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4. Strengthening the green transition

The green transition requires a holistic approach that integrates multiple strategic cross-cutting areas to achieve a sustainable, regenerative, and resilient economy that prioritizes the well-being of both people and the planet, restoring natural resources and preserving the environment. To succeed, a holistic approach is required, one that harnesses the potential of innovation, technology, and sustainable practices to drive growth, create jobs, and improve well-being. This chapter examines the essential elements of a successful green transition, including the creation of a sustainable and regenerative environment, the leveraging of R&I to boost eco-innovation, and the integration of digital solutions to support the green transition. By exploring these cross-cutting themes, we can identify the most effective strategies for strengthening the EU's green transition and unlock its full potential, ensuring that it is both sustainable and competitive.

* 1. A sustainable and regenerative environment

Addressing the multiple ecological, social and economic crisis requires moving beyond resources conservation towards a **regenerative environment** that is capable to restore and revitalise natural and human ecosystems, and increase their resilience. Such a system can provide numerous benefits for climate change mitigation, resource efficiency, biodiversity conservation, human health and well-being, as well as economic development. Creating sustainable and regenerative economy and environment requires a multi-faceted approach that involves various sectors. As key examples, the bioeconomy, and sustainable use of biomass, the blue economy, nature-based solutions, biotechnologies, and agroecosystems regeneration are interconnected domains that must be linked to drive this transition as they hold significant potential for sustainable development and regenerative growth.

The **bioeconomy** lies at the heart of the green transition, which involves the production, processing, and use of biological resources to create products, services, and energy. A key component of the bioeconomy is the **sustainable use of biomass**, which ensures that biological resources are harvested and utilized in a way that maintains ecosystem services, biodiversity, and soil health.

**Nature-based solutions (NBS)** are essential for achieving the green transition, as they involve working with and enhancing natural ecosystems to address societal challenges, such as climate change, biodiversity loss, and human well-being. NBS can be applied in various contexts, including agroecosystems, forests, wetlands, and urban areas, to promote ecosystem services, biodiversity, and ecosystem resilience. By integrating NBS with the bioeconomy and blue economy, we can develop holistic approaches that support the regeneration and restoration of degraded ecosystems, while promoting sustainable land use and resource management.

**Agroecosystems regeneration and resilience** are essential for achieving the green transition, as they involve the restoration and regeneration of degraded agricultural landscapes to promote ecosystem services, biodiversity, and soil health. Agroecosystems regeneration can be achieved through the adoption of sustainable agricultural practices, such as agroforestry, permaculture, and regenerative agriculture, which prioritize soil conservation, efficient water use, and integrated pest management.

**Biotechnologies** are a critical enabler of the green transition, as they offer innovative solutions for sustainable production, processing, and use of biological resources. Biotechnologies can be applied in various sectors, including agriculture, forestry, and marine industries, to improve crop yields, disease resistance, and water efficiency, while reducing the environmental impacts of production systems.

Finally, the **blue economy** plays a vital role in the green transition, as it focuses on the sustainable use of ocean resources to promote economic growth, social inclusion, and environmental protection. By integrating the blue economy with the bioeconomy, we can develop innovative solutions for sustainable aquaculture, marine biotechnology, and coastal ecosystem restoration.

All the above cross-cutting domains are essential to drive the green transition: by integrating these areas, we can develop innovative solutions that promote sustainable development, mitigate climate change, and support the regeneration and restoration of degraded ecosystems. This holistic approach will be essential for achieving a sustainable, regenerative, and resilient future aligned with human well-being and the health of the planet.

4.1.1 Sustainable and circular bioeconomy

A **sustainable and circular bioeconomy** is essential for a green and fair transition in Europe. It is a key enabler to address the interconnected environmental, societal, and economic challenges. Additionally, the bioeconomy can ensure both greater resilience and strategic autonomy in securing sustainable food, energy, and materials. By reducing dependency on fossil-based and non-renewable resources, the bioeconomy can help tackle the intertwined crises of climate change, pollution, and biodiversity loss.

Bioeconomy policies take a holistic and cross-sectoral perspective to improve policy coherence and identify and resolve trade-offs across the entire bio-based value chain, embracing in a system perspective from ecosystem services to end-of-life of bio-based products and including sustainable management of natural resources, land and biomass supply and demand, products manufacturing, food, energy production, cascading and circular use of resources. This makes it possible to identify win-win solutions that generate economic gains, preserve the environment, and increase resilience and capacity for recovery.

In essence, a sustainable, circular bioeconomy offers opportunities to support the EU’s strategic priorities by:

* **Reducing reliance on fossil fuels and advancing a circular economy** through the use of biomass, biomass residues, side streams, and circular product designs.
* **Promoting regenerative practices in agriculture, forestry, and aquaculture** to diversify income sources and improve sustainability.
* **Strengthening rural and coastal economies**, particularly in Central and Eastern Europe, rich in biological resources.

At its core, the bioeconomy depends on the **competitiveness and sustainability** of primary sectors such as sustainable agriculture, forestry, and water and waste management. By aligning scientific and technical innovations, such as alternative proteins, biomanufacturing, and sustainable construction, with environmental and climate policy goals, the bioeconomy can drive prosperity, competitiveness, and environmental restoration while supporting net-zero emissions, ecosystem restoration, and resilience.

**Biomass** offers a viable alternative to fossil-based materials; however, while being a renewable raw material, biomass is limited by the capacity of ecosystems to regenerate it while preserving or restoring healthy conditions. These conditions are essential for maintaining biodiversity and providing critical ecosystem services. Climate change exacerbates these challenges, increasing extreme weather events threaten the availability of biomass from agriculture, forestry, and aquatic sources. The five primary drivers of **biodiversity loss**—land and sea use changes, overexploitation, climate change, pollution, and invasive species—continue to erode natural ecosystems. Projections indicate an increasing **biomass supply gap** towards 2050, as sustainable biomass supply struggles to meet demand for materials and energy. Addressing this requires a holistic, cross-sectoral approach and coordinated policies to manage competition for sustainable biomass resources and ensure the availability of feedstock.

