Weekly Summary

Economics of Climate Change

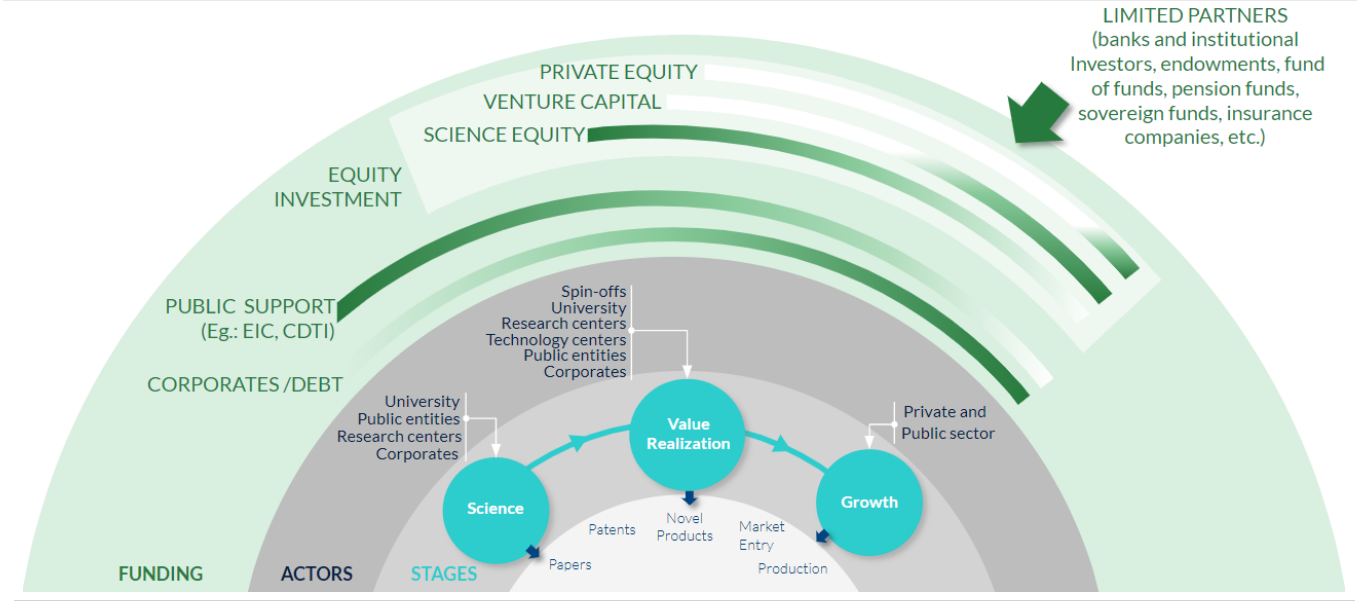
January 26, 2024

Deep Science, paving the way for a more sustainable EU

Deep science is a key domain of disruptive innovation, essential for EU climate action. The EU leads in Science with a strong base of talent and environmental innovation. Science equity represents a powerful tool to enhance deep science and pave the way for a more sustainable, competitive and resilient Europe. Two main policy strategies will also be needed: direct investing and market enhancement.

Deep science, a key domain of disruptive innovation.[1] Deep science includes disruptive innovation in physical, tangible or hard technologies (advanced materials, nanotechnology, biotech, micro and nanoelectronics, photonics,...). **It is a complex process involving many actors and stages**, which starts with scientific research and only succeeds with actual growth (see **Figure 1**). The deep science ecosystem includes three stages **- science, value realization and growth**[2]- where specialized equity investors play a pivotal role in the success of value realization[3].

