IBISBA SHARING THE WAY TO INNOVATION

Policy Brief

November 2020 | www.ibisba.eu

Industrial biotechnology is an advanced technology at the heart of the bioeconomy and the circular economy: its development needs efforts from the public sector

- **Breakthroughs in engineering biology,** such as synthetic biology, are impulsing new developments in industrial biotechnology and provide low carbon solutions for societal challenges.
- **Industrial Biotechnology is relevant** to the bioeconomy and the circular economy because it provides solutions to valorise biobased resources, including organic residues and waste streams.
- **The combination of biobased and digital technologies** is generating new opportunities to develop advanced manufacturing processes, products and services.
- **The EU must increase its investments** in biotechnology to acquire greater manufacturing autonomy taking back control over strategic value chain.
- **Tomorrow's industrial biotechnology will contribute** significantly to efforts to achieve the aims of the Green Deal and those of UN Sustainable Development Goals.

Industrial development: an evolving issue in a changing world

The chemical industry began in the late 17th century and was built on fundamental knowledge in chemistry and physics acquired over the previous decades. During the 19th century the development of organic chemicals constituted a major step forward. Since then, working hand in hand with the coal, oil and gas industries, industrial chemical progressively introduced the vast array of chemicals and sophisticated materials that characterise our modern consumer society. Our current advanced economy is thus heavily reliant on the petrochemical industry, despite the fact that there is significant evidence to show that it is unsustainable.

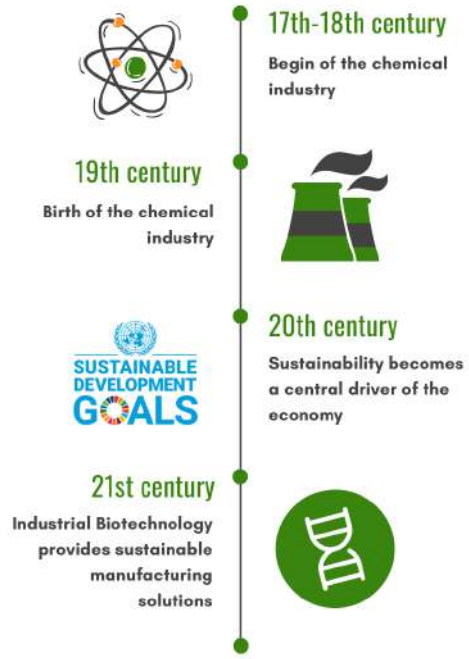
The end of the 20th century was a period of game-changing realisations that are now dominating socio-political agendas across the globe. Importantly, climate change and the negative impact of fossil resources were recognised as major threats to the planet. More recently, calls for new approaches to world problems were voiced and formalised, notably in the framework of the UN's sustainability development goals (SDGs). The 17 SDGs form part of an ambitious transformational agenda that aims to create better life quality using sustainability as a central driver.

Rather like industrial chemistry in the 18th century, the stage is now set for developments in engineering biology to further empower industrial biotechnology (IB).

Industrial biotechnology as a response to the new world paradigm

Rather like industrial chemistry in the early 20th century, IB has now been around for some time and several examples of successful industrialisation are visible, one of the most recent being the production of 1st generation ethanol. Despite this, manufacturing of most products is still dominated by industrial chemistry, with IB playing a minor role. Nevertheless, new fundamental knowledge acquired in biology over the second half of the 20th century and the development of engineering biology approaches, such as synthetic biology, is heralding in a new phase of industrial development in IB that **will provide solutions more compatible with 21st century needs and expectations**.

Industrial development timeline from the 17th century to present



➜ **IB addressing the circular economy**

Presently, strong focus is being placed on the development of a more sustainable economic paradigm that focuses on circular rather than linear value chains, that provides both services and products, and that involves lower environmental footprint manufacturing solutions. All of these challenges are within the scope of IB, a technology family that focuses on Nature-based solutions.

➜ **IB offers a wide range of solutions in various market sectors**

Together, engineering biology and industrial biotechnology apply engineering principles to design biological systems and then integrate them into manufacturing designs that deliver a wide range of products and services including alternative energies, chemicals, advanced materials, ingredients for feed, food and cosmetics, and healthcare solutions.