The bioeconomy offers opportunities for greater benefits by leveraging numerous **technologies and innovations** that enhance the production, processing, and use of biomass with reduced environmental impact. **Biotechnologies, social innovations, and nature-based solutions** contribute not only to a circular economy but also to creating new markets and adding long-term value. These advancements are fundamental in transitioning toward a sustainable bioeconomy that benefits both people and the planet.

As global demand for bio-based products grows, the EU’s bioeconomy holds the potential to **boost competitiveness and unlock significant growth opportunities** through sustainable and innovative production methods. While still heavily reliant on research, increased investment in the bioeconomy can enhance biomass production, position Europe as a leader in green technologies and high-value bio-based manufacturing, and support the development of competitive, resilient value chains.

Assessing the **environmental impacts** that bioeconomy solutions can play is crucial, and particularly regarding the potential of bio-based products to reduce environmental impact in comparison to their conventional counterparts. It is of particular interest to understand the potential trade-offs and shifting of impacts among different products, the various life cycle stages (e.g., reducing impacts of raw materials but requiring additional manufacturing steps) or environmental impacts (e.g., reducing climate change while increasing land use impacts). In this respect, to monitor the environmental implications of bio-based products consumed in Europe the Joint Research Centre (JRC) proposed a first life cycle assessment (LCA)-based ‘**Bioeconomy Footprint**’ model (Sinkko et al. 2023). Available results showed an increase (+23%) of the EU Bioeconomy Footprint between 2010 and 2020, associated with an increased consumption of bio-based products as well as of population (+1–2 %). Among bio-based sectors, food consumption showed the highest share of the total impacts (around 80%), followed by bioenergy (around 10%).

An integrated and adaptive **governance framework** for the EU Bioeconomy is essential. **Coordination and cooperation among MS** are important to ensure a coherent EU bioeconomy policy framework and to share knowledge advances in a fast-changing policy area.

Furthermore **coherence across bioeconomy objectives and policies** is key to properly manage trade-offs and ensure sustainability of the bioeconomy.

In April 2023, the Council of the European Union provided recommendations for the European Commission to further integrate bioeconomy into all policies, to facilitate knowledge transfer towards rural areas and finally to update the EU Bioeconomy Strategy and associated Action Plan**. The Commission will review the bioeconomy strategy in 2025**, also reinforcing the bioeconomy's industrial dimension and its links to biotechnology and biomanufacturing to contribute to a stronger EU economy.

The Knowledge Centre for Bioeconomy (KCB)[[1]](#footnote-2) managed by the JRC keeps developing and maintaining the key knowledge on bioeconomy to support EU policymakers. As part of the KCB knowledge base, the EU Bioeconomy Monitoring System (EU-BMS)[[2]](#footnote-3) was developed by the JRC to track the progress towards the bioeconomy strategy objectives. The latest trends in the EU bioeconomy observed with the EU-BMS are illustrated in a recent report (European Commission, Korosuo et al. 2024).

In the next sections further and specific insight is provided on some **key topics which are instrumental** for the bioeconomy or are strictly related to it, namely: biomass, nature-based solutions, agroecosystems and biotechnologies. An overview on blue economy concludes this section.

4.1.2 Sustainable use of Biomass

Biomass use is increasingly driven by demand for bioenergy and material, as the uses of biomass for food and feed remains stable. While recycling of biomass has increased in the past decade, so has sourcing of virgin fibres, resulting in an increasing impact on biomass-producing system (Mubareka et al., 2023). Ecosystem conditions are deteriorating all over Europe. Especially the pressure on forests is high and undermines good forest condition (Maes et al., 2021). Hence, strategic management of biomass is essential for a sustainable bioeconomy.

Biomass is central for several EGD initiatives. The analysis of EGD policy documents with linkages to biomass[[3]](#footnote-4), revealed where biomass is more relevant using the method of qualitative content analysis2. (Footnote: [1] Qualitative content analysis is a methodological approach used to analyse textual data through systematic coding and interpretation. It involves the identification of recurring themes, concepts, and patterns within a body of text, thereby providing insights into the underlying meanings and intentions conveyed (Hsieh and Shannon 2005))

Table 1 summarises the expectations of biomass towards EGD thematic areas through specific policies. A numerical value was assigned based on the strength of reference to biomass3: (Footnote: A number is assigned according to the following criteria: 3 for the main thematic area the biomass in the policy contributes to and which is prevalent in the policy text, 2 for moderate expectation, i.e. the biomass is mentioned in relation to the EGD, but it is not prominent in the text and 1 indicates low or indirect expectations. biomass is mentioned without explicit mention of the EGD, for example the Farm to Fork strategy advocates the use of less pesticides in agriculture, which has an indirect impact on *Zero Pollution* 0 when there is no mention of biomass.)

* ‘‘3’ denotes strong expectations towards biomass in achieving the thematic area
* ‘2’ denotes moderate expectations
* ‘1’ indicates low or indirect expectations
* ‘0’ designates an absence of a reference to biomass in the policy in relation to the thematic area.

*Table 1. Heatmap of expectations towards biomass in EGD: 3 = strong expectation, 2 = medium expectation, 1 = low or indirect expectation, 0 = no expectation.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **EGD:**  **1**. Climate ambition | **EGD:**  **2**. Clean, affordable and secure energy | **EGD:**  **3** Industral strategy for a clean and circular economy | **EGD:**  **4.** Sustainable and Smart Mobility | **EGD:**  **5.** Building and renovating  in an energy  and resource  efficient way | **EGD:**  **6.** Greening  the common agriculture F2F | **EGD:**  **7.** Preserving  and restoring ecosystems and biodiversity | **EGD:**  **8.** Towards  zero pollution ambition for  a toxic free environment |
| Forest Strategy | 3 | 2 | 2 | 0 | 2 | 2 | 2 | 0 |
| Farm to Fork | 1 | 0 | 1 | 0 | 0 | 3 | 2 | 1 |
| Soil Monitoring Law | 2 | 0 | 0 | 0 | 0 | 2 | 3 | 1 |
| Biodiversity Strategy | 2 | 0 | 1 | 0 | 0 | 2 | 3 | 0 |
| Nature Restoration Law | 2 | 0 | 0 | 0 | 0 | 2 | 3 | 0 |
| Towards a strong and sustainable Algae sector | 2 | 1 | 1 | 0 | 0 | 3 | 2 | 0 |
| CAP New Strategic plans | 1 | 1 | 0 | 0 | 0 | 3 | 1 | 1 |
| Progress Report of Bioeconomy Strategy 2022 | 3 | 0 | 1 | 0 | 0 | 2 | 1 | 0 |
| RED II/III | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| EU Soil Strategy for 2030 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | 0 |
| Framework for Carbon Removals | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| LULUCF | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| REPowerEU | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Adaption to Climate Change | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Circular Economy Action Plan | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 |
| Transition pathways for a chemical industry | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 2 |
| Conservation of fisheries resources and protection of marine ecosystems | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 |
| Climate Law | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

