



Latvia University
of Life Sciences
and Technologies

Transformations of economics from sectoral approach to the bioeconomy

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Samarkand, April 27, 2022



Co-funded by the
Erasmus+ Programme
of the European Union



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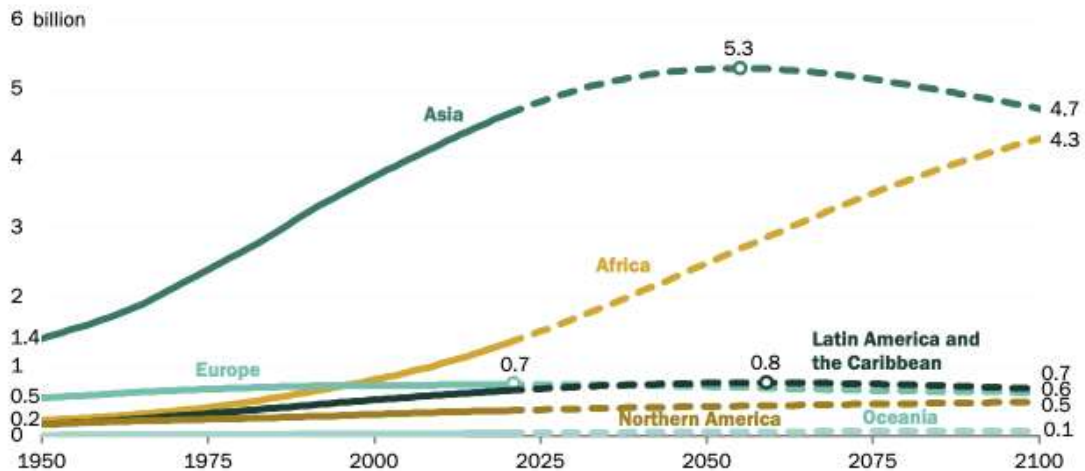


Why Bioeconomy?

Challenges in 21 century – demand for food

Population growth in Africa is projected to remain strong throughout this century

Population by region, in billions



Note: Data labels show projected peak population for each region: Europe (2021), Asia (2055) and Latin America and the Caribbean (2058). Regions follow United Nations definitions and may differ from other Pew Research Center reports.

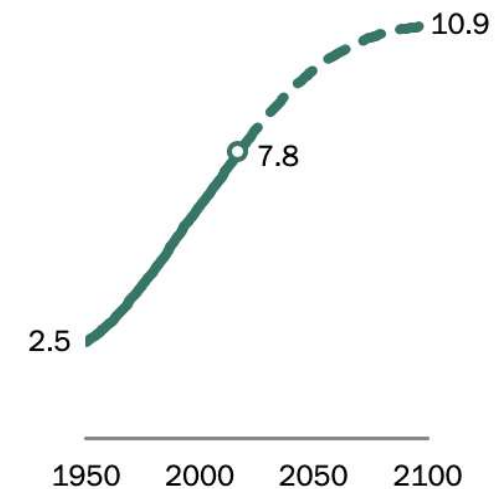
Source: United Nations Department of Economic and Social Affairs, Population Division, "World Population Prospects 2019."

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- ✓ Global population growth from 7.8 bn in 2020 to more than 10.9 billion in 2100 is estimated to lead to a 70% increase in food demand
- ✓ Feeding a growing population
- ✓ Eating habits are changing

World population growth is projected to flatten in coming decades

World population, in billions



Note: Data labels shown for 1950, 2020 and 2100.

Source: United Nations Department of Economic and Social Affairs, Population Division, "World Population Prospects 2019."

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Why Bioeconomy?

