



JEDI

THE EUROPEAN ARPA

**THE EUROPEAN RESPONSE TO THE IRA
MUST BE AN ALL-OUT SCIENTIFIC AND
TECHNOLOGICAL OFFENSIVE:
AN APOLLO 2.0**

MAY 2023

THE JOINT EUROPEAN DISRUPTIVE INITIATIVE

The Joint European Disruptive Initiative (JEDI) is the European advanced research projects agency (ARPA) with a mission to bring Europe in a leadership position in emerging and breakthrough technologies.

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AN APOLLO 2.0**

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**FONDATION ROBERT
SCHUMAN**

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Europe has found its new bogeyman: Joe Biden's Inflation Reduction Act (IRA), the great American plan to support the energy transition, enacted in August 2022.

Blind to the development, the European Union cried foul to mask its frustration. Frustration at not having anticipated the American decision - Joe Biden's electoral programme already included a "Build Back Better" plan, which is twice the size; frustration at the complexity of its own Green Deal, the tangible results of which have been difficult to see since 2019, in the face of the simplicity of the American plan; shameful frustration, finally, that while the United States had to be asked to make much greater efforts on climate, it is now doing so without forgetting its own interests. Interests that the Europeans forget about when it comes to the economy and trade, as they roll out the red carpet for Chinese batteries, electric vehicles and solar panels at the expense of their own chemical and automotive industries.

The proposed European response to the US IRA is far too blurred compared to the emergency

The US has planned to invest \$369 billion in energy security and decarbonisation to boost its economy and reduce greenhouse gas emissions by 40% by 2030. European mobilisation has helped to raise concerns on this side of the Atlantic, but France and Germany missed the highly visible opportunity of the 60th anniversary of the Elysée Treaty on 22 January 2023 to develop a common position. At the World Economic Forum in Davos mid-January, we saw the President of the European Commission, Ursula von der Leyen, combative and committed. However, the determination displayed by the Commission could not mask the difficulty Europeans have in reaching agreement, and the vagueness of the proposals. Europe will never succeed by being defensive, by over-regulating or by promoting an industrial policy inherited from the 20th century - and sometimes advocated in Paris, Brussels or Berlin. The world has changed: Europeans must launch an all-out technological and scientific offensive, and not behave like followers.

The EU has missed four technological revolutions

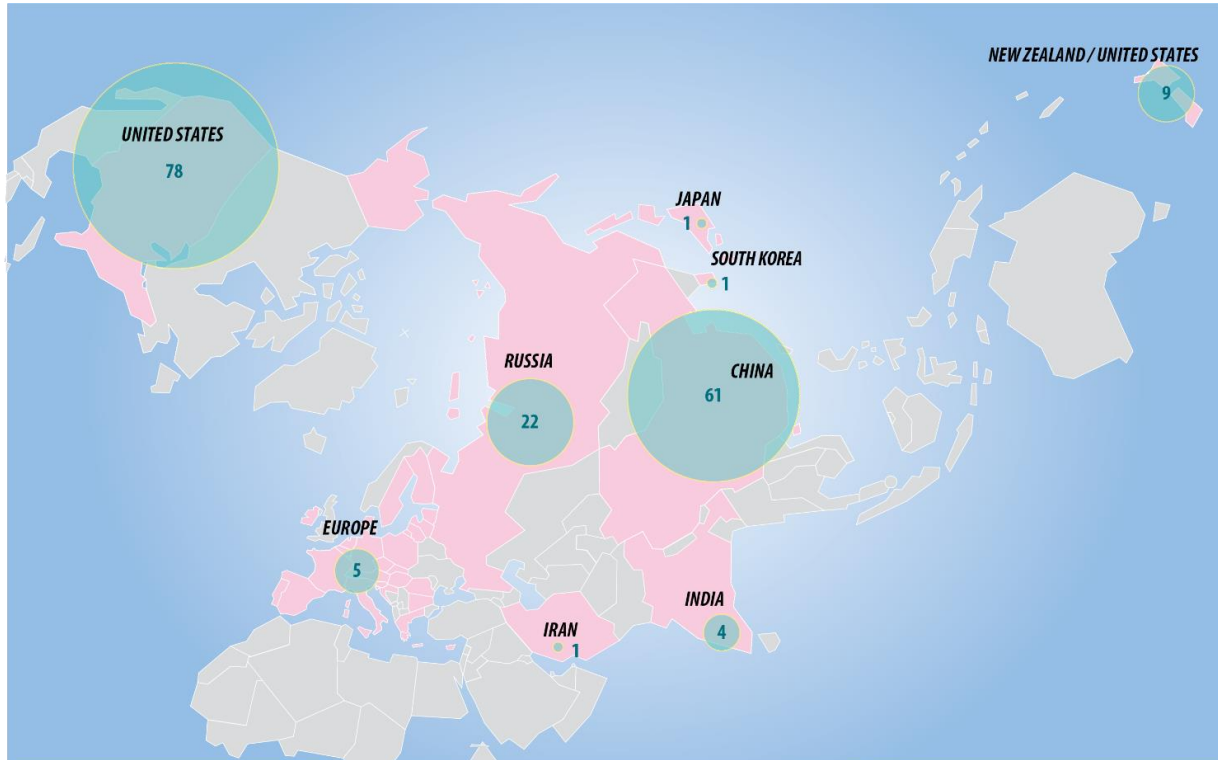
The situation is dire: Europe's decline is widespread, on climate, health and digital issues. At the end of 2022, Europeans missed four revolutions that they should have been leading.