*Source: JRC, own elaboration, 2024*

Out of 18 policy documents analysed, 13 have moderate to high expectations towards biomass with respect to achieving the objectives of TA1 (climate ambition), 10 for achieving the objectives of TA6 (ecosystems and biodiversity), 8 for TA5 (food system), 3 for TA2 (energy) and 3 for TA3 (circular economy). It is worth noting that the reason why biomass matters in these policies can differ: to function as a carbon sink (regulating service); to provide renewable energy (provisional service); to provide food (provisional service); to provide material (provisional service).

**Figure 1.** The two broad expectationss in EU policies regarding biomass



Source: JRC, own elaboration, 2024.

EGD biomass-related policies present two approaches: protection and biomass use. Protection policies focus on conserving and restoring primary production systems like forests and agricultural land, crucial for water regulation, carbon sequestration, and biodiversity. Biomass use policies aim to utilize biomass for economic purposes, such as energy, materials, and food, while addressing environmental concerns, embodying the “win-win” policy discourse. Examples include the RED III and REPowerEU Plan, which promote biomass use to reduce fossil fuel dependence and support climate goals, and the Circular Economy Action Plan, which encourages biomass for material production and waste reduction. Other policies like the EU Algae Initiative and Farm to Fork strategy emphasize the dual benefits of biomass for economic growth and environmental sustainability. There are overlaps between the policies, in the sense that some protection side policies advocate the extraction of biomass and vice versa. Challenges such as biomass availability and competition with other sectors are noted, particularly in the Transition pathways for a chemical industry transition.

While biomass emerges as a central component contributing to various thematic areas of the EGD, including climate ambition, biodiversity preservation, greening the agriculture sector, and fostering circular economy, yet there is a notable **absence of quantification of biomass uses** for all sectors, but especially so for woody biomass use sectors.Not only does this hamper an effort to assess whether the policies are feasible in their ambition within a wider policy context, it also makes policy-making, in particular at the implementation stage, more difficult. For instance, wood for bioenergy is now reported under the Regulation EU 2018/1999 on the Governance of the Energy Union and Climate Action in Eurostat, but there are many issues with this dataset (see a discussion in section 3.2.3 of EC JRC et al., 2025). . While bioeconomy provides the essential framework to ensure policy coherence regarding biomass use, if the current uses are not known, there is little to discuss. It is essential to recognize that while biomass holds promise as a sustainable resource, its finite availability necessitates careful consideration of its prioritization and utilization for the potential trade-offs and tensions associated with biomass use, particularly concerning environmental implications and competition for use.

4.1.3 Nature-based solutions

**Nature-based solutions are so called ‘win-win’ strategies** that are based on natural processes to partially address the societal challenges described in the EGD such as unsustainable food systems and inequalities, while at the same time having benefits for environmental challenges, namely climate change and biodiversity loss. Examples of win-win strategies (or co-beneficial strategies) are enhancement of urban green networks, multifunctional forestry and enhancement of ecosystems, such as the restoration of wetlands.

In the European Green Deal, nature-based solutions are a part of the Climate Action for their mitigation potential, but they are also a part of the adaptation strategy to climate change, in that green infrastructure and management of natural areas can reduce climate risk. Specifically in the Sustainable Carbon Cycles communication, nature-based solutions are expected to play a role in carbon removal (so-called “**carbon farming**”), as well as in ecosystem restoration. The enhancement of the CO2 removals can be achieved by proactively managing terrestrial ecosystems to enhance carbon storage or minimize greenhouse gas emissions (Griscom et al., 2017). These are the so-called Nature-based Climate Solutions **(NbCS)** - see text box

The concept of ecosystem restoration also features in the EU Biodiversity Strategy and the EU Forest Strategy. Apart from land, with notable examples in agroecology and forestry, nature-based solutions are encouraged for the restoration of coastal and marine environments as well.

**Synergies** between ecosystem and biodiversity conservation and climate change adaptation **can be** **leveraged.** A few examples are listed in what follows:

1. **Ecosystem based adaptation** to climate change is more cost-effective than engineered measures.
2. **Nature-based solutions** simultaneously provide mitigation and adaptation to climate change while providing other benefits for biodiversity, agriculture and urban planning. Insufficient engagement with stakeholder for the scope, design of objectives and advantages of PAs [18](Frontiers) (UNEP - UN Environment Programme).
3. **Shift to more sustainable diets and agricultural practices** may clear suitable areas for reforestation with benefits for biodiversity and climate.
4. Identify and protect natural "**sanctuaries**" for biodiversity restoration.
5. **Reforestation** of formerly forested land can create a large carbon sink in its early decades and, in the longer term, store considerable amounts of carbon.
6. Restoring **natural ecosystem functions** (e.g. hydrology and carbon dynamics)
7. **Catchment** **restoration** protects simultaneously from floods, droughts, while contributing to carbon storage and sequestration.
8. **Reforestation** couples carbon sequestration with other adaptation benefits, notably floodwater impedance.
9. Restoring **grasslands** ecosystems and savannahs (e.g. removing trees and reinstating natural fire regimes) increases resilience and supports soil carbon storage.