Figure 1. **DEEP SCIENCE: ACTORS, STAGES AND FUNDING**



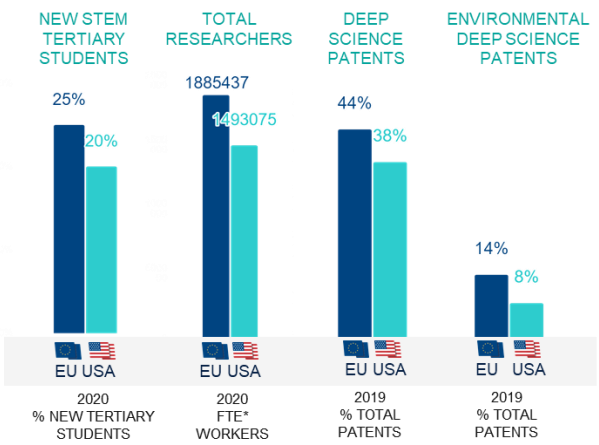
Source: BBVA Research and BeAble.

1: This note is based on European Deep Science Technologies. BBVA Research and BeAble.
2: Science stage focuses on fundamental research and academic output from Universities, public entities, corporates,... Value realization is the stage where scientific discoveries from start-ups, Universities, corporates,... are turned into practical applications and novel products. The growth stage concentrates on market expansion of these innovations, increasing economic activity, public or private.
3: See European Deep Science Technologies

Deep science, crucial to address EU challenges, especially climate solutions. Innovation, and in particular deep science, plays a pivotal role in facing European great challenges and uncertainties -such as geopolitical tensions, climate change, aging population, inequalities and disruptive technologies- that underscores the need to be better prepared for future systemic shocks and to strengthen resilience and internal cohesion. Moreover, it is essential to boost high-tech manufacturing[4]. For this purpose, **the EU three-pillar strategy focuses on sustainability, competitiveness and resiliency.** Europe has stepped up to these challenges, with innovation as a pivotal driver, launching **Horizon Europe[5]** in 2021, an ambitious programme that complements other initiatives geared towards research and innovation (see **Box 1**).

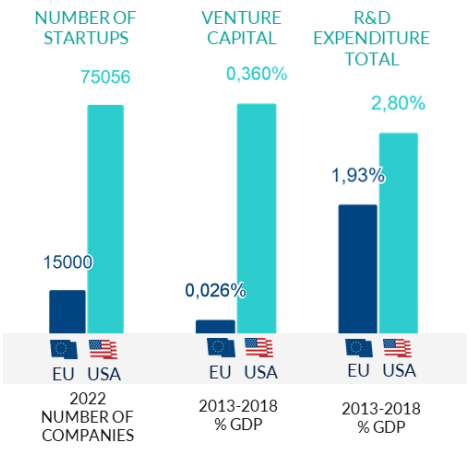
EU strength in talent, science and environmental innovation. In the science stage Europe excels, boasting a strong base of talent[6], also in the area of deep science and environmental innovation (see **Figure 2**). However, it is in the transition to the value realization stage and the final growth stage that Europe encounters challenges, often attributed to funding constraints. These difficulties contrast with the proficiency of the USA (see **Figure 3**).

Figure 2. **TALENT AND SCIENCE EU-USA**



Source: BBVA Research from OECD data. (*) FTE: full time equivalent.

Figure 3. **VALUE REALIZATION AND FUNDING EU-USA**



Source: BBVA Research from OECD data

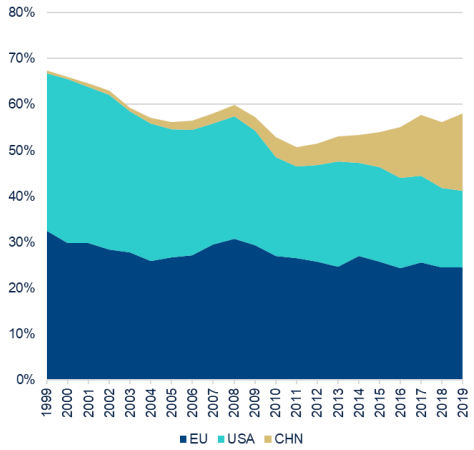
Deep science will be key to achieving EU climate goals. The EU has been at the forefront of recognizing and tackling environmental challenges. Its commitment to green innovation has led it to maintain a **dominant position in the field of environmental patents[7]** and it has succeeded in maintaining a significant share worldwide, reaching a peak share of 31% of the global share of environmental patents in 2008 (see **Figure 4**). However, recently the global landscape has witnessed significant shifts, with a remarkable rebound from China, even reaching the USA in environmental patents.