Since the end of November 2022, ChatGPT has been revolutionising artificial intelligence and endangering the very core business of Google, its search engine. No Big Tech is actually invincible - which is a great message of hope.

A historic breakthrough in nuclear fusion was achieved in December 2022 in California, while Europeans have all the skills and the imperative to revolutionise energy.

While space is becoming central to our security and communications, Europeans will be grounded for most of 2023 due to delays with Ariane and the failure of the small Vega launcher.

Finally, synthetic biology, which holds out the hope of an economy based on production rather than extraction, and which is a possible solution to the major agricultural, health and climate challenges, is being held back in its development. The European Union is even losing its lead: BioNTech, which developed an mRNA vaccine with Pfizer against Covid-19, now intends to expand into the UK.



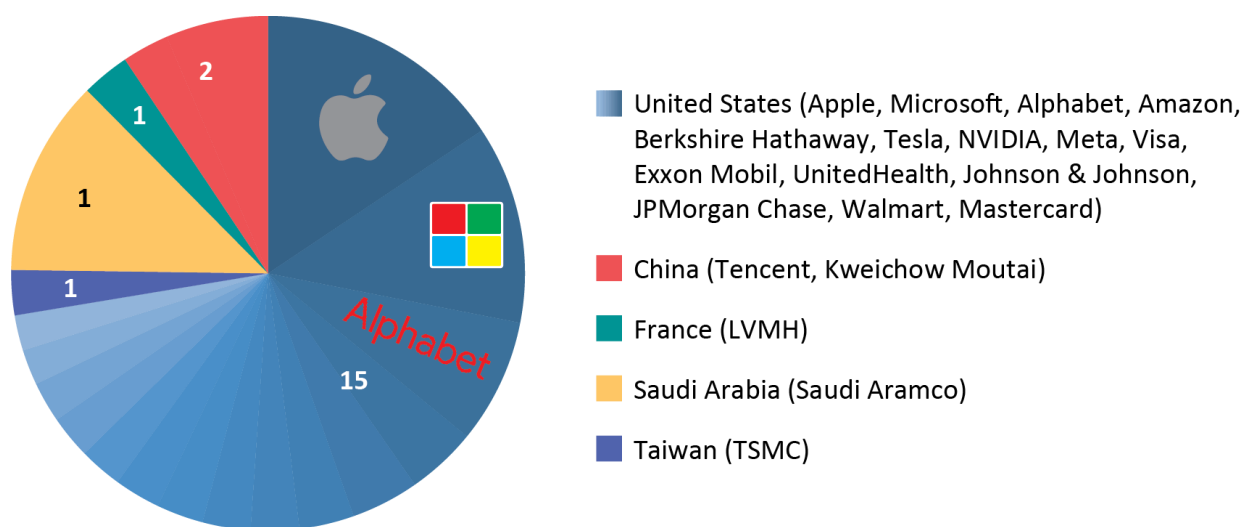
The rise of New Space has reignited the space race

Credits: Pascal Orcier for the Robert Schuman Foundation, January 2023.
Source : https://space.skyrocket.de/doc_chr/lau2022.htm.

