



Global Bioeconomy Alliance - Leading research and education for a worldwide bioeconomy

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1. Introduction

Bioeconomy encompasses 'the knowledge-based production and utilisation of biological resources, innovative biological processes and principles to sustainably provide goods and services across all economic sectors'. Bioeconomy-based enterprises are envisaged to lead the transition and emergence of many industries, facilitating a shift from fossil fuel processes to sustainable bio-based industries. Bioeconomy encompasses industries in fuel, food, feeds and fibre sectors, and includes the utilisation of endemic plants for medicines and materials, the production and utilisation of engineered organisms for food, bioactives and materials, the discovery of bio-based processes for use in the industrial production of commodity and fine chemicals, as well as the utilisation of novel microbial solutions for mining and environmental remediation.

Bioeconomy is a global topic and can only be realized by combining agricultural, technical and social aspects of the biobased-industry and society as present at different locations of our planet. Therefore, in partnership with the **Technical University of Munich (TUM)** and the **Sao Paulo State University (UNESP)** UQ formed an alliance that aims to transfer knowledge and technologies to boost the global bioeconomy. This Global Bioeconomy Alliance (GBA) is dedicated (i) to exchange experiences, (ii) to discuss the major topics of a biobased industry in research and education and (iii) to develop joint initiatives to promote Bioeconomy, and it is open for expansion by including partners from the academic, industry and Government sectors across the globe.

2. Founding Members

• The University of Queensland

For more than a century, The University of Queensland (UQ) has maintained a global reputation for delivering knowledge leadership for a better world. The most prestigious and widely recognised rankings of world universities consistently place UQ among the world's top universities.

UQ has also won more national teaching awards than any other Australian university. This commitment to quality teaching empowers our 53,600 current students, who study across UQ's three campuses, to create positive change for society. In 2019, UQ was also ranked first in Australia by the prestigious Nature Index tables, and 79th overall in the world.

The University has global impact, delivered by an interdisciplinary research community of more than 1500 researchers at our six faculties, eight research institutes and more than 100 research centres.



Fig.1: The University of Queensland.

2. Founding Members

• Technical University of Munich

TUM was founded in 1868 as a centre of learning dedicated to the natural sciences. Today TUM is one of Europe's top universities. It is committed to excellence in research and teaching, interdisciplinary education and the active promotion of promising young scientists. The university also forges strong links with companies and scientific institutions across the world. With 14 departments, 6 Integrative Research Centre, 545 professors and 10,000 staff members TUM provides an excellent environment for research and for the education of 41,000 students in 177 degree programs.



Fig.2: Technical University of Munich.

At TUM bioeconomy was recently (October 2017) concentrated at TUM Campus Straubing (TUMCS) for Biotechnology and Sustainability. This integrative research centre conducts fundamental research and technological developments on biogenic resources, biotechnology and bioeconomy. Research focuses are the chemical and energetic use of biogenic resources as well as its economic aspects. Additionally to PhD studies, at TUMCS the academic education takes place within the Master's and Bachelor's degree programs "Renewable Resources", "Chemical Biotechnology", "Technology- and Management-oriented Business Administration", "Biomass Technology" and "Bioeconomy".

2. Founding Members

• Sao Paulo State University

UNESP was established in 1976 and is one of the largest and most prestigious research-intensive universities in Brazil. The institution offers free education and is committed to excellence in teaching, research and community engagement.

It has a distinctive structure, with schools and institutes located in 24 cities in the state of São Paulo, being one of the most successful multi-campus universities in the world. About 3500 academics and 7000 non-academic staff contribute to the development of the institution that counts with about 36,000 undergraduate and 15,000 graduate students.

The University awards more than 1200 PhD diplomas per year and is responsible for about 8% of all Brazilian scientific publication. In the last five years, almost 31,000 scientific papers were published by university's researchers. The institution's research priorities are Healthy Societies, Transformative Technologies, One Health, Feeding the World, Biosphere, and Bioeconomy.

The institution's permanent social engagement through different initiatives, the high employability rates among alumni and its top ten position in the most prominent Latin America rankings among other relevant features, reinforce UNESP's reputation as one of the best institutions in the region.



Fig.3: Sao Paulo State University.

3. General Research Focus

- Cross-industry and cross-disciplinary collaboration, in which various disciplines work closely together. These include the natural, engineering, ecosystem and economic sciences in order to comprehensively cover questions ranging from molecules to the marketing of biogenic resources.
- Development of strategies for the sustainable and environmentally compatible supply of biogenic resources.
- Integrated techno-economic and life cycle analysis to enable systems optimisation, translation and business development.

3. General Research Focus

Main fields of research interest include:

- Biotechnology and bioengineering
- Biogenic materials and renewable biomass
- Sustainable food production and food safety
- Sustainable chemicals and processes
- Renewable energy
- Economics and policies

4. Example of an Emerging Research Collaboration

• Cell-free biomanufacturing

Synthetic biology has emerged as a powerful approach to optimise metabolic pathways for the production of high-value chemicals. While considerable progress has already been made with cell-based systems, their efficiency, controllability and longevity can be limited by operational conditions (e.g. temperature and pressure) and the toxicity of end products to the engineered organism. To bypass these limitations cell-free, enzyme-based approaches have thus gained increasing attention as pipelines for high-value chemicals. While the catalytic efficiency and stability of naturally occurring enzymes are often not optimal for use in an engineered multi-enzyme cascade, techniques are emerging to tailor the properties of such proteins for required needs (as pioneered by the 2018 Nobel Prize laureate in Chemistry). We have embarked on a collaboration to develop an optimised cell-free biomanufacturing pipeline (EnzOnomy) for platform chemicals. We also aim to demonstrate the potential (i.e. the translation readiness level - TRL) of the approach to transform industrial processes of the emerging sustainable bioeconomy.

