

UNLEASHING THE POTENTIAL: GERMANY AS A GLOBAL PIONEER IN BIOMANUFACTURING AND FOODTECH

SPRIND Position Paper on driving the Deep-Tech Bioeconomy

Deep-tech bioeconomy will play a crucial role in achieving a climate-neutral industry in Germany. The biomanufacturing sector, in particular, fosters technological sovereignty and strengthens Germany as an industrial nation. Currently, the industry relies heavily on fossil resources. This dependence is not only problematic from a sustainability and climate protection perspective. It also exposes industries to significant market fluctuations due to resource shortages. The development of a robust deep-tech bioeconomy¹ will lead to greater resilience and offers technological sovereignty, while strengthening Germany as an industrial nation. SPRIND's experience has shown that by acting quick, unbureaucratic, and bold (i.e., using pre-commercial procurement vehicles) we can mobilize the best teams from industry and academia to present highly innovative solutions that quickly unlock economic potential and create new jobs in Germany. Investments in a bio-based industry are investments in Germany as a preferred partner and the partner of choice for the industry 4.0.

Action 1: Commitment towards developing the deep-tech bioeconomy for a sustainable industry in Germany.

The bioeconomy encompasses divergent concepts; therefore, we need to define the industrial priorities of the deep-tech bioeconomy. It utilizes tools such as genetic engineering, new plant- and microbe-based breeding methods, and synthetic biology approaches, among other solutions, that are applicable across a wide breadth of industries and economic sectors. These tools are products of Germany's globally recognized basic research institutions; however, while the rest of the world recognizes their value, there is no clear strategy for translating these foundational concepts into profitable outcomes for Germany. Germany currently lacks a clear plan to integrate biomanufacturing processes into its existing industrial manufacturing policies. Supplementing conventional manufacturing with biomanufacturing capabilities can augment existing German engineering industries and open up manufacturing streams to create new domestic markets. It is of utmost urgency to create a strategic plan and adopt economic policies that mobilize coordinated investments from the private sector and from public funds, in order to realize a sustainable bioeconomy in Germany built on German ingenuity and discovery.

Recommendation: Appointment of a new business-oriented bioeconomy council with a mandate to create a strategic plan and adopt economic policies as part of the ongoing infrastructure

¹ We define deep-tech bioeconomy as an umbrella term for synthetic biology, biomanufacturing and food technology, whereby genetic engineering, new breeding methods, and synthetic biology approaches are used to establish new production methods to supplement conventional methods such as the petrochemical industry or the agricultural industry. This refers to green, red, white and gray biotechnology.

development plan under the leadership of the German Federal Ministry for Economic Affairs and Climate Action, with the involvement of German innovation agencies such as SPRIND.

Action 2: Establishment of an organization to bundle biomanufacturing facilities with targeted infrastructure investments.

Biomanufacturing is a cornerstone of the economic transformation process. The leapfrog innovation potential lies in combining the concept of Industry 4.0 with the principles of the bioeconomy to catapult industrial production to a more sustainable and environmentally friendly level. This potential comes from the vision of utilizing carbon-containing waste streams as local feedstock for the microbial production of valuable raw materials, which in turn are used directly to manufacture a wide array of commodity products. So far there are only individual efforts (e.g., UMP Biofore Leuna) that demonstrate this potential. The SPRIND Circular Biomanufacturing Challenge is tackling the current gaps in biomanufacturing, which prevent us from creating a truly sustainable and economically profitable bioeconomy-based industry. It is our experience at SPRIND that enables us to catalyze this transformation process by tackling the unsolved issues with targeted investments. For example, new fermentation reactors have been developed that would never have been realized without the initiation of SPRIND. The implementation of a national organization to manage biomanufacturing plants enables the support of a wide range of industrial sectors, not only in MedTech and FoodTech.

Recommendation 2: The establishment of an organization under SPRIND to (1) coordinate activities across Germany and with the rest of Europe, and (2) manage infrastructure and programmatic investments (i.e., central network for fermentation capacities, investments in infrastructure and companies, establishment of biomanufacturing plants) for advancing an economically profitable bioeconomy-based industry in Germany. This organization's concerted effort, in partnership with all other industry sectors, would enable a fast, efficient, and holistic implementation of Industry 4.0, and thus strengthen Germany's technological sovereignty.

Action 3: Optimize the regulation of genetic engineering processes for faster and more efficient approval by the German government.