It is obvious that we need to change our methods. Let us start by being collectively lucid: we are no longer leaders, and the single market is a fable in all the strategic fields of the future, such as cyber, hydrogen, artificial intelligence, and quantum. In these fields, there are often twenty-seven agencies, twenty-seven strategies, twenty-seven implementations, which are rarely coordinated, resulting in market fragmentation and the absence of a competitive advantage through size, which is essential in technology.

Then, it is important to evaluate what has already been launched: where are the tangible results of the NextGenerationEU plan, the European recovery and investment plan of 2020, which was supposed to create a "healthier, greener and more digital" Europe, but of which only 19% of the €750 billion announced is estimated to have been deployed by the beginning of February 2023? Where are the results of the 2018 French artificial intelligence plan, which we were told would work wonders? Why are there no technology leaders - apart from the Dutch equipment manufacturer ASML - when €230 billion has been invested in European research since 1984? What have the important projects of common European interest (IPCEI) in batteries or microelectronics achieved, if not to finance the large European groups best connected to Brussels? What has France 2030

achieved to date, having already spent €10 billion in 2022? The world developed a vaccine against Covid-19 in eight months; what other problems could we have solved in eight months?



Among the 20 largest global capitalizations at the beginning of 2023, 15 are American, half of which are technology companies (Apple, Microsoft, Alphabet, Amazon, Tesla, NVIDIA, Meta)

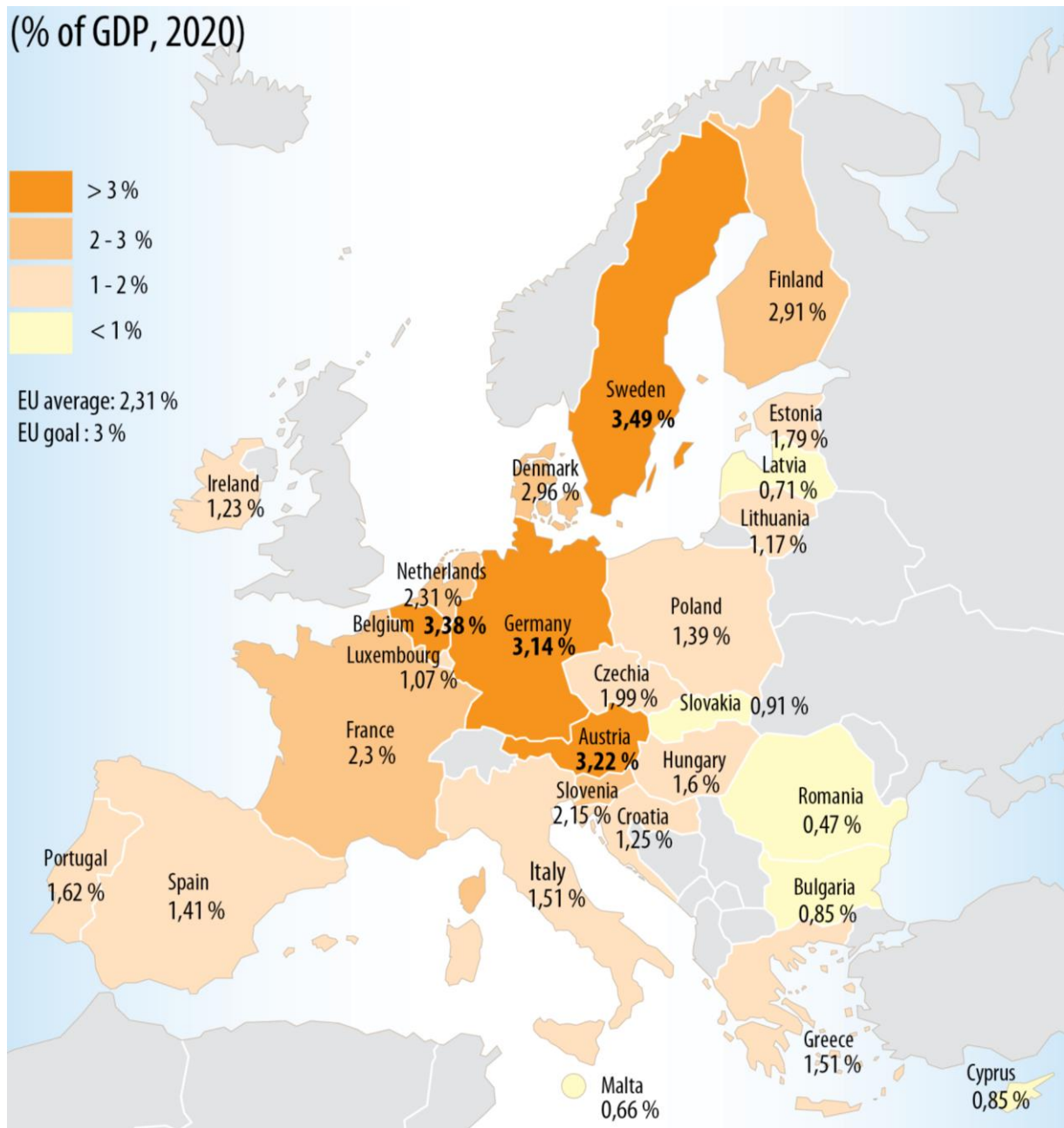
Source: CompaniesMarketCap.com (updated February 2023)