➜ **IB empowered by digital technology**

Combining biobased technologies with digital solutions, such as high-power computing and machine learning, offers the prospect of advanced solutions for many of modern society's problems, including GHG emissions, food insecurity and the pollution of the environment by plastics.

What's at stake for the EU?

Historically, Europe has played a leading role in the development of research in biology and was an early player in industrial biotechnology, being the birthplace of several world-leading biotechnology-based companies. Today, the EU is well-endowed with human talent and the research infrastructure required to further develop biobased manufacturing.

Nevertheless, the EU trade balance in biotech is negative

Encouraging facts about IB should not obscure current reality. Despite the enormous potential of IB, advanced biobased industrial solutions are at an early stage and the current EU trade balance in biotechnology-related products is negative. The underlying causes are numerous, but include the fact that the EU increasingly fails to draw full benefits from value chains, relinquishing the control of manufacturing and regulatory power to foreign countries. To correct the trade imbalance and acquire greater manufacturing autonomy, The EU must invest more in the industrialisation of the biotechnology, aiming to bring it up to a level of maturity equivalent to that of the petrochemical industry. This involves significant public support for research, development and innovation.

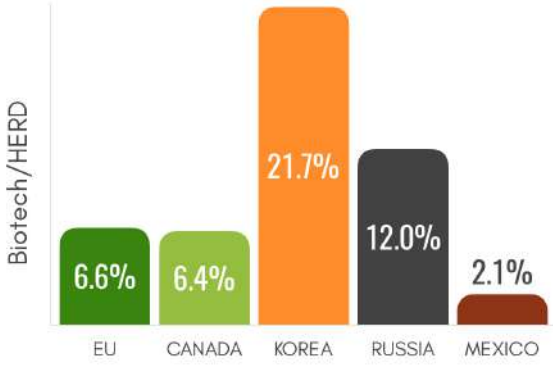
Industrial Biotechnology, it is time to act:

➜ **to guarantee EU autonomy** in the strategic field of industrial biotechnology - Insufficient support to industrial biotechnology will jeopardise the EU's ability to acquire full control of vital value chains (alternative energy production, manufacture of key chemicals and materials and bioproduction of food and healthcare ingredients) and reap the benefits both the bioeconomy and the circular economy, transitions that offer the EU the opportunity to free itself from its dependency on feedstocks (e.g. oil reserves) detained by foreign powers.

➜ **to maintain EU industrial capability** in a competitive world arena - Engineering biology and industrial biotechnology are high on the strategic agendas of most modern economies and particularly those of North America, UK, China and its BRIC counterparts, and other countries in the Asia Pacific region. Therefore, while EU-27 is currently well-positioned in the world arena, it is not alone.

What needs to be done? Focus on IB development as an advanced industrial technology

It is frequently noted that the EU possesses considerable underused strengths, with this being also true in the case of industrial biotechnology. To realise the potential of these strengths, major efforts are required to support the fields of engineering biology (e.g. through support to synthetic biology) and industrial biotechnology, notably those aimed at surmounting EU shortcomings. These include interlinking EU's fragmented R&D&I hotspots, networking its rich panoply of research infrastructure to provide the research and innovation community with easier access to facilities, and giving greater consistency to disjointed member state R&D&I strategies.



Biotech R&D expenditures in the public sector as a percentage of HERD (Higher Education Research & Development), 2015-17.
Source: OECD, Key Biotechnology Indicators, http://oe.cd/kbi, October 2019.

Time to act together

The Green Deal calls for collective action to develop a clean and circular economy, provide the means to produce clean, affordable and secure energy, devise strategies to procure a pollution-free environment and deliver sustainable food systems. All of these ambitions fall within the capabilities of industrial biotechnology. Therefore, it is vital that future R&D&I programming in the framework of Horizon Europe and at the Member State level targets promote ambitious, collective initiatives in favour of this game-changing advanced technology for industry.

IBISBA is a European infrastructure that uniquely produces translational R&D&I services for an international community of industrial biotechnology stakeholders. IBISBA simplifies access to advanced multidisciplinary services to accelerate end-to-end bioprocess development and contributes to the delivery of low carbon, low environmental footprint technologies for a wide variety of market sectors.