Nature based climate solutions

Nature-based Climate Solutions (NbCS) have a large potential to increase CO2 removals by proper management of terrestrial ecosystems to enhance carbon storage and minimize greenhouse gas emissions. NbCS such as conserving and restoring carbon-rich forests and wetlands, optimizing the use of land for agriculture, forestry, and grassland management can offer not only environmental and climate benefits, but also economic incentives, and potential diversification of income for farmers and land managers. The carbon sequestration capacity of ecosystems largely depends on how they are managed. Examples of management practices and NbCS to enhance carbon sinks and bring biodiversity benefits are:

* **Forest Management**: Enhancing carbon sequestration through reforestation, silvicultural practices (including diversifying tree species, extending the rotation period between harvest cycles, reducing harvest intensity etc.) and agroforestry, while maintaining biodiversity and ecosystem services;
* **Agricultural Soil Management**: Increasing soil organic carbon (SOC) through sustainable practices such as manure applications, conservation agriculture, and organic amendments, the use of cover crops, nitrogen fertilization, shifting annual cropland to other uses (Peterson et al., 2025);
* **Peatland Rewetting**: Restoring carbon sequestration and reducing GHG emissions by rewetting drained peatlands (Buma et al., 202x);
* **Grassland Management**: Converting cropland to grassland or maintaining continuous grasslands to increase SOC;

**Co-benefits and Trade-offs:**

NbCS can yield co-benefits such as biodiversity enhancement and biophysical climate adaptation impacts, but may also involve negative trade-offs, including biophysical impacts, nutrient cycle changes, and methane emissions. Afforestation, for example, can increase precipitation (Caporaso et al., 2024), but may also lead to negative effects on water availability (Hoek van Dijke et al., 2022). The following key considerations should therefore be carefully taken into account:

* **Water Availability**: Afforestation is only sustainable in areas with sufficient water availability, and in regions where this is not jeopardized by climate change.
* **Leakage**: Harvest intensity reduction is one of the NbCS with higher potential for carbon sequestration enhancement. However, reduced timber harvesting intensity can lead to leakage, such as increased wood import from other regions (I. Kallio and Solberg, 2018).
* **Afforestation of drained peatlands** might not be a vible option due to trade-offs between carbon sequestration of the trees at the cost of enhanced soil respiration, leading to likely negative feedback of soil emissions (Jurasinski et al., 2024).
* **Regional Context**: NbCS must be tailored to regional contexts, taking into account local conditions, species niches, and potential trade-offs).

Overall, NbCS offer a promising approach to climate mitigation, but require careful consideration of co-benefits, trade-offs, and regional contexts to ensure effective and sustainable implementation

4.1.4 Towards agroecosystems regeneration and resilience

Industrial agriculture is dominated by anthropic inputs, typically obtained by extractive (non-circular) processes and aimed at a commodity-production model. Agroecological and regenerative approaches, instead, aim at maximising the efficiency (circularity, sustainability) of natural inputs in terms of resource use (water, soil, biodiversity) and favouring the regeneration of ecosystems functions and services. Healthy ecosystems, managed towards their continuous regeneration, can in turn provide a multitude of services to farmers and the human community, from ecological inputs (such as clean water, fertile soil and pollination), to natural protection against flooding and extreme weather.

For decades, mainstream agriculture has been extractive without directly accounting for the depletion of the natural capital. Consequently, agriculture has become one of the main drivers of environmental degradation, biodiversity loss and climate change. For example, the agricultural sector in Europe is responsible for an estimated 11% of total GHG emissions, most of which (66% per cent) is due to livestock production through enteric fermentation (49%) and manure management[[4]](#footnote-5).

Two EU guiding strategies (Biodiversity Strategy for 2030 and Farm to Fork), include targets aiming to reduce the impacts of the food system on the environment, fostering the transition to healthier, more sustainable and fairer food systems. Targets include significant reductions in the use of mineral fertilisers and pesticides, as well as an increased uptake of more environmentally sustainable farming practices and farm management systems (see Chapter 3).

The challenge is to decrease environmental impacts while guaranteeing food security and social standards, in a supportive economic environment that aligns with broader sustainability goals. Such shift involves acting on different parts of the food system, by keeping a system approach (see Chapter 3). Changing human diets (consuming less animal products and more plant-based proteins) coupled to reducing food waste are pre-conditions for shifting production towards an increased environmental sustainability to avoid exceeding the planetary boundaries, while enhancing the regenerative capacity of natural capital (Muller at al. 2017, Poux and Aubert, 2018, Röös et al. 2020).

In this frame, ecological approaches to farming such as agroecology are possible solutions for food systems transformation, enhancing food security, nutrition, health and wellbeing, livelihoods, soil health, biodiversity, sustainability, and ecosystem services (Bezner Kerr et al., 2023; Ceddia et al., 2024).

Building on the key principles of agroecology (HLPE, 2019), five key farm management principles can be identified:

* Build-up and maintenance of soil health;
* Decrease of total input intensity;
* Increased reliance on self-produced inputs;
* Avoidance of most harmful inputs; and
* Presence of semi-natural elements on farm.

Benefits deriving from an enhanced supply of ecosystem services are multifold. Supporting agricultural production, protecting agricultural fields against extreme events, supporting ancillary activities, such as those based on food and wine tourism are benefits quantifiable in economic terms. The value of seven ecosystem services[[5]](#footnote-6) accounts for the EU-27 in 2018 is estimated at 56.7 million euro per year for cropland and grassland (Croitorov et al., 2024[[6]](#footnote-7), La Notte et al., 2021). In addition, the Gross Ecosystem Product (GEP), which aggregates the contribution of ecosystem services to the economy, shows that in a macroeconomic scenario driven by changes in consumer preferences towards a greater consumption of plant-based protein, the shift in the EU agricultural sector generates an increase of 1.5% (equivalent to approximately 2.3 billion euros) (Rokicki et al., 2024).