Let's dare to make a radical change to our approach

In the face of the climate emergency, of American and Chinese competition, and of the war in Ukraine, which raises the fundamental question of the *raison d'être* of the European project, the European Union has a unique opportunity to launch a few targeted projects that could change the world and involve all European countries. Let us give ourselves the means to achieve our leadership ambition. Beyond the sometimes-empty speeches, let us mobilise our forces for the improvement of our societies: let us show the same capacity for execution and impact as during the Eurêka programmes of the 1980s, let us launch an "Apollo 2.0".

Some national and European attempts exist, of course, but they systematically overlook several of the key cumulative conditions for the creation of the exceptional momentum that has helped the United States to become the undisputed leader once again in technology and industry, both politically and diplomatically.

Let us pick a few real priorities, with clear and measurable goals to achieve. At most, let us make progress on a handful of subjects that can mark real breakthroughs in key areas for Europeans - and therefore truly capable of changing the game. The European Research Framework Programme 2014-2020 - Horizon 2020 - with a budget of almost €77 billion has funded 39,500 projects, which makes political readability and evaluation impossible. It is even referred to as an embodiment of the "*watering can principle*" (*Gießkannenprinzip* in German). A fraction of Horizon Europe, its successor for 2021-2027 which has been endowed with €95 billion, should be dedicated to an Apollo 2.0 project, managed independently of the traditional, often bureaucratic, calls for projects.

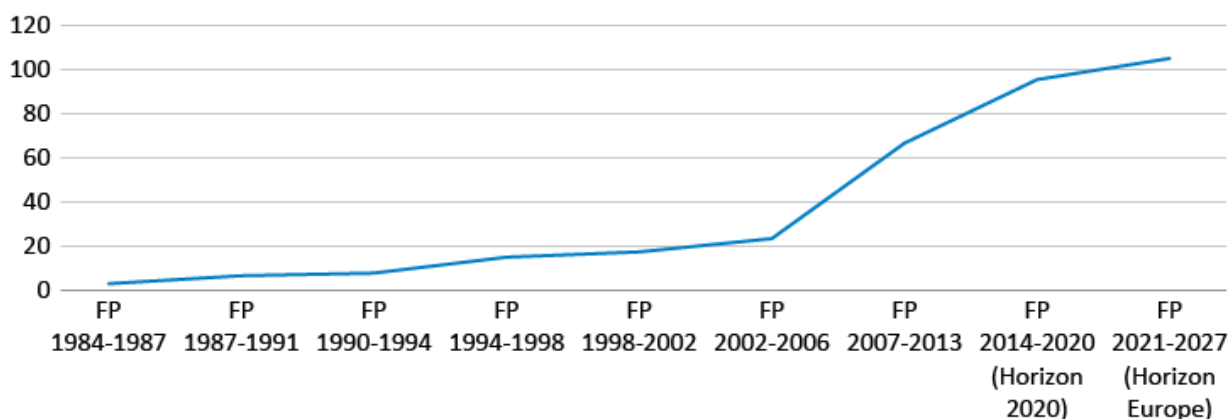


Research and development expenditure in the European Union

*Credits: Pascal Orcier for the Robert Schuman Foundation, January 2023.
Source: Eurostat.*

Let us then dare to put an end to the systematic primacy of the criterion of geographical return: the fact that the European Union advances in a coherent manner and without too many disparities is a legitimate political objective. The quest for excellence in science and technology is also legitimate. But it is imperative to have distinct tools to avoid ending up with the smallest common multiple, or artificial and bureaucratic consortia, which is often the case. We must take inspiration from the European Research Council (ERC), which is a shining exception in this panorama, but which is focused solely on excellence. We need a tool that sets priorities, which is not the case with the ERC. Let us also imagine a new method of managing research projects, based on an approach

that is independent of the administrative system - but which can be part of a public structure, like the American DARPA. A method based on the pursuit of efficiency in a short time, twelve to eighteen months, supported by an assumed prospective approach — with projects managed by agile teams, which have the technical skills to support and evaluate the progress made by the research teams on a daily basis, in relation to the objectives set.



