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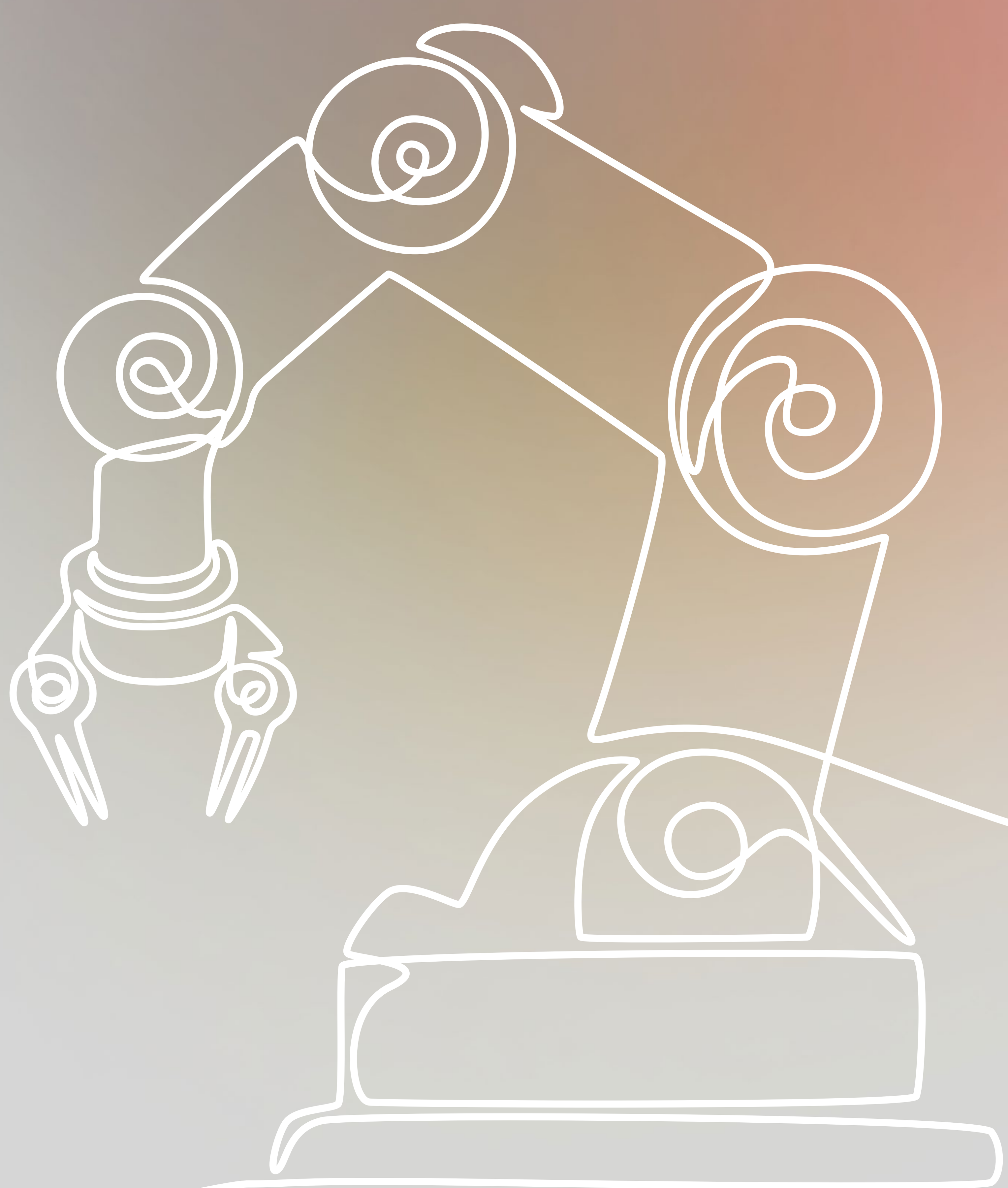
Boosting New Technology and Innovation in Europe:

Lessons across sectors including Defense



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Introduction

In his report, *Much more than a Market*, Enrico Letta emphasizes that the EU's lag in R&D investment is "critical obstacle to economic competitiveness" and argues that major pan-European projects in AI and quantum computing have the potential to deliver breakthroughs that can drive sustainable growth. Mario Draghi, meanwhile, made a clear and urgent call:

"Europe urgently needs to accelerate its rate of innovation both to maintain its manufacturing leadership and to develop new breakthrough technologies".