The provision of these ecosystem services serves to mitigate the economic exposure of the agricultural sector, thereby reducing the potential for nature-related financial risks and ultimately increase the resilience of the sector. To illustrate, the decline in pollinators, the intensification of soil erosion and the occurrence of flooding events have the effect of increasing the operating costs of agricultural businesses and reducing their profitability. For banks that extend credit to these agricultural enterprises, lower profitability may result in elevated default rates, which are indicative of credit risk. Also, the insurance sector may be under pressure to cover claims due to an increased exposure to hazards, which relates to liquidity risk. Furthermore, a reduction in production levels will result in a decline in demand for activities associated with the transformation of primary production. This will have an impact on the value chain, which is linked to credit and market risks. In countries where the economy is heavily reliant on the agricultural sector, a reduction in exports could have a detrimental effect on revenue, potentially leading to an increase in sovereign debt risk.

4.1.5 Biotechnologies

Biotechnologies can be applied and have an impact on several fields: from human and animal health (Chekol & Gebreyohannes 2018) to food and feed (Giraffa et al. 2010); from biodiversity preservation (Cruz-Cruz et al. 2013) to the numerous uses marine biotechnologies can have (Rasmussen & Morrissey 2007). According to the EPO[[7]](#footnote-8), biotechnologies can be classified according to the field in which they are primarily used. “Red” biotechnologies are those predominantly used in the healthcare and pharmaceutical sector; those used in manufacturing and industry are labelled “white” biotechnologies; while “green” biotechnologies are those applied in agriculture.

The recent communication on “Building the future with nature: Boosting Biotechnology and Biomanufacturing in the EU”[[8]](#footnote-9) highlights the role of biotechnology as both contributor to the solution of many societal and environmental challenges and as critical technology for economic security.

The communication also underlies the biunivocal relationship between biotechnology and bioeconomy: biotechnology is an enabler for the bioeconomy but at the same time, it depends on the bioeconomy for a wider range of inputs. This calls for an adjustment of the EU policy on bioeconomy in order to strengthen the links to biotechnology.

The EU has a vibrant biotechnology sector, but there is a need to act in order to construct a supportive environment for its growth. There are currently several challenges to be addressed in order to build this supportive setting for the growth of the biotechnology sector in the EU, namely:

* boosting the transfer from research laboratories to the market;
* simplify regulation and ease access to finance;
* ensure skills availability along the value chain;
* increase public acceptance of biotechnologies and their uses;
* provide a stable and unified IP framework.

By integrating biotechnologies with the bioeconomy, blue economy, and NBS, we can develop cutting-edge solutions for sustainable biomass production, biorefining, and bioenergy, while promoting the development of new industries and job opportunities.

4.1.6 Blue economy

*Socio-economic relevance of the EU Blue Economy*

The Blue Economy (BE), encompassing all economic activities based on or related to oceans and seas, directly employs over 3.5 million people in the EU and accounts for 1.3 % of EU Gross Value Added (GVA). Established blue economy sectors, including fisheries, aquaculture, coastal tourism, maritime transport, port activities, shipbuilding and marine extraction of oil and gas, generated a GVA of €171.1 billion in 2021, up by 35 % compared with 2020, when most Blue Economy sectors – particularly Coastal Tourism – suffered from the restrictions imposed by the COVID-19 pandemic, making the lowest contribution to the EU economy since 2009. These figures do not include the marine defence industry and other emerging sectors for which data is not fully available in the public domain. The contribution of the BE to the entire EU economy extends well beyond the abovementioned sectors. It also supports a wide range of related industries and services across multiple supply chains, leading to considerable spillover effects and economic benefits, further amplifying its economic impact. Furthermore, the blue economy has the potential to drive innovation and technological advancements in a wide range of sectors, such as marine renewable energy, aquaculture, desalination, robotics, and marine biotechnology.

Seas and oceans remain largely unexploited compared to land, holding vast potential for economic growth and development. Their exploitation requires careful management to ensure a sustainable, resilient and competitive BE. In turn, marine ecosystems require conservation and restoration activities, thereby creating new opportunities for sustainable management practices, nature-based solutions and green employment.

*Enablers, solutions & way forward*

A broad range of economic activities and sectors depend on marine resources, natural capital and ecosystem services. This includes a primary sector (e.g. fishing and aquaculture), the marine extractive industry (e.g. oil, gas, and other minerals), manufacturing industries (e.g. shipbuilding, nautical equipment, sport goods, apparel, etc.), and services (e.g. food, beverage, accommodation and recreational activities in coastal areas, maritime transport, finance, insurance, defence, etc.). For some of the more “established” BE sectors, EU Member States regularly share comparable statistics about their socio-economic performance mainly via Eurostat. This includes economic activities in the Marine living resources, Marine non-living resources, Offshore wind energy, Port activities, Shipbuilding and repair, Maritime transport, and Coastal tourism sectors. Economic activities of other sectors, such as emerging business applications harnessing innovative technologies and nature-based solutions, are less available in Eurostat statistics. This includes economic activities in sectors such as Blue Biotechnology, Desalination, Ecosystem restoration, Innovative marine infrastructure, Research, Robotics, etc.

The following table provides an overview of some of the most promising enabling solutions for the sustainability transition under implementation in the BE, sector by sector (Table 1). Based on good practices and sectoral policies inspired by the European Green Deal, the solutions presented in this table offer leverage points towards the establishment of a regenerative environment in the EU.

