Feedstock: The building blocks of EU's sustainability and resilience

Feedstock is essential to any industrial activity. The basic concept of (bio)manufacturing implies the transformation of an input into an output or a raw material into a product. Nonetheless, there is a wide range of existing and potential feedstocks, and it is important to explore the topic **in the context of the ongoing EU's Green Transition and the bioeconomy**.

Industry is moving away from long-standing use of fossil fuels as energy or feedstock sources. If in the first case, there are already well positioned renewable energy sources and technologies such as solar or wind energy, the latter is steadily building a new paradigm. Biomanufacturing - the application of biotechnologies at industrial scale - is an important part of this shift as it significantly relies on sustainable feedstock to produce alternative or novel products.

The shift from non-renewable fossil raw materials to sustainable ones brings two-folded advantages. On one hand, it **supports industries' de-fossilisation** by promoting circularity and sustainability. On the other, it **strengthens supply-chains and resilience** by relying on sustainable feedstock and exploring its full potential, as evidenced by the bioeconomy's performance during the COVID-19 pandemic 1.

What is Feedstock for Biomanufacturing?

Feedstock is "a raw material going into a chemical process or plant as input to be converted into a product" 2. Any raw material is by definition a source of carbon, due to its ability to for complex and stable molecules, such as proteins or DNA.

Biomanufacturing relies on microorganisms or plants to carry on the processing of raw materials into final products in bioreactors. In biomanufacturing, the raw material is simultaneously the "food" for the organism to perform the process and the carbon that will be transformed into new molecules. But here is the catch: **what is the carbon source?**

In the context of the bioeconomy, industries are transitioning to use sustainable feedstock such as **bio-based** (e.g., biomass, agricultural waste), **recycled carbon** (e.g., industrial waste) and **captured carbon**. The feedstock sustainability is based on its renewability, circularity, supply-chain optimization and GHG emissions saving criteria. Examples can result from integration into existing economic activities, such as carbon capture from energy intensive industries or creation of new value-chains, such as the use of agricultural or municipal waste that would otherwise have ended in a landfill. References to below 345.

300 megatons

of biodegradable household, household-like, industrial and other **wastes** are generated every year in the EU and **remain largely unexploited.**

2.5 billion tonnes

of CO2-equivlent per year **could be saved** in the EU by 2030 **by replacing fossil fuel-intensive products and processes with bio-based ones.**

40-70%

shortfall in biomass supply vs demand for materials and energy in the EU by 2050.

1 JRC: Bioeconomy and resilience to economic shocks: insights from the COVID-19 pandemic in 2020 (2023). https://publications.jrc.ec.europa.eu/repository/handle/JRC134062

2 European Commission (EC): Feedstock (2024). https://knowledge4policy.ec.europa.eu/glossary-item/feedstock_en

3 EC: Bio-based products and processes (2024). https://research-and-innovation.ec.europa.eu/research-area/environment/bioeconomy/bio-based-products-and-processes_en

4 EC: Bioeconomy Strategy (2018). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018SC0431

5 Material Economics: EU Biomass Use in A Net-Zero Economy (2021). https://materialeconomics.com/node/3

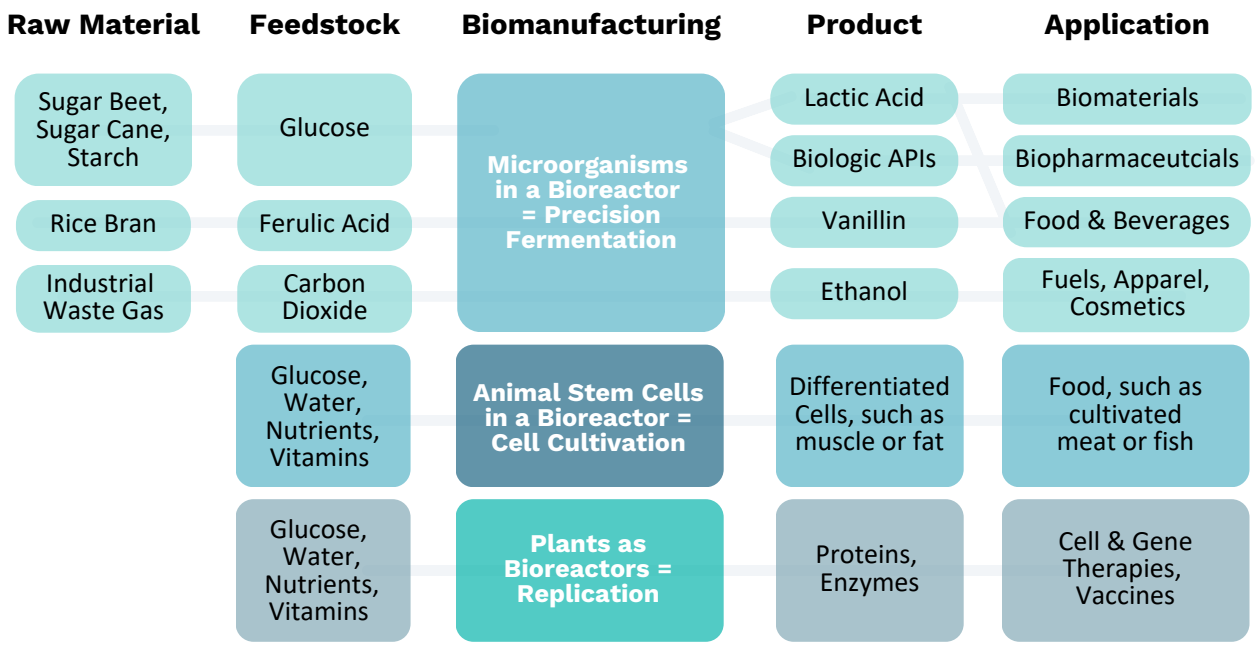

Figure 1. Six examples of existing value-chains which start from sustainable feedstock and lead to the biomanufacturing of ingredients that take part in products from our everyday lives. The examples are not exhaustive, and value-chains may differ significantly. APIs stands for Active Pharmaceutical Ingredients.

Challenges & Opportunities

The shift to biomanufacturing and its **scaling-up capacity is closely linked to the ability to increase the sourcing of sustainable feedstock**, which would secure a higher and constant industrial production. This factor underpins the critical importance of feedstock for biomanufacturing, a pillar of the bioeconomy.

Nonetheless, an increasing demand for sustainable feedstock may raise challenges across supply-chains and markets, such as increasing the overall price of raw materials due to limited availability, growing sectorial debate on priority uses for bio-based feedstock and increasing land use for bio-based feedstock production and potentially reducing biodiversity 6.

However, many challenges also represent opportunities. The access to feedstock can be ramped-up through the application of innovative biotechnologies to process a growing array of raw materials, such as municipal or industrial waste. Moreover, the creation of new value-chains can be fostered through a close collaboration between industry and the primary sector and by optimizing the circularity of industrial processes.

Future Remarks

Sustainable feedstock requires a future-proof and fit-for-purpose governance model and policy framework throughout supply-chains, in order to tackle challenges while exploring technological and industrial opportunities. Policies can play a key role on setting the standards, improving market uptake and creating a level-playing field between bio-based and conventional products 7, strengthening the bioeconomy, and making the EU more resilient and competitive in a new industrial breakthrough.

6 EEA: The European biomass puzzle (2023). https://www.eea.europa.eu/publications/the-european-biomass-puzzle
7 JRC: Biomass production, supply, uses and flows in the European Union (2023). https://publications.jrc.ec.europa.eu/repository/handle/JRC132358