He reaffirms the strong and direct link between research, innovation, productivity, and ultimately, growth and purchasing power. However, this paradigm is now being reshaped in Europe by a number of new forces. Geopolitical shifts are reintroducing inter-state competition with some referring to the rise of a sovereignty-based capitalism. Simultaneously, major technological revolutions – are intensifying global competition. Furthermore, the nature of innovation itself is evolving, increasingly shaped by ecosystems and non-linear pathways. At the same time, Europe faces an urgent imperative to invest massively in its defence in order to acquire the military, industrial and technological capabilities needed for its strategic autonomy. To round off the suite of strategic measures, Enrico Letta calls for unlocking a "fifth freedom" in the Single Market – the free circulation of knowledge, researchers, and data – paired with scaled pan-European research & innovation finance mechanisms to crowd in private capital and narrow the EU's innovation gap.

A proved link between innovation and growth

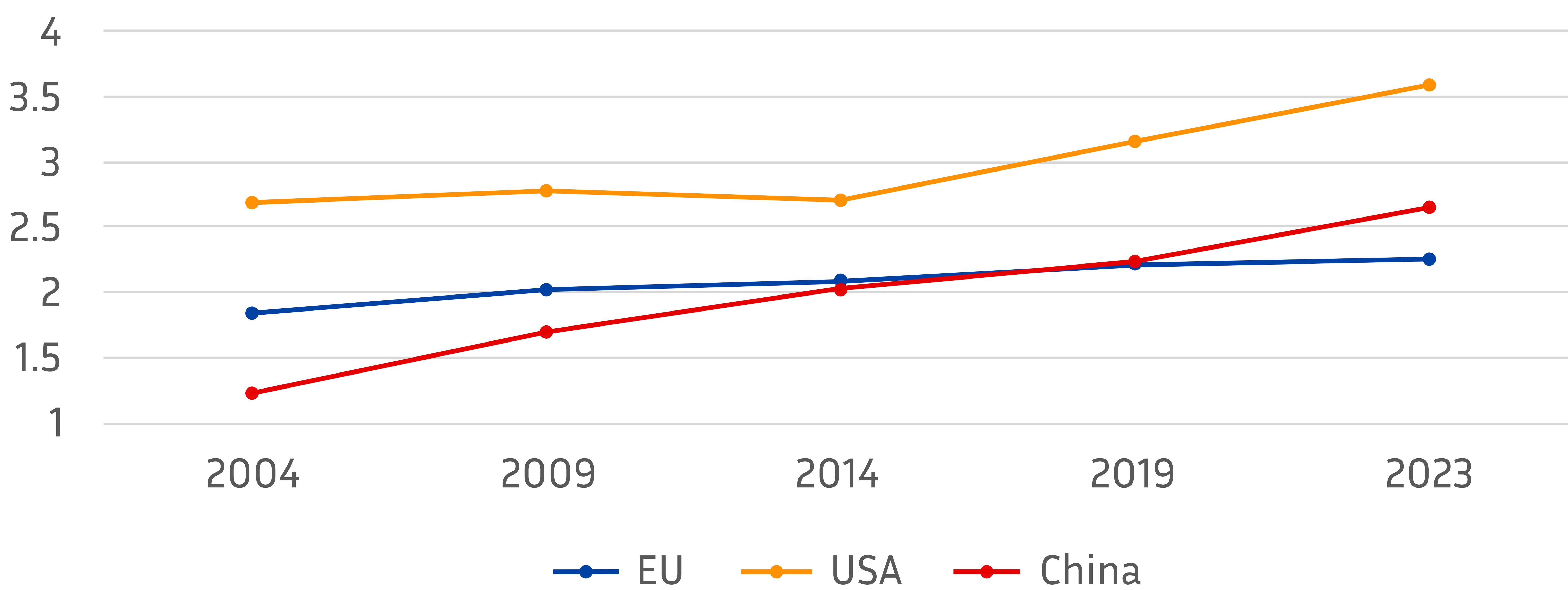
In economic literature, innovation is widely recognised as the key internal driver of long-term growth and competitiveness. Models of **endogenous**

innovation – from Romer (1990) to Aghion & Howitt (1992) – demonstrate that the accumulation of knowledge, protected by intellectual property rights and diffused through investment in R&D, leads to sustained increases in total factor productivity. Schumpeter had already highylighted this dynamic of creative destruction: firms that introduce new products or processes gain market share, forcing less innovative competitors to adapt or exit the market, thereby improving the overall efficiency of the economy. Empirical evidence supports this relationship: in OECD countries, each additional point of GDP **invested in R&D is associated with long-term gains** in multifactor productivity, while the creation of technology companies serves as a regional boost to skilled employment and rising wages.

In this context, the question of how to mobilize the appropriate means and instruments to accelerate innovation and technological development in Europe is more pressing than ever. For years, Europeans have been committed to investing at least 3% of their GDP in R&D. Moreover, Horizon Europe's €95.5 billion budget for 2021–2027 provides a significant pool for collaborative R&D, though recent evaluations suggest that simpler access mechanisms are needed to boost SME participation in breakthrough and defence-related projects.