*Relevant policy and governance frameworks*

Since 2018, the JRC publishes annual **EU Blue Economy Reports**[[1]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-IE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fe6f3b20461fc475a994101a2618ac555&wdorigin=TEAMS-MAGLEV.teamsSdk_ns.rwc&wdexp=TEAMS-TREATMENT&wdhostclicktime=1734348160500&wdenableroaming=1&mscc=1&hid=1A166EA1-609D-A000-0560-289EB8E28FF8.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=cd723258-68f7-198f-ed59-26b45dc85690&usid=cd723258-68f7-198f-ed59-26b45dc85690&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Feceuropaeu.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&csc=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn1) monitoring the socio-economic performance of established and emerging EU Blue Economy sectors. In 2021, in collaboration with DG MARE (A4), the JRC established an **EU Blue Economy Observatory**[[2]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-IE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fe6f3b20461fc475a994101a2618ac555&wdorigin=TEAMS-MAGLEV.teamsSdk_ns.rwc&wdexp=TEAMS-TREATMENT&wdhostclicktime=1734348160500&wdenableroaming=1&mscc=1&hid=1A166EA1-609D-A000-0560-289EB8E28FF8.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=cd723258-68f7-198f-ed59-26b45dc85690&usid=cd723258-68f7-198f-ed59-26b45dc85690&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Feceuropaeu.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&csc=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn2)to act as a knowledge gateway facilitating access to information about the socio-economic performance of EU Blue Economy sectors and their progress in decarbonisation and energy transition[[3]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-IE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fe6f3b20461fc475a994101a2618ac555&wdorigin=TEAMS-MAGLEV.teamsSdk_ns.rwc&wdexp=TEAMS-TREATMENT&wdhostclicktime=1734348160500&wdenableroaming=1&mscc=1&hid=1A166EA1-609D-A000-0560-289EB8E28FF8.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=cd723258-68f7-198f-ed59-26b45dc85690&usid=cd723258-68f7-198f-ed59-26b45dc85690&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Feceuropaeu.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&csc=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn3) using best available data.

In 2008, the Commission adopted the Marine Strategy Framework Directive (MSFD)[[4]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-IE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fe6f3b20461fc475a994101a2618ac555&wdorigin=TEAMS-MAGLEV.teamsSdk_ns.rwc&wdexp=TEAMS-TREATMENT&wdhostclicktime=1734348160500&wdenableroaming=1&mscc=1&hid=1A166EA1-609D-A000-0560-289EB8E28FF8.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=cd723258-68f7-198f-ed59-26b45dc85690&usid=cd723258-68f7-198f-ed59-26b45dc85690&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Feceuropaeu.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&csc=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn4) represents the environmental pillar of the EU's maritime policy, providing a framework for EU marine waters to achieve Good Environmental Status (GES). Later, in 2012, the Blue Economy Strategy[[5]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-IE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fe6f3b20461fc475a994101a2618ac555&wdorigin=TEAMS-MAGLEV.teamsSdk_ns.rwc&wdexp=TEAMS-TREATMENT&wdhostclicktime=1734348160500&wdenableroaming=1&mscc=1&hid=1A166EA1-609D-A000-0560-289EB8E28FF8.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=cd723258-68f7-198f-ed59-26b45dc85690&usid=cd723258-68f7-198f-ed59-26b45dc85690&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Feceuropaeu.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&csc=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn5) was introduced to make the best of ocean and coastal resources as to stimulate sustainable economic growth and prosperity. With the adoption of the Maritime Spatial Planning directive[[6]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-IE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fe6f3b20461fc475a994101a2618ac555&wdorigin=TEAMS-MAGLEV.teamsSdk_ns.rwc&wdexp=TEAMS-TREATMENT&wdhostclicktime=1734348160500&wdenableroaming=1&mscc=1&hid=1A166EA1-609D-A000-0560-289EB8E28FF8.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=cd723258-68f7-198f-ed59-26b45dc85690&usid=cd723258-68f7-198f-ed59-26b45dc85690&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Feceuropaeu.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&csc=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn6) in 2014, the EU introduced a key instrument of integrated maritime policy which allows to increase cross-border cooperation and protect the marine environment more effectively. In 2021, the Commission adopted the Communication on a new approach for a sustainable blue economy in the EU “*A Green Recovery for the Blue Economy – Transforming the EU's Blue Economy for a Sustainable Future*”[[7]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-US&rs=en-IE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fe6f3b20461fc475a994101a2618ac555&wdorigin=TEAMS-MAGLEV.teamsSdk_ns.rwc&wdexp=TEAMS-TREATMENT&wdhostclicktime=1734348160500&wdenableroaming=1&mscc=1&hid=1A166EA1-609D-A000-0560-289EB8E28FF8.0&uih=sharepointcom&wdlcid=en-US&jsapi=1&jsapiver=v2&corrid=cd723258-68f7-198f-ed59-26b45dc85690&usid=cd723258-68f7-198f-ed59-26b45dc85690&newsession=1&sftc=1&uihit=docaspx&muv=1&cac=1&sams=1&mtf=1&sfp=1&sdp=1&hch=1&hwfh=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Feceuropaeu.sharepoint.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&csc=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn7). In line with the European Green Deal, this strategy is the current long-term policy framework guiding the sustainability transition of all blue economy value chains, replacing unchecked expansionary targets with roadmaps to achieve climate-neutrality, zero pollution, responsible food systems, biodiversity protection and coastal resilience. Good practices and enabling solutions for this transition are outlined in Annex 1.

* 1. The role of Research & Innovation

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| *Coordinator: Michaela Batorova / Laia* | *Others:* *Aliki, PF 13, Mecia (B7)* | *Pages:* |

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focus on innovation elements of the GT for competitiveness, start-ups etc.

* Horizon Europe / DG RTD / Tech Sovereignty / Regional Innovation Valleys / EU Missions for the Green Deal / [R&I Days 2024 recordings](https://research-innovation-community.ec.europa.eu/events/52ZqLn024m4rAeKyvr3zNu/programme)
* Horizon 2020 Green Deal Call - [research and innovation to drive the green deal-KI0221026ENN.pdf](file:///C:/Users/batormi/Downloads/research%20and%20innovation%20to%20drive%20the%20green%20deal-KI0221026ENN.pdf) - list of projects [Green Deal Projects | Research and Innovation (europa.eu)](https://projects.research-and-innovation.ec.europa.eu/en/strategy/strategy-2020-2024/environment-and-climate/european-green-deal/green-deal-projects-support/green-deal-projects-interactive-map/projects)
* REGIONAL DIVERSIFICATION IN GREEN TECHNOLOGIES chapter from the [science research and innovation performance of the-KI0224481ENN.pdf](file:///C:/Users/batormi/Downloads/science%20research%20and%20innovation%20performance%20of%20the-KI0224481ENN.pdf) (p. 452) written by JRC.B6 colleagues: **Dario Diodato, Lorenzo Napolitano, Emanuele Pugliese**;
* Energy Union R&I pillar / Competitiveness progress report
* Include all 7 dimensions of the EGD / Innovation Ecosystems for Bioeconomy and Food Systems

Research and innovation (R&I) are central to Europe’s strategic objectives, especially the EU ambitions for decarbonisation and the transition to a net-zero economy. However, despite considerable efforts, the EU has consistently fallen short of its target of 3% of GDP for R&I investment[[1]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn1), a crucial figure for long-term progress. EU leaders[[2]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn2) have recently re-affirmed this target, calling for an innovation-friendly environment based on excellent science, aiming to accelerate market adoption and the industrial scaling of innovations.