Among climate-related patents, there are technologies aimed at fostering a sustainable ocean economy, environmental management, adaptation or mitigation technologies, covering the latter sectors like energy, transportation or building. All these innovations, excluding information and communication (ICT) and management, are considered deep science and play a crucial role as drivers towards a more sustainable and resilient future (see **Figure 5**). In addition, developing **new green technologies helps boost growth,** through increased investment in

4: Productivity is supported by deep science, where more than 80% of patents belong to manufacturing.
5: See Horizon Europe
6: Talent refers to human capital in Science: number of students in tertiary education, in STEM, researchers,...
7: Patents have been used as an innovation proxy, reflecting the inventive performance of countries, regions, firms,..

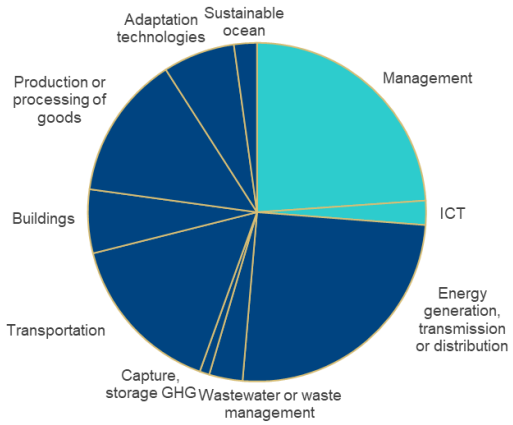
the first few years and spreading to further growth benefits from cheaper energy and efficient production processes. National and global climate policies are also key to fostering green innovation.[8]

Figure 4. **ENVIRONMENT PATENTS**
% WORLD ENVIRONMENTAL PATENTS. PCT[9]



Source: BBVA Research from OECD Patents.

Figure 5. **EU ENVIRONMENTAL PATENTS. 1999-2019**

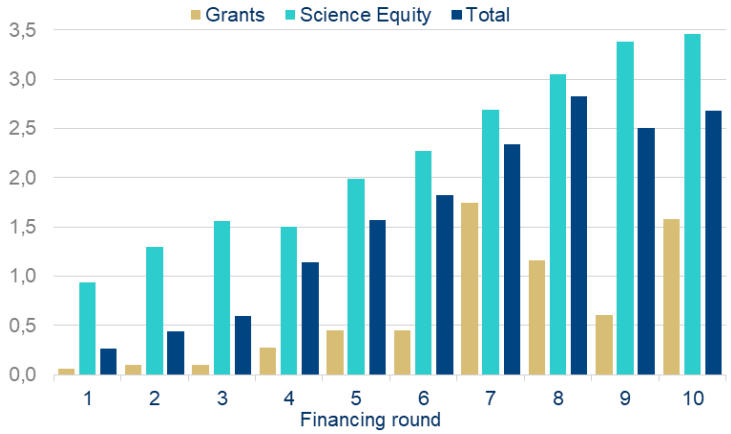


Source: BBVA Research from OECD Patents and BeAble. Note: Deep Science in dark blue

Science equity, an efficient funding source for deep science. Despite the EU strength, there is a gap in value realization and funding. Science equity is a new investment asset class, different from traditional Venture Capital and Private Equity that only invests in deep science and mostly in pre-seed and seed stages (see **Figure 1**). Grants are also a good signaling mechanism, but it is science equity that allocates larger and more efficient funds that allow enterprises to focus their early-stage efforts on their projects rather than on managing recurrent financing needs (see **Figure 6**). Science equity represents a powerful tool to enhance innovation processes and increase competitiveness.

8: For further detail see: How Green Innovation Can Stimulate Economies and Curb Emissions
9: Patent Cooperation Treaty (PCT) are "international" patent applications. PCT patents based on priority date and applicant's country of residence have been used.