However, as the following figure shows, Europeans – despite having made progress over the past 20 years – still invest just over 2% of their GDP in R&D, remaining well behind the United States and Japan, and having been doubled over the past 10 years by China. Mario Draghi warns that without a step-change in productivity-enhancing investment, Europe will be forced into painful trade-offs; his competitiveness report estimates the Union must mobilize roughly €750–800 billion in additional annual investment – public and private – to regain technological leadership.

Figure 1 - **R&D intensity** (Gross Domestic Expenditure on R&D as % of GDP)



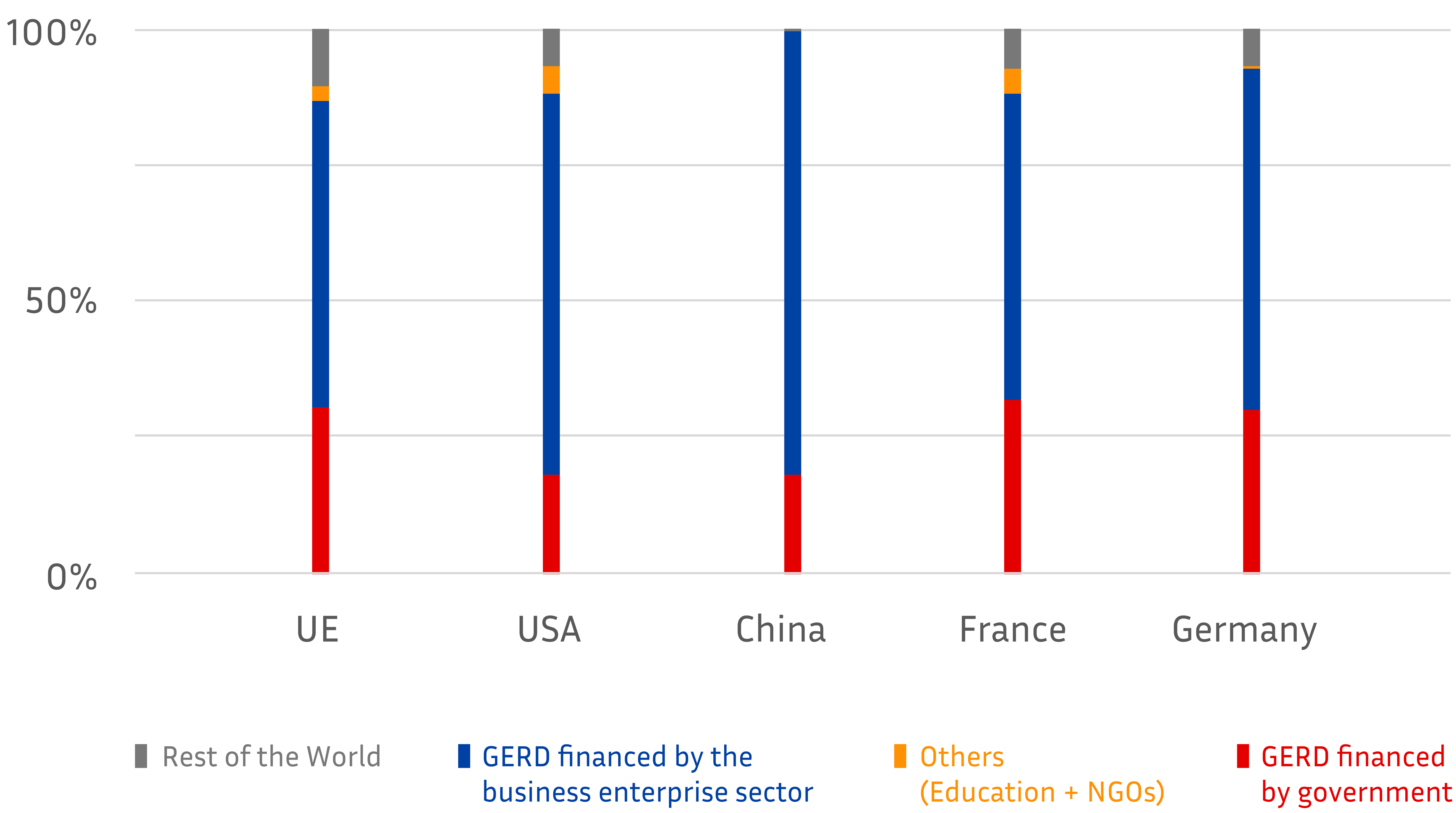
Source: Eurostat

The American model, a textbook case of innovation and growth

The American **economy** combines an **unmatched volume of R&D investments (≈ $940 billion in R&D in 2023**, or ~3.4% of GDP) with a **strategic state** that initiates "missions" while leaving commercialization to the private sector (see figure 2). It benefits also from efficient **university-industry transfers** and **venture capital deeply** rooted **in regional clusters.**