Currently, the EU’s research and development (R&D) intensity stands at 2.2% of GDP[[3]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn3), lagging behind global competitors such as the US, China, Japan, and South Korea. While public investment in clean energy technologies has grown, notably through Horizon Europe and national funding, private sector contributions remain insufficient. Europe excels in green technologies like wind energy and hydrogen, but faces increasing challenges in digital sectors, where countries like the US and China are advancing rapidly. This growing technological gap undermines Europe's global competitiveness.

A key issue is the underutilisation of Europe’s R&I ecosystem, with significant innovation divides across Member States, particularly in southern and eastern Europe. Although public R&I investment is rising, regional disparities persist, impeding progress and hindering Europe’s ability to compete in emerging technologies[[4]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn4). Addressing this gap requires coordinated investments and stronger public-private collaboration.

Moreover, the decline in government support for private R&D, which fell by 3.4% in 2020, further deepens the issue[[5]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn5). To bridge the innovation gap, the EU needs more robust public-private partnerships, especially in green technologies, and focus on scaling up green start-ups, which face high costs and limited funding. The EU faces barriers in bringing innovation to market and scaling up in the field of clean technologies. A dedicated EU Start-up and Scale-up Strategy[[6]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn6), as indicated in the Competitiveness Compass[[7]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn7), will address the barriers to business growth by strengthening university-business collaboration, improving patent commercialization, and enhancing access to risk capital. It will address market fragmentation, talent mobility, and innovation support. The Competitiveness Compass also mentions the European Innovation Act, which will further boost access to research infrastructures, intellectual assets, and regulatory sandboxes for testing new ideas.

In his report[[8]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn8), Letta suggests introducing a "fifth freedom" to complement the traditional four—people, capital, goods, and services[[9]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn9). This new freedom would focus on the unrestricted movement of research, innovation, knowledge, and education, strengthening the single market[[10]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn10).

The Draghi report[[11]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn11) urges the EU to implement a new competitiveness strategy, recommending an annual investment of EUR 750 – 800 billion, primarily from the private sector. This strategy emphasises reinforcing Europe’s leadership in areas where it excels, while also advancing in emerging technologies. It also calls for better alignment between R&I efforts and industrial policies.

To boost competitiveness, the EU must prioritise R&I at the core of its economy, aiming to double its research budget to EUR 220 billion for the next funding period[[12]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn12), while simplifying procedures and reducing costs for participants. Horizon Europe, the EU’s flagship research funding programme, with nearly EUR 100 billion allocated for 2021-2027, is a critical tool in this effort.

While the decrease in R&D productivity is a global phenomenon, EU-based firms show lower R&D productivity, particularly in generating sales and new ideas[[13]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn13). Simply increasing R&D investments is not enough. To enhance innovation, the EU needs to improve R&D processes, attract and retain top talent, and develop more effective policy instruments to drive impactful innovations.

Looking ahead, Europe must also strengthen international scientific cooperation, particularly with researchers in China, the USA, Africa, and Latin America, to maintain its global relevance. A critical goal will be reversing the brain drain of young scientists from Europe, fostering a “brain gain” to ensure a sustainable and innovative future for the continent[[14]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn14).

Public investment in research and innovation in the Energy Union R&I priorities[[15]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn15) has been steadily increasing, with EU MS reporting a 23% rise in 2022 compared to the previous year[[16]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn16). Combined with Horizon Europe funds, public investment in clean energy technologies has surpassed EUR 9 billion, positioning the EU as a leader in R&I spending in this sector. Nevertheless, the Commission’s assessment of draft National Energy and Climate Plans in December 2023[[17]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn17) highlighted a lack of national objectives and funding targets. To keep pace with global leaders, Europe must accelerate private sector investments in critical areas like solar PV and electrolysers. Targeted measures, such as green public procurement rules[[18]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn18) and reduced regulatory burdens, aim to further support EU-based start-ups and scale-ups[[19]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn19). Anti-subsidy measures, such as the investigation into Chinese electric vehicle imports, help safeguard EU industries from external market distortions[[20]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn20).

The 2024-2029 Commission political guidelines recognise R&I as a key driver of competitiveness, with measures to increase research spending and support strategic technologies[[21]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn21). The EU must adopt a more coordinated approach to R&I funding, focusing on critical areas of the Green Deal such as renewable energy, energy efficiency, and green hydrogen. Frameworks like Horizon Europe and the Strategic Energy Technology (SET) Plan represent progress, but greater action is needed. For example, the Horizon Europe programme has not prioritised manufacturing processes, showing that the EU’s research and innovation policy is not sufficiently linked to its industrial policy.

In 2023, the Commission revised the SET Plan and integrated it into the Net-Zero Industry Act. This strengthens its role in advancing R&I within the Energy Union and boosting the EU’s manufacturing capacity for net-zero technologies. Through coordinated national research efforts, the SET Plan helps to lower the cost of new technologies, foster cooperation across EU countries, companies, and research institutions, and align national R&I programmes with its objectives.

The EU must also streamline regulatory processes to reduce barriers for clean-tech start-ups and ensure that Europe remains a hub for green innovation. Public-private partnerships, such as the European Battery Alliance and the European Clean Hydrogen Alliance, are crucial to scaling up transformative technologies.