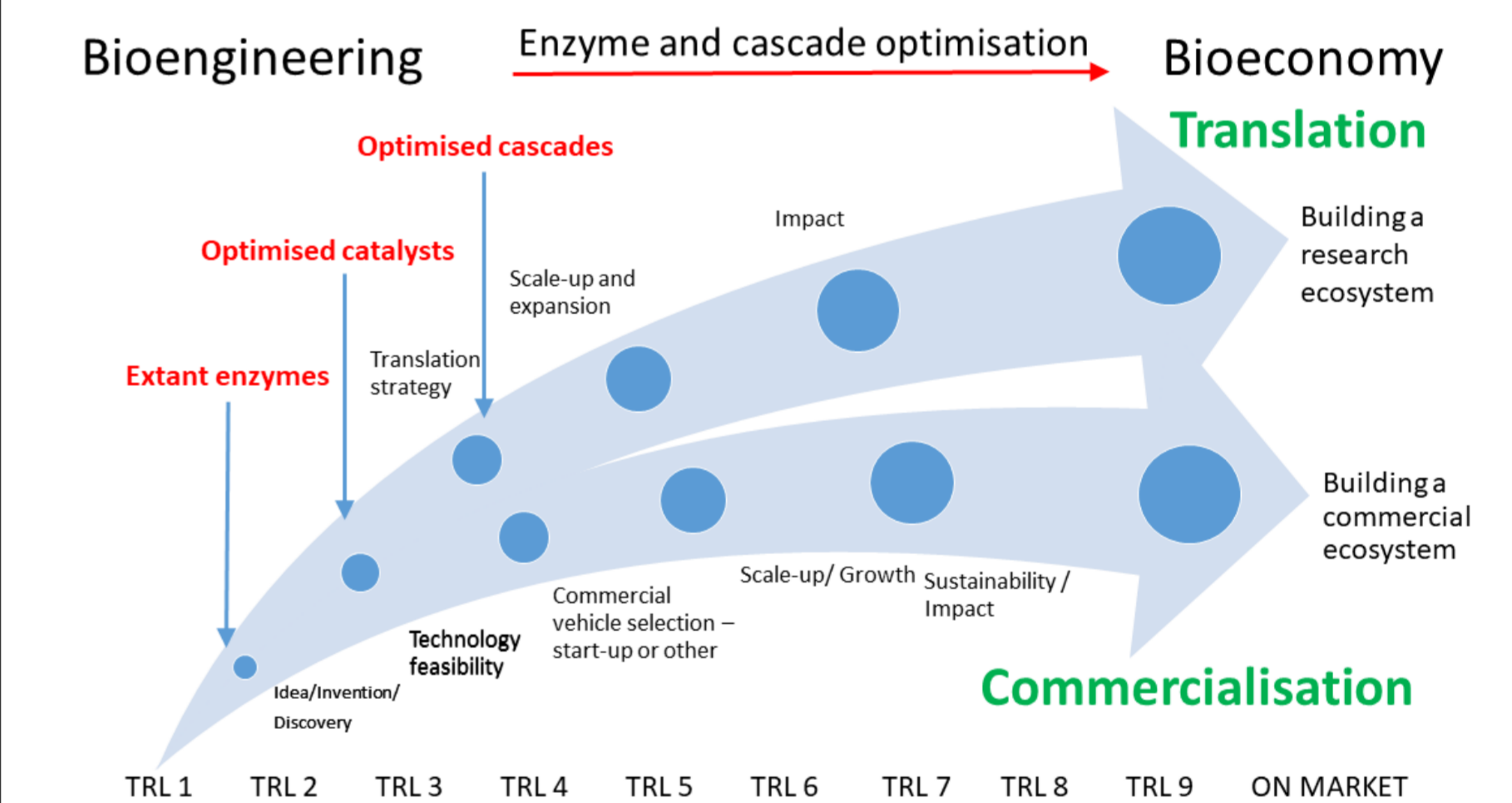


Fig.4: The overarching project aim is to advance a representative cell-free bioproduction cascade from TRL 2 to TRL 5, enabling the translation of the technology towards diverse products and develop a strategy for commercialisation.

5. Teaching Focus

All partners of the GBA have a varied offer of degree programs in the field of bioeconomy. This refers to both Bachelor and Master programs. Some examples are listed below. One of the GBA's main objectives for the future is to intensify the educational exchange of students and staff between the partner universities.

- Bachelor degree programs (B.Sc.) in Chemical Biotechnology, Management and Technology, Renewable Resources, etc;
- Master degree programs (M.Sc.) in Renewable Resources, Biomass Technology, etc;
- Postgraduate Certificate and Diplomas in Biotechnology.

6. Future Developments

The GBA has the vision to develop a membership scheme open for international academic institutions, industries and relevant government agencies. Annual symposia will provide a platform to foster collaborations and influence policies.

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