Amount of the EU's research and innovation framework programs, in billions of euros (inflation taken into account): a massive increase in resources that has not translated into global technological leadership positions.

Source: European Commission.

For the European Union to (re)become a hub of innovation a new methodology is needed

Current/European methodology	DARPA/JEDI/Apollo 2.0 methodology
Curiosity research	Purpose-driven research
Best efforts	Quantitative measures of impact, project termination in case of unsatisfactory results
Peer Review Committees	Programme Manager challenging teams
Spray & Pray (Giesskannenprinzip)	Focus on key issues with major social impact
Size of the budget ("how many billions?")	Speed as important as budget
Public money in private projects that could have been funded by private sector	Focus on projects too risky for private sector
Systematic use of Calls for proposals creating a bias towards established organisations and insiders, and bureaucratisation	Proactively soliciting the best, wherever they come from

Source : JEDI – Joint European Disruptive Initiative.

Let us remove the obstacles to the participation of the best teams in these projects: we must stop talking about batteries or clouds, and instead talk of the societal and economic objectives to be achieved, of the impact to be obtained: how to improve the storage of electricity, how to reduce the carbon footprint, how to develop tools that place people at the centre of the digital revolution, how to save lives? Instead of encouraging lobbies and technophiles of all shapes and sizes, we should encourage creativity and responsibility on the part of scientific actors. We need to

encourage the best to participate in changing the world and to excel, by putting aside the classic call for project mechanisms - bureaucratic monsters in which the best no longer participate - in favour of a system of GrandChallenges. Most of this support would only be awarded if tangible and relevant results were achieved. Instead of encouraging a large number of 'bounty hunters', we would then encourage real breakthrough innovations. Let us leave the intellectual property of the results obtained to the scientific actors and entrepreneurs - even if it means for example giving priority to funders and investors in terms of equity investment for a limited period.

Finally, on the other hand, let us concentrate the efforts of public policies on the framework for action, whether ethical, legislative or regulatory. A framework that promotes European values, while leaving room for innovation.

Targeted projects that can change the world

To make this Apollo 2.0 a success, here are the major projects that could form its framework.

First of all, energy, the mother of all battles to ensure both the continent's energy independence and the climate transition, the urgency of which is growing every day.

As we emerge from a "nuclear winter" that has lasted about ten years, a pragmatic look must be taken at the many advances that are being made in the nuclear sector, most often in start-ups (CFS for fusion) or large groups (Rolls-Royce for small modular reactors) that do not have an established nuclear history. However, the European regulatory framework in this area remains unclear, while the development of nuclear power (fission as well as fusion) requires several decades. If nuclear revolutions are being achieved in the United States (such as the December 2022 breakthrough in fusion technology at the Lawrence Livermore Laboratory) and if their development is being held back in Europe, Europe is running the risk of closing an energy "door" once again.

At the same time, energy storage has become essential in the context of energy transition and electrification: the development of renewable and therefore intermittent energies requires energy storage, since energy demand fluctuates much less than supply. However, "thinking" about energy storage requires the development of a technologically agnostic policy, which does not a priori favour either electric batteries or storage in the form of hydrogen (or, for that matter, other forms of storage, such as via electric dams). Similarly, smart grids, equally focused on the traditional subject of interconnections and on the less usual subject of software and decentralised storage (such as via electric vehicles), would contribute to securing energy flows on a European scale. These networks would help to meet the challenges of peak electricity demand while avoiding the need for fossil-fired backup power stations as far as possible.

Carbon capture, particularly for heavy industry, is one of the few 'green' industries in which the United States has invested much more than Europe, and this will accelerate with the IRA. However, any delay will be costly, since these are the technologies that will facilitate the combination of decarbonisation and industrialisation. This does not mean granting a licence to continue to emit carbon, but we must be clear: reducing our carbon emissions rapidly and drastically without mobilising the full range of tools available will be even more complex. We must give ourselves the tools to achieve our goals.

The second major component is to move from an economy of extraction to an economy of production.