Without a strategic reassessment of funding priorities and improved policy coordination, Europe risks falling further behind in achieving its 3% R&D target[[22]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en-gb&rs=en-gb&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-Shapinggreentransition-LeadershipTeamchannel%2F_vti_bin%2Fwopi.ashx%2Ffiles%2Fd88b1829e66d4b8faed25c69df6c5a33&wdenableroaming=1&mscc=1&hid=d345684f-0eba-4860-a264-57e26495d9f9.0&uih=teams&uiembed=1&wdlcid=en-gb&jsapi=1&jsapiver=v2&corrid=cbe907b3-369f-4483-b71f-c8acdeab8412&usid=cbe907b3-369f-4483-b71f-c8acdeab8412&newsession=1&sftc=1&uihit=TeamsModern&muv=v1&accloop=1&sdr=6&scnd=1&sat=1&rat=1&sams=1&mtf=1&sfp=1&halh=1&hch=1&hmh=1&hwfh=1&hsth=1&sih=1&unh=1&onw=1&dchat=1&sc=%7B%22pmo%22%3A%22https%3A%2F%2Fwww.microsoft365.com%22%2C%22pmshare%22%3Atrue%7D&ctp=LeastProtected&rct=Normal&wdhostclicktime=1741382634153&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush#_ftn22). However, by leveraging initiatives like Horizon Europe, improving access to finance for start-ups, and strengthening international collaborations, the EU can accelerate progress toward its goals. The key will be ensuring that R&I serves not only as a driver of technological innovation but also as a catalyst for economic resilience and sustainability.

To close the R&I gap with global competitors and successfully transition to a sustainable economy, the EU must prioritise R&I investments aligned with the Green Deal’s objectives. By fostering collaboration, increasing funding, and addressing regulatory barriers, Europe can maintain its leadership in clean energy technologies and achieve the Green Deal’s ambitious targets.

***Advancing transformative research for a greener Europe***

The European Research Council (ERC) is the EU’s premier funding body for investigator-driven, high-risk, and high-gain research. Established in 2007, it supports ambitious ideas across all disciplines, aiming to strengthen Europe’s knowledge base and competitiveness. Recognising the urgency of tackling climate change, biodiversity loss, and resource degradation, the ERC carried out a Mapping Frontier Research exercise to assess how the research it funds can drive transformative impact. Over 300 ERC projects receiving more than EUR 650 million in total grants were identified as contributing to a greener Europe. These initiatives highlight the potential of advanced science and interdisciplinary collaborations to help shift towards net-zero emissions, sustainable resource use, and resilient socio-ecological systems.

***Key findings***

**Alignment with green transition objectives:** A significant group of ERC-funded projects focuses on areas such as renewable energy, biodiversity conservation, sustainable agriculture, circular economy, zero pollution, and climate resilience.

**Frontier research across disciplines:** ERC projects demonstrate deep interdisciplinarity, bridging natural sciences, social sciences, and the humanities. Achievements range from rethinking circular production processes to pinpointing ‘social tipping points’ for sustainable lifestyles. Projects further emphasise the need for systems thinking to balance environmental, economic, and social priorities. This breadth enables ERC-funded research to address the complex interdependencies underpinning systemic change.

**Barriers in research and innovation:** Despite promising technological and social solutions, insufficient deployment of renewable energy infrastructure, regulatory complexity, and funding mechanisms favouring incremental over transformative investments still hinder rapid progress. Many ERC projects specifically investigate why such solutions are not more widely adopted, identifying hurdles to be overcome and enabling factors that could catalyse deeper systemic change.

**Examples of advanced technologies supporting Europe’s green transition:** Next-generation photovoltaic cells and innovative wind turbine materials, CO₂ flux models and high-resolution climate simulations, precision farming with plant stress sensors and soil restoration techniques, methods for recovering critical materials from waste and bioplastics using engineered microorganisms, renewable-powered charging networks for electric vehicles and vehicle-to-grid technology, digital twins to monitor ecosystems and AI tools for tracking pollution and biodiversity changes.

Focusing on the transformative impact of research helps identify initiatives with the greatest capacity to produce system-wide benefits, guiding funding bodies to align support with systemic transitions and ensuring that investments deliver real-world outcomes. By highlighting how breakthroughs in clean energy, circular production, or climate modelling can be scaled, these findings can inform industrial strategies, reinforce Europe’s global competitiveness in sustainable technologies, and foster more balanced innovation across the continent. Crucially, nurturing collaboration, risk-taking, and societal engagement is essential, as these factors determine the uptake of new solutions and help translate bold ideas into widespread adoption - ultimately advancing Europe’s green transition.

* 1. The digital transformation

Asked to PF14

Digital technologies and Artificial intelligence



1. <https://knowledge4policy.ec.europa.eu/bioeconomy_en> [↑](#footnote-ref-2)
2. <https://knowledge4policy.ec.europa.eu/bioeconomy/monitoring_en> [↑](#footnote-ref-3)
3. Forest Strategy, Farm to Fork, Soil Monitoring Law, Biodiversity Strategy, Nature Restoration Law, Towards a strong and sustainable Algae sector, CAP New Strategic plans, Progress Report of Bioeconomy Strategy 2022, RED II/III , EU Soil Strategy for 2030, Framework for Carbon Removals, LULUCF , REPowerEU, Adaption to Climate Change, Circular Economy Action Plan, Transition pathways for a chemical industry, Conservation of fisheries resources and protection of marine ecosystems, Climate Law. [↑](#footnote-ref-4)
4. <https://www.eea.europa.eu/en/analysis/indicators/greenhouse-gas-emissions-from-agriculture> [↑](#footnote-ref-5)
5. The seven ecosystem services are: crop provision, pollination, soil retention, flood control, habitat and species maintenance, water purifica.tion and nature-based recreation. [↑](#footnote-ref-6)
6. <https://cepr.org/voxeu/columns/models-used-inform-policy-are-lacking-natural-capital> [↑](#footnote-ref-7)
7. https://www.epo.org/en/news-events/in-focus/biotechnology-patents/red-white-green [↑](#footnote-ref-8)
8. Full text available at <https://research-and-innovation.ec.europa.eu/document/download/47554adc-dffc-411b-8cd6-b52417514cb3_en> [↑](#footnote-ref-9)