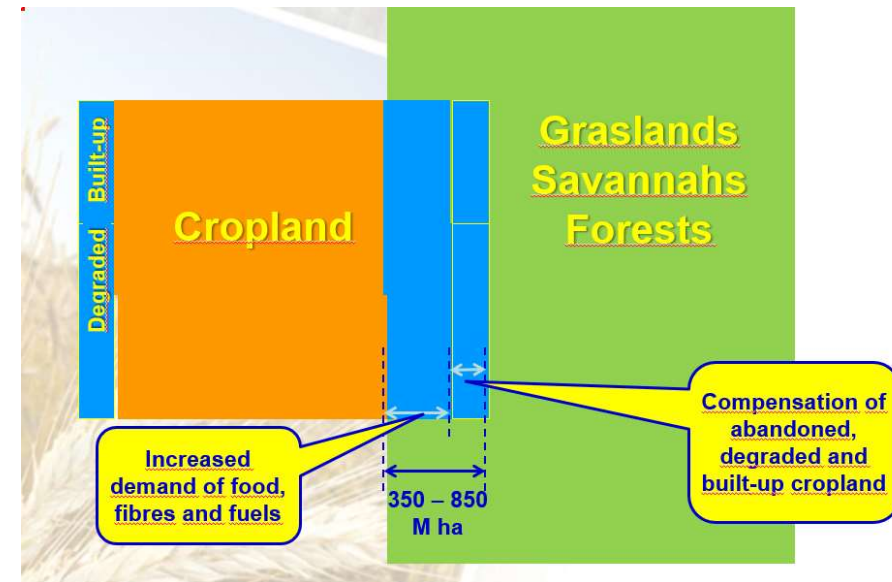
Challenges in 21 century – limitation of natural resources

✓ increasing demand of cropland (2005 – 2050)

It is estimated that by 2050 an extra billion tons of cereals and 200 million tons of livestock products will need to be produced annually (Bruinsma 2009).

However, meat production requires more land than crop production. To produce 1 kg of meat, 3–100 kg of biomass is required, depending on which animals and production systems are used (Smeets et al. 2007).

✓ increasing biomass demand for energy use



Why Bioeconomy?

Challenges in 21 century – limitation of natural resources

Competition in land use:

- ✓ For food
- ✓ For textile
- ✓ For forests
- ✓ For renewable energy
- ✓ For roads, buildings, cities etc.



Why Bioeconomy?

Challenges in 21 century – limitation of natural resources

Water Use in Agriculture



- ✿ 44% of total water extraction in Europe is used for agriculture
- ✿ Water pollution through agriculture has reduced in the last decades, but crop protection runoff and nitrate pollution remain an issue.
- ✿ Research areas remain open:
 - Innovative products in fertilizers and crop protection that protect water sources
 - Drought-resistant breeding

Why Bioeconomy?

Challenges in 21 century – limitation of natural resources

Water consumers (by priority)	Total water requirement	including by source		
		Surface Water	Underground Water	Return Water
2018				
Domestic utilities	5320	2200	3120	0
Industry	1885	855	1030	0
Rural water supply	485	415	70	0
Fisheries	640	460	0	180
Energy	770	770	0	0
Irrigated Agriculture	55100	50000	1100	4000
Total	64200	54700	5320	4180
2030				
Domestic utilities	6200	2450	3750	0
Industry	3500	1580	1920	0
Rural water supply	950	810	140	0
Fisheries	640	460	0	180
Energy	780	780	0	0
Irrigated Agriculture	48000	46800	700	500
Total	60070	52880	6510	680

Actual and prospective water consumption (demand) by sectors in Uzbekistan (million m³ per year)



Source: Irrigation and Drainage in Republic of Uzbekistan, Tashkent 2020

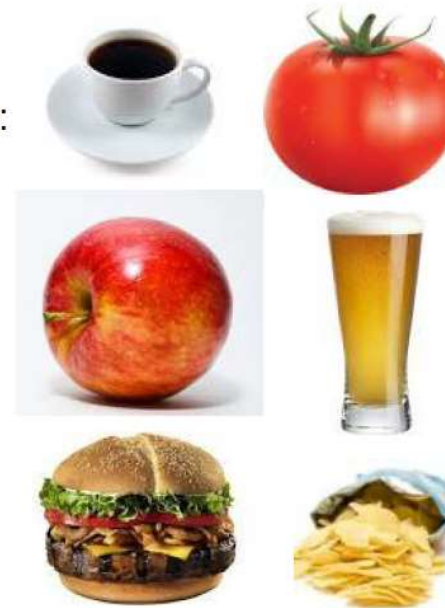
Why Bioeconomy?