Genetic engineering processes to engineer microbes, known as genetically modified organisms (GMOs), are essential tools of the deep-tech bioeconomy. GMOs allow us to manufacture products for various industries (e.g., aerospace, automobile, manufacturing, food, and medicine). The current security protocols and safety requirements for handling genetic engineering processes originate from the biomedical industry, which requires costly and complex processes to ensure the safety of the product for human disease interventions. These policies are not economically viable for non-medical applications, where profit margins are much lower. This tremendous cost burden results in less private capital flowing to biomanufacturing companies. Current safety and security requirements are too capital intensive. In situations where GMOs are used as manufacturing platforms, the products made for the automotive or aviation industries, for example, never come into direct contact with customers. It stands to reason that a better distinction is needed to separate the applications of these tools between basic research, the manufacture of medical products, the production of novel foods, and their use as tools for traditional, non-medical industrial production. Accordingly, clearly defined policies

must be introduced with approval and safety concepts corresponding to the applications of the GMOs in the respective industries. It is also critical that a set of uniform guidelines are developed across regions of Germany and the European Union that leave little room for local interpretation, thus creating predictable safety standards and legal assurances for companies using GMOs.

Recommendation 3: The federal government should act decisively and progressively through the coordination of the authorities, industry, research and innovation communities to develop a simplified process for the safe and secure use of GMOs in various industries. This streamlined process will create predictable CAPEX investment requirements and provide legal assurances for the use of GMOs in different industries and start-ups; therefore, making biomanufacturing companies more competitive and attractive to investors.

Action 4: Promoting of synergies between artificial intelligence, automation and synthetic biology for accelerating the development of the bioeconomy.

Successes, such as DeepMind, have shown us that the rapid development of artificial intelligence is a cornerstone technology that will drive the rapid evolution of the bioeconomy. The combination of artificial intelligence and automation, coupled with new biological engineering processes, allows the accelerated development of GMOs and enzymes far beyond the possibilities of nature and even further beyond what we perceive as natural biological development today. The results of these synergies will lead to unimaginable levels of complexity that can be leveraged for the advancement of manufacturing overall. The opportunities enabled by artificial intelligence and automation outweigh the risks; however, it must be ensured that their use as tools is ethical and coincides with our understanding of fundamental safety & security concepts. The emerging synergies from artificial intelligence, automation, and synthetic biology should be coordinated and advanced with targeted investments. SPRIND's investments are working to reach this goal. Above all, it is important to work against global influences that do not necessarily reflect the best intentions of German and European citizens because there is a desire to indoctrinate foreign political will to dominate global market positions at the expense of European society and its values.

Recommendation 4: Create explicit funding lines to support the synergies of artificial intelligence, automation, and synthetic biology to ensure safe and responsible use in the spirit of societal well-being. This funding should be employed through public pre-commercial procurement vehicles in order to transfer pioneering concepts to industry through investments in infrastructure and real-world laboratories.

Action 5: Advocate for reliable, food safety expert-based approval processes for alternative proteins for FoodTech without compromising high safety standards.

The development of protein sources for nutrition is comparatively new. Nevertheless, Germany's FoodTech ecosystem is showing tremendous potential to raise Germany's position as a preferred location for innovation and business in this industry. Alternative protein sources offer economic opportunities for innovative new market players, established companies, and for farmers who want to tap into new sources of income. Alternative protein sources, such as

fermentation and cell-based foods, are maturing from basic research concepts and early proof of concepts to market ready products. German companies and research institutions are among the pioneers in these areas. Germany has all the prerequisites to play a pioneering role in protein diversification and to become an innovation leader in the field of alternative protein sources. This potential requires political support to ensure a reliable path to market, fair and competitive market conditions, and an active promotion of the sector by public actors. Given the current approval procedures, Germany is losing this innovative industry to foreign countries because basic concepts such as public tastings of these novel foods, such as cultured meat and some fermentation-based products, is not allowed.

Recommendation 5: As alternative protein sources affect a large number of policy areas, cooperation should be bundled in a new department in the Federal Ministry of Food and Agriculture (BMEL) that coordinates work on this topic and is the point of contact for stakeholders in the sector. The German government should develop a comprehensive roadmap for the mass market entry of alternative proteins that sets out in a binding manner what measures need to be taken to establish Germany as a global innovation leader in this area by 2030. Most importantly, Germany should allow tastings of alternative protein products, especially fermentation- and cell-based foods, in real laboratories.

The actions proposed here will strengthen Germany's position in the global bioeconomy. They will ensure that German citizens and companies benefit from developments in the field of biomanufacturing and FoodTech. These efforts help to ensure that efforts to address climate change will be achieved and strengthen technological sovereignty. It is critical that we ensure secure access to raw materials for manufacturing industries. The resulting recommendations combine investments, awareness-raising, and coordination measures and are in alignment with the European bioeconomy strategy for 2025.