Figure 6. **MEDIAN FUNDING RAISED BY ROUND 2012-2022** (MILLION DOLLARS)



Source: BBVA Research and BeAble from PitchBook Data, Inc.

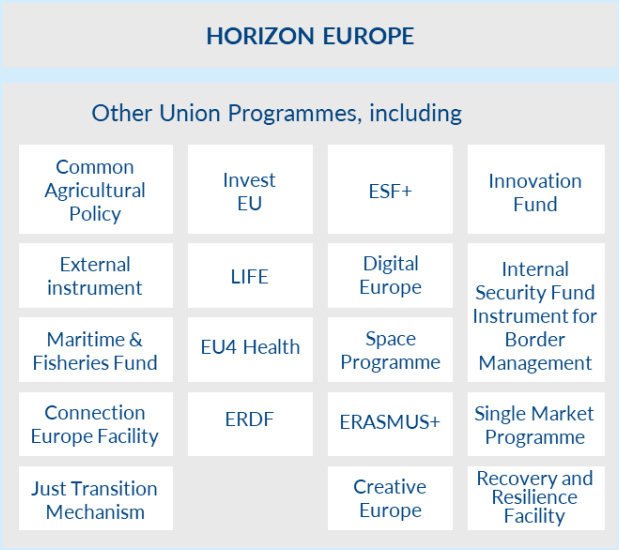
And two policy strategies to catalyze innovation in Europe: direct investing and market enhancement. While national policies serve as the main driver for climate action, for deep science the emphasis relies on promoting scientific equity, since Europe's main challenge is the shortfall in funding. To address this concern, specific strategies are needed, such as **direct investment, especially in the early stages, and market enhancement**, requiring the engagement of institutional investors and the progress toward a Capital Markets Union (CMU), which can provide the necessary financial support to fill funding gaps and stimulate advances in deep science.

In summary, deep science is an area of innovation essential to achieving European strategic objectives, especially climate goals. It offers an opportunity to develop disruptive technologies that pave the way for a more sustainable, competitive and resilient Europe.

Box 1. HORIZONTE EUROPE

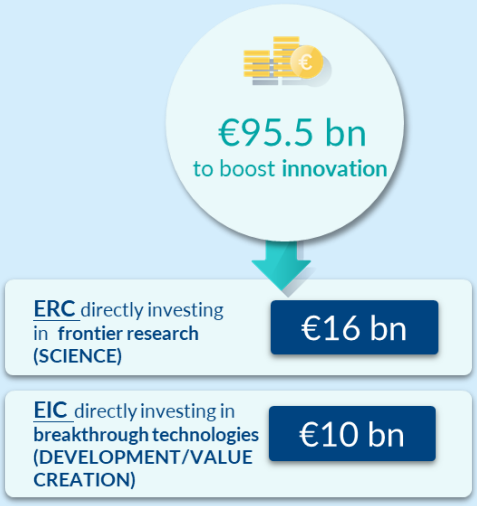
Horizon Europe is the EU key funding programme for research and innovation.
It is a programme for the period 2021-2027 with a budget of €95.5 billion that aims to strengthen the knowledge base, encourage breakthrough innovation, and support innovative solutions to restore industrial leadership and strategic autonomy. The structure of Horizon Europe is built around four pillars: (i) excellent science, (ii) global challenges and European industrial competitiveness, (iii) innovative Europe, and (iv) widening participation and strengthening the European Research Area. The programme includes **€26 billion to boost disruptive innovation** (€16 bn from the ERC[10] for excellent science and €10 bn from the EIC[11] for breakthrough technologies) (see **Figure B2**).

Figure B1.1. **EU INNOVATION STRATEGY**



Source: BBVA Research from Horizon Europe.

Figure B1.2. **HORIZON EUROPE BUDGET**



Source: BBVA Research from Horizon Europe.

10: ERC: European Research Council. For further details see ERC at a glance.
11: EIC: European Innovation Council. For further detail see EIC.

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