This architecture fosters strong linkages between fundamental science, entrepreneurship, and end markets – explaining the sustained contribution of innovation to U.S. growth and productivity. Agencies such as **DARPA** (Defense), **BARDA** (Biomedical), **ARPA-E** (Energy), and the newly created **ARPA-H** (Health) fund high-risk technological bets and act as early public purchasers (e.g., DoD, NASA), thereby creating markets (e.g., the Internet, mRNA vaccines, LIDAR) and accelerating the diffusion of innovations into the civilian sector (e.g., GPS, surgical robots). The recent **CHIPS and Science Act, Inflation Reduction Act**, and the network of Tech Hubs are redirecting subsidies and tax incentives toward semiconductors, clean tech, and AI – further catalyzing private investment.

Figure 2 **- Breakdown of public versus private spending**



Source: Eurostat & OECD database

Dual-use innovation in the spotlight

During the Cold War, it was widely believed that **major innovations in the military domain underpinned the economic growth** and technological revolutions of the 20th century – from electronics and computing to aeronautics and medical advances. At the time, the prevailing view held that great economic power could not exist without military power, and vice versa.

However, by the 1980s, this assumption was **increasingly questioned.** The economic difficulties of the United States, contrasted with the industrial successes of Germany and Japan, seemed to challenge the link between military strength and economic dynamism. In this context, and following the end of the Cold War, many governments significantly scaled back public funding in defense R&D, **shifting responsibility to the private sector.** The rise of information and communication technologies (ICTs) and the vitality of private-sector innovation further reinforced the belief that technological progress could flow from the commercial sector to defense, reversing the traditional direction of spin-offs.

Since the early 2000s, however, this narrative has again come under scrutiny. **The continued technological dominance of the U.S. economy** – both in commercial innovation and military R&D spending – the emergence of new threats requiring specialized technologies, and the relative scarcity of breakthrough innovations since the Cold War have all reignited debate over the direction and nature of technological spillovers. However, under the European Chips Act, the Commission has mobilised over €43 billion of public and private investments to double Europe's share of global semiconductor production to 20 % by 2030, underlining the strategic imperative of chip sovereignty for both civilian and defence applications.

Several key trends stand out:

- The **scope of dual-use technologies** – applicable to both civilian and military domains – **continues to expand**. The model embodied by DARPA, in which military-driven innovation (e.g., the Internet, satellite observation) later fed into civilian sectors, is no longer the norm. Today, cross-fertilization is more balanced, with defense companies increasingly integrating civilian technologies (e.g., advanced electronics, materials) to enhance the performance of military systems. EU instruments such as the €7.3 billion European Defence Fund (2021-27) and the EU Defence Innovation Scheme (EUDIS) explicitly target dual-use R&D, lowering barriers for SMEs and start-ups to join cross-border defence technology programmes and accelerate spin-in from the civilian sector.
- The **digital revolution has been a major driver of this shift.** But financial imperatives (reducing the cost of defense equipment) and operational

needs (providing military users with flexible, user-friendly tools) have also contributed significantly.

- The **war in Ukraine has further accelerated this transformation**, highlighting the need to respond in real time to frontline operational demands. Operational experience in Ukraine – where small teams have rapidly adapted low-cost commercial drones, AI-enabled targeting tools, and fast-track procurement pathways – illustrates how agile, bottom-up innovation can outpace traditional acquisition cycles and is now being closely studied by European and allied militaries. Moreover, a new industrial ecosystem has emerged, composed of small, agile, and innovative companies that adapt civilian – often digital – technologies to improve military capabilities (e.g., in artillery, drones, targeting systems).
- Once limited to special forces, this fast-paced, iterative model of development is now embraced across a broader spectrum of the armed forces, reshaping the defense industrial landscape, with **SMEs and startups playing a growing role** in the dialogue between end users and industry.

Conclusion – Lessons for boosting innovation in Europe

These evolutions of defense innovation offers lessons for the private sector – particularly in terms of methodology. It also underscores the importance of stronger public-private collaboration, ensuring that corporate R&D for competitiveness is informed by public research aimed at societal and strategic objectives, and vice versa. The emergence of AI and quantum technologies illustrates the urgent need for convergence between the public and private sectors, as well as between the civilian and military spheres. EU-funded research programs can play a decisive role in this decompartmentalization – especially by further integrating military R&T, as initiated by the European Defence Fund since 2021.

- How can Europe build an innovation ecosystem as agile and impactful as the DARPA model in the U.S.?
- What are the main barriers to integrating civilian innovations into defense systems—and vice versa—in Europe?
- What strategic approach should Europe take to mobilize public and private investment in critical technologies such as semiconductors, AI, and quantum computing?
- How can SMEs and start-ups be better integrated into Europe's innovation and defense ecosystems?