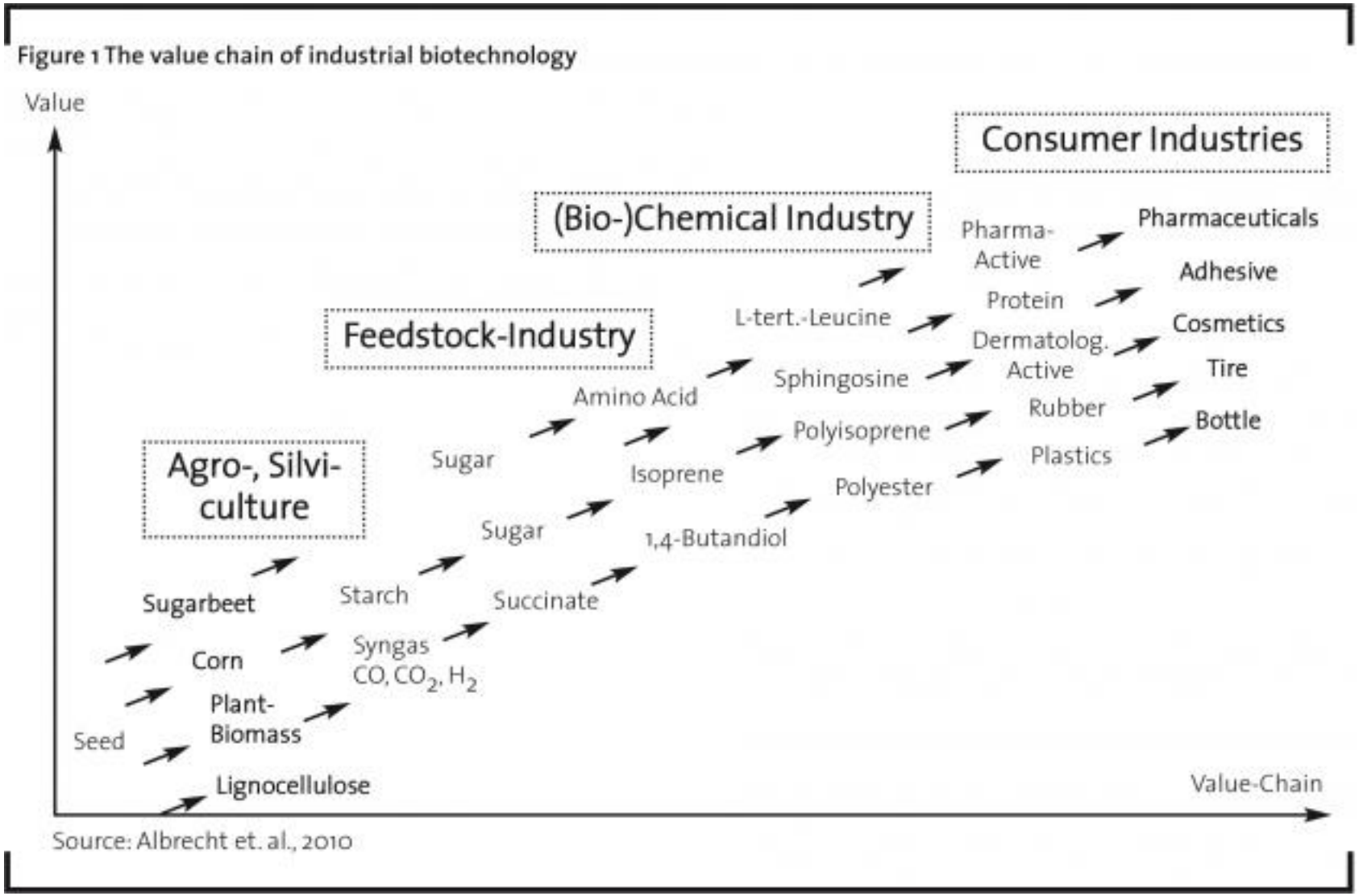

Cross-industrial collaborations in the area of biofuels (and biopolymers) indicate a convergence.

Agricultural company	Oil/chemical company	Collaboration type	Duration	Aim and focus
ADM	ConocoPhillips	Strategic collaboration	Since 2007	▪ Employing lignocellulosic biomass for 2nd generation biofuels
Weyerhaeuser	Chevron	50-50 JV (Catchlight Energy)	Since 2009	▪ Technologies for biofuels from lignocellulosic biomass
IOGEN CORPORATION	Shell	50-50 JV (Iogen Energy)	Since 2002	▪ Production of cellulosic ethanol (already commercially available)
cosan	Shell	JV	Since 2010	▪ Bioethanol from sugar cane
Cargill	DOW	50-50 JV (NatureWorks)	1997 – 2005	▪ Production of polymers from renewable resources (e.g., PLA)

Source: Preschitschek (2014).