Challenges in 21 century – limitation of natural resources

Water Use in Agriculture

Current water footprint for common agricultural products:

- 13 litres of water of a tomato
- 70 litres of water for an apple
- 75 litres of water for a glass of beer
- 120 litres of water for a glass of wine
- 140 litres of water for a cup of coffee
- 184 litres of water for a bag of potato crisps
- 2400 litres of water for a hamburger

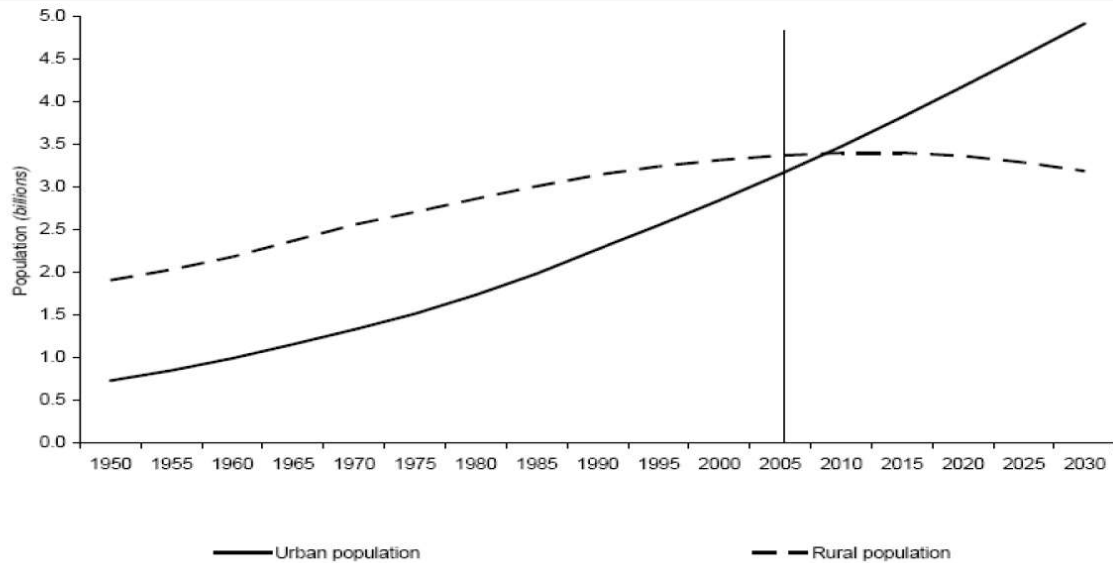


Source: IFAD "Water Facts and Figures" (Online)

Why Bioeconomy?

Challenges in 21 century – urbanisation and demand for space and public goods

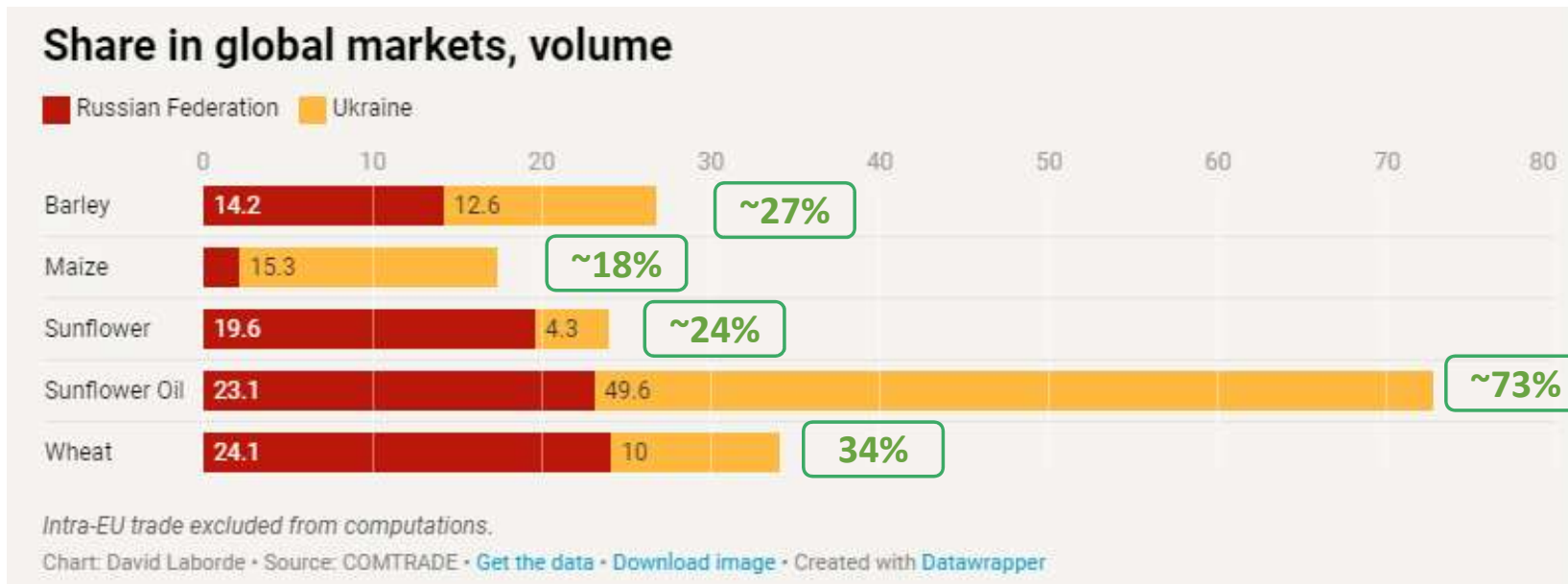
World wide trend of urbanisation



Why Bioeconomy?

Challenges in 21 century – geopolitical events

How will Russia's invasion of Ukraine affect global food security?



Source: <https://www.ifpri.org/blog/how-will-russias-invasion-ukraine-affect-global-food-security>

Why Bioeconomy?

Challenges in 21 century – some conclusions

It is necessary develop innovations in the primary sectors:

- ✓ Innovations will need to generate more resource-use-efficient technologies
- ✓ Innovates the methods for increasing productivity in agriculture, forestry and aquaculture without jeopardizing the Earth's carrying capacity and biodiversity.
- ✓ New resources by building on renewable biomass
- ✓ Transition to a sustainable society, it helps to substitute or reduce the use of limited fossil resources, thereby contributing to climate change mitigation.

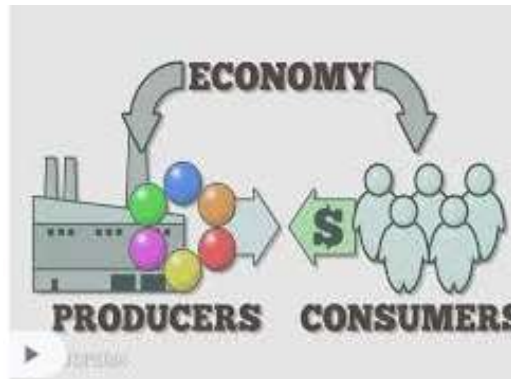
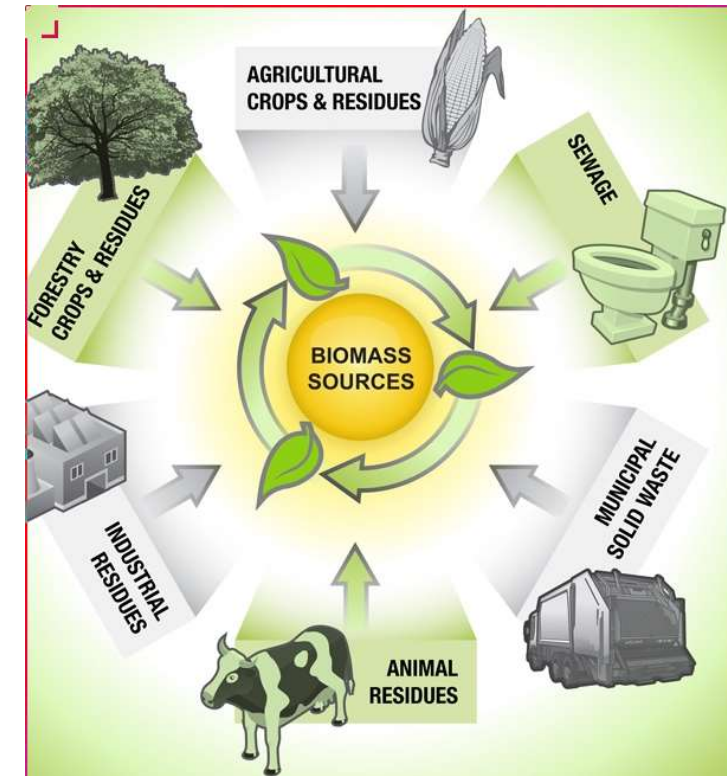


What the bioeconomy means

Bio - Biobased Resources.

Biobased resources are of biological origin and stem from biomass. This biomass can be untreated or may have undergone physical, chemical or biological treatment

Biomass - stems from living or once-living -organisms including plants, trees, algae, marine organisms, microorganisms and animals. Excluded are materials embedded in geological formations and/or fossilized.



Economy - is the large set of inter-related production and consumption activities that aid in determining how scarce resources are allocated. In an economy, the production and consumption of goods and services are used to fulfill the needs of those living and operating within it.

What the bioeconomy means

Bioeconomy definition (history)

- ✓ The use of the term “**bioeconomics**” can, according to Bonaiuti (2014, p. 54), be traced back to Zeman, who used the term in **the late 1960s** to designate an economic order that appropriately **acknowledges the biological bases of almost all economic activities**
- ✓ An essential element in Georgescu-Roegen’s (**1970s**) use of the term bioeconomics was his concern that **unlimited growth would not be compatible with the basic laws of nature** (Bonaiuti 2014, p. 54)
- ✓ According to von Braun (2014, p. 7), the term **was first defined by the two geneticists** Juan Enriquez Cabot and Rodrigo Martinez, who in **1998** in their work “Genomics and the World’s Economy”, discusses that the application of the discoveries of genomics will lead to a **restructuring in the role of companies and industries** “in a way that will change the world’s economy”. The source represents one of the roots of the concept of bioeconomy: **advancements in the biological sciences and in biotechnology**, which have the potential to transform many industrial production processes



What the bioeconomy means

Simple bioeconomy definition

- ✓ Bioeconomy can be seen as a knowledge-based production and use of natural/biological resources, together with biological processes and laws, that allow providing economy goods and services in an environmentally-friendly way (EBCD is an environmental NGO that promotes the sustainable use of natural renewable resources in Europe and worldwide)

There is no single correct definition:

- ✓ Each country or region chooses the most appropriate definition (understanding) of what the bioeconomy means
- ✓ Which definition to choose is determined by the country's development history, achievements and priorities for the future



What the bioeconomy means – some examples

OECD definition (2009)

A bioeconomy can be thought of as a world where biotechnology contributes to a significant share of economic output.

There are three main sectors where biotechnology can be applied: agriculture, health, and industry.

While primary production includes all living natural resources, such as forests, plant crops, livestock animals, insects, fish and other marine resources, the main current uses of biotechnology are for plant and animal breeding and diagnostics.

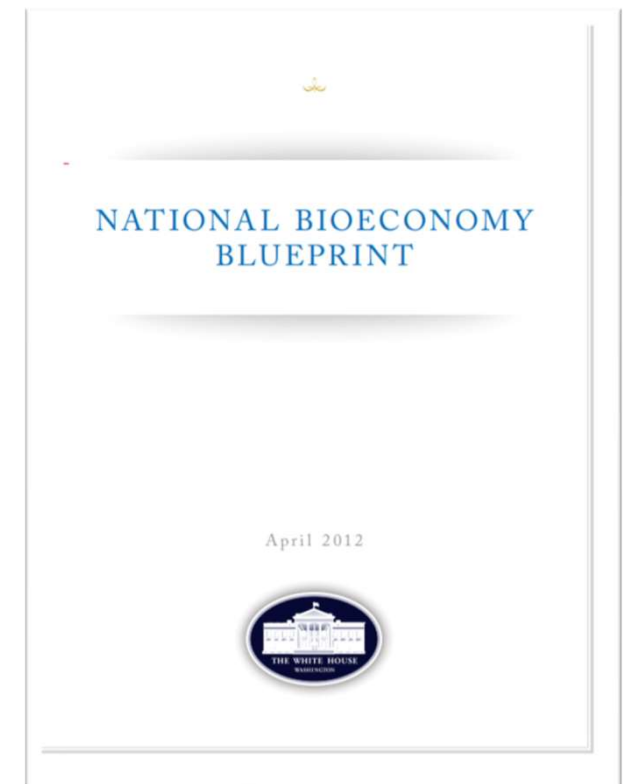
Human health applications include therapeutics, diagnostics, pharmacogenetics to improve prescribing practices, functional foods and nutraceuticals, and some medical devices.

Industrial applications include the use of biotechnological processes to produce chemicals, plastics, and enzymes, environmental applications such as bioremediation to clean up polluted soils, biosensors, methods to reduce the environmental effects or costs of resource extraction, and the production of biofuels.

What the bioeconomy means – some examples

United States of America (USA) (2012)

- ✓ *Bioeconomy is one based on the use of research and innovation in the biological sciences to create economic activity and public benefit.*
- ✓ Birner further adds that *the U.S. bioeconomy is all around us: new drugs and diagnostics for improved human health, higher-yielding food crops, emerging biofuels to reduce dependence on oil, and biobased chemical intermediates, to name just a few.*



*Birner R. (2018) Bioeconomy Concepts. In: Lewandowski I. (eds) Bioeconomy. Springer, Cham. https://doi.org/10.1007/978-3-319-68152-8_3

**https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/national_bioeconomy_blueprint_april_2012.pdf

What the bioeconomy means – some examples

European Union (EU) (2012)

The European Commission defends the importance of bioeconomy *as a way to stimulate the economic growth* of developed economies.

It states *bioeconomy is meant to reduce the dependence on natural resources, transform manufacturing, promote sustainable production of renewable resources from land, fisheries and aquaculture and their conversion into food, feed, fiber, bio-based products, and bio-energy while growing new jobs and industries.*

The bioeconomy or bio-based economy ...encompasses the production of renewable resources and their conversions into food, feed, bio-based products and bio-energy.

It includes **agriculture, forestry, fisheries, food and pulp and paper production**, as well as **parts of chemical, biotechnological and energy industries.**



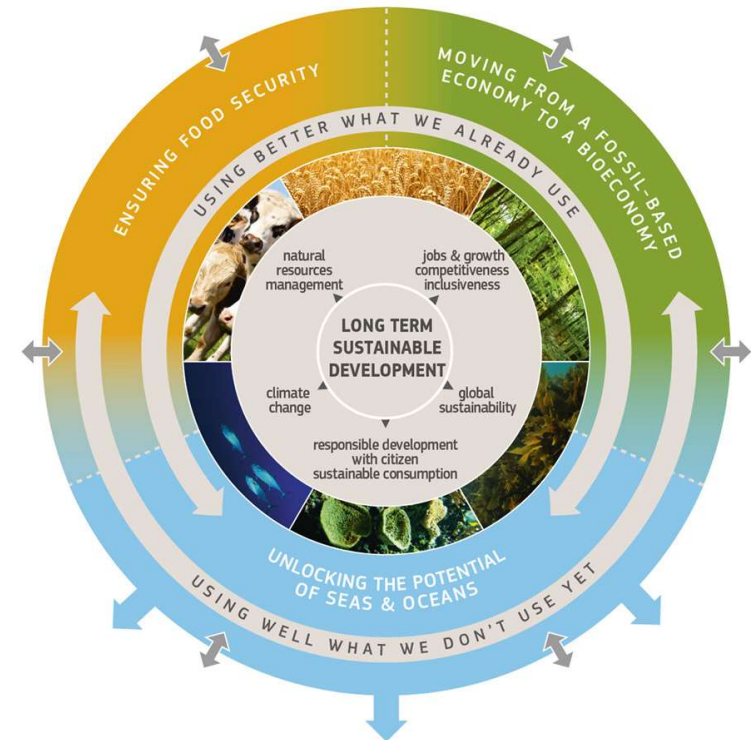
Source: European Bioeconomy Strategy, EC, 2012

What the bioeconomy means – some examples

European Union (EU) (2018)

Sustainable & Circular: Bioeconomy the European way

- ✓ The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles
- ✓ It includes and interlinks: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services.
- ✓ To be successful, the European bioeconomy needs to have sustainability and circularity at its heart. This will drive the renewal of our industries, the modernisation of our primary production systems, the protection of the environment and will enhance biodiversity



What the bioeconomy means – some examples

Global Bioeconomy summit

In 2015:

- ✓ Bioeconomy is defined in different ways around the world
- ✓ We have **not aimed for a unified definition**
- ✓ but note that an understanding of 'bioeconomy as **the knowledge-based production and utilization of biological resources, innovative biological processes and principles to sustainably provide goods and services across all economic sectors**'

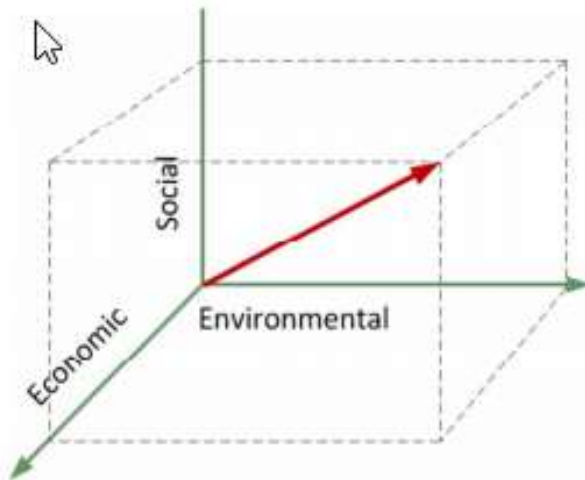
In 2018:

- ✓ Bioeconomy is **the production, utilization and conservation of biological resources**, including related knowledge, science, technology and innovation, to provide information, products, processes and services across all economic sectors aiming towards a sustainable economy'

In 2020:

- ✓ The bioeconomy encompasses **the traditional bioeconomy sectors**, such as agriculture, forestry, fisheries and aquaculture, as well as **related processing and service industries**, such as food, paper, textiles, building and construction, chemistry, and bio-pharma. **Key enabling and converging technologies**, such as bio-, nano- and information technologies, are vitally important to **the knowledge-based bioeconomy which uses biobased processes and principles in engineering and across industrial applications.**

Bioeconomy – sustainability*



A bioeconomy can be considered sustainable if:

- ✓ it is ensured that resources are spent reasonably and in a strategic manner,
- ✓ that they are used in the most efficient way by producing as many high-value products as possible,
- ✓ It is able to improve the supply security of the country in terms of major resources, such as food, fuels and materials, as well as to create an opportunity for a new knowledge-intensive industry.

In order to ensure that the approach to implementing bio-economic solutions is truly sustainable, it is necessary, instead of focusing only on the technological part, to take a broader look and consider the interconnections between industries and the whole life cycles of bio-based goods produced.

* Sustainability defined by UN: «development that meets the needs of the present without compromising the ability of future generations to meet their own needs»

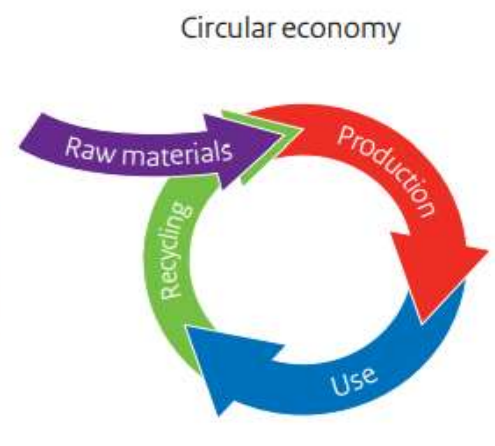
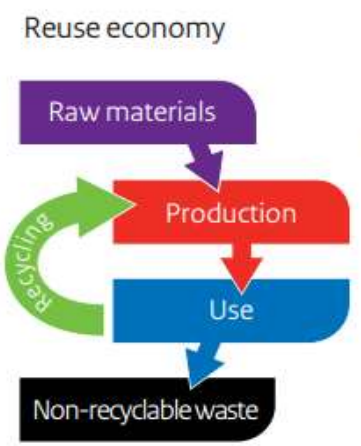
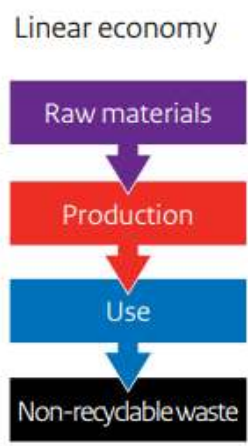


Sustainable Bioeconomy – key principles in EU

- ✓ **Food first** –improve availability, access and utilization of nutritious and healthy food
- ✓ **Sustainable yields** –the amount harvested should not be larger than regrowth
- ✓ **Cascading approach** –biomass is first used for the option with the highest value; then for the second highest, and so on...
- ✓ **Circularity** –any matter can be reused and recycled (waste reduction)

Bioeconomy – circularity

From a linear to a circular economy



From a linear to a circular economy

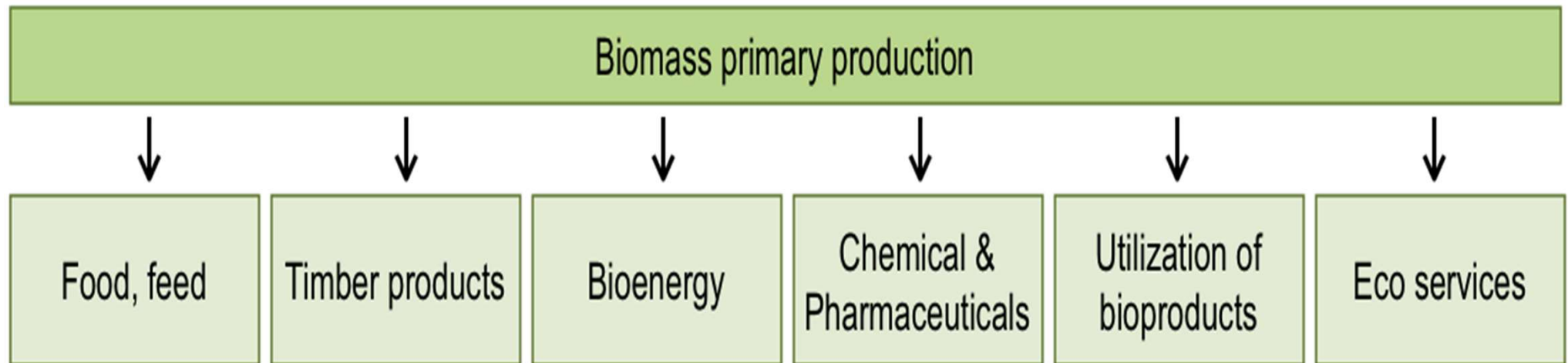
- In a linear economy, raw materials are extracted from the earth, used and discarded: "take-make-waste". At best, this economy leads to the relative decoupling of economic growth from the use of natural resources.
- In the reuse economy, many non-recyclable materials are used

again (cascading, repair/maintenance, reuse, remanufacturing, recycling). At best, this reuse economy leads in part to an absolute decoupling of economic growth from the use of natural resources and from emissions: the demand for natural resources and the emissions decrease as the economy grows.

- The ideal picture is a circular economy in which raw materials are never depleted. This economy can be structured so that there is a positive coupling between economic growth and the growth of natural resources ("negative" emissions / positive footprints). In a circular economy, value chains will be organised differently.

Global Bioeconomy Summit (2015): systemic approaches across sectors (i.e. nexus thinking), particularly innovation policy measures that aim at optimizing Bioeconomy value networks

Bioeconomy sectors (conceptually)



Bioeconomy sectors (conceptually)

Traditional sectors

Primary production of biomass

- Crop and animal production, hunting (A01)
- Fishing and aquaculture (A03)
- Forestry and logging (A02)

Biomass processing

(highly biomass dependent sectors)

- Manufacture of food, beverages, tobacco (C10, C11, C12)
- Manufacture of leather and related products (C15)
- Manufacture of wood, straw and plaiting products, paper (C16, C17)
- Manufacture of furniture (C31)

Biomass processing

(biomass competing with other raw materials)

- Manufacture of textiles, wearing apparel (C13, C14)
- Manufacture of chemicals and chemical products (C20)
- Manufacture of pharmaceutical products and preparations (C21)
- Electricity, gas, steam and air-conditioning supply (D)

Utilization of bioproducts and water management

- Water collection, treatment and supply (E36)
- Sewerage (E37)
- Waste management and materials recovery (E38)
- Remediation and other waste management services (E39)

Bioresource use in services

- Food service activities (I56)
- Accommodation (I55)
- Construction (F)
- [Eco-services](#)

Bioeconomy sectors according to NACE classification (Latvia)



Benefits of the Bioeconomy

Some of the main advantages of the bioeconomy to be:

- ✓ It is an open and innovative approach that involves the collaboration of different stakeholders, fostering dialogue and cooperation at a global scale;
- ✓ Mitigation and adaption to climate change, reducing greenhouse gas (GHG) emissions;
- ✓ Decreasing the dependence on fossil resources by helping to restructure energy and food production is another advantage of bioeconomy;
- ✓ Bioeconomy is connected to wiser management of natural resources;
- ✓ It promotes research across disciplines and borders;
- ✓ Has the potential to create employment in both urban and rural settings.
- ✓ Improved food security
- ✓ Creation of jobs and maintaining European competitiveness
- ✓ Cross-sectoral interdisciplinary approach to research and innovation



Thank you!