Innovation process and challenges – Commercialization and market diffusion

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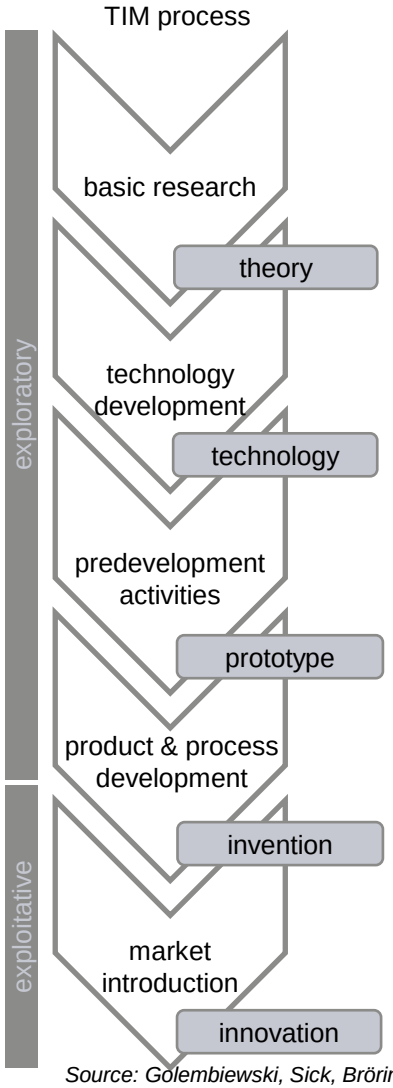

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The importance of societal acceptance, complementarities, new standards, competitive technologies and the oil price…

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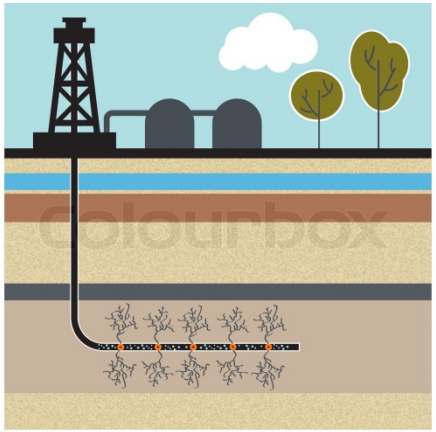
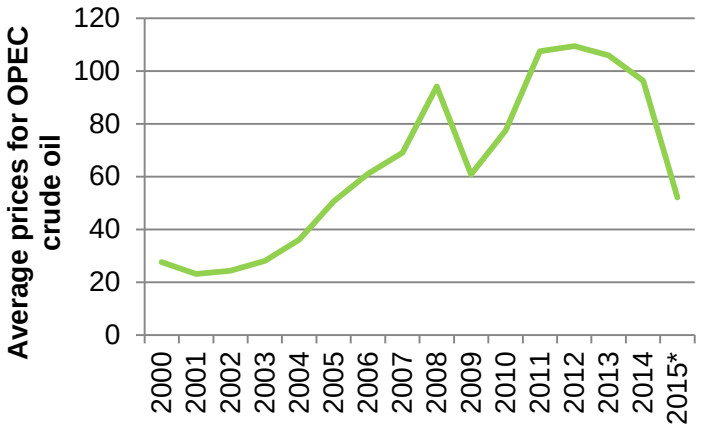
- **Consumer acceptance and communication: E10 in Germany**

- **Competitive technologies: Fracking**



- **Complementarities in linked industry sectors: Flex Fuel Vehicles in Brazil**

- **Future development of crude oil price**



Conclusion and implications

I. Current evolution of the bioeconomy concept

- No common understanding of the concept
- Evolution still on a strategic level
- Missing broader picture approach

II. Main challenges in bioeconomy research

- New, complex knowledge base
- Cross-chain technology development
- Commercialization & market diffusion

III. Future implementation of the bioeconomy concept

- More bioeconomy specific studies along the 3 challenges
- Contingency based approach
- Modification of TIM methods and concepts

Econ-BioSC: Biomass flows and technological innovation in the bioeconomy: A global scenario analysis

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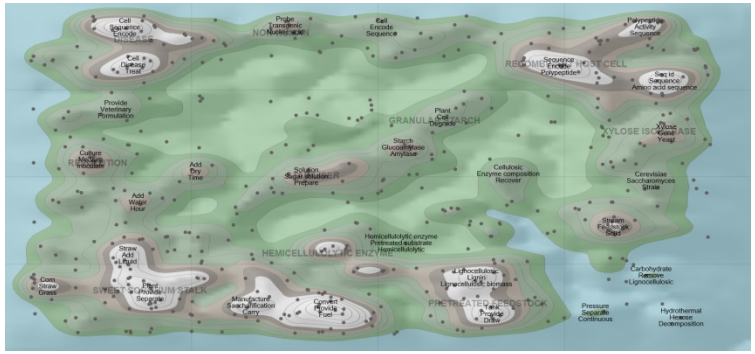
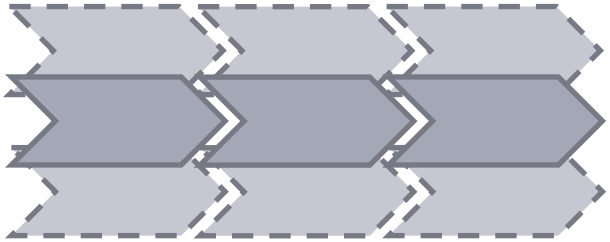
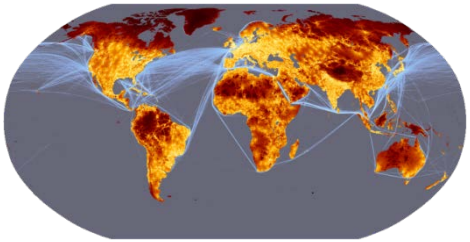


Roadmapping of innovations for biomass production and processing



Emergence of new value chains

Societal acceptance



Modeling of effects of changes in biomass trade patterns on socio-economic and environmental indicators (e.g. employment, biodiversity)

Sources: http://bioval.jrc.ec.europa.eu/products/gam/index.htm; Thomson Innovation. We thank Thomson Reuters for providing a free trial access.

Thank you very much…

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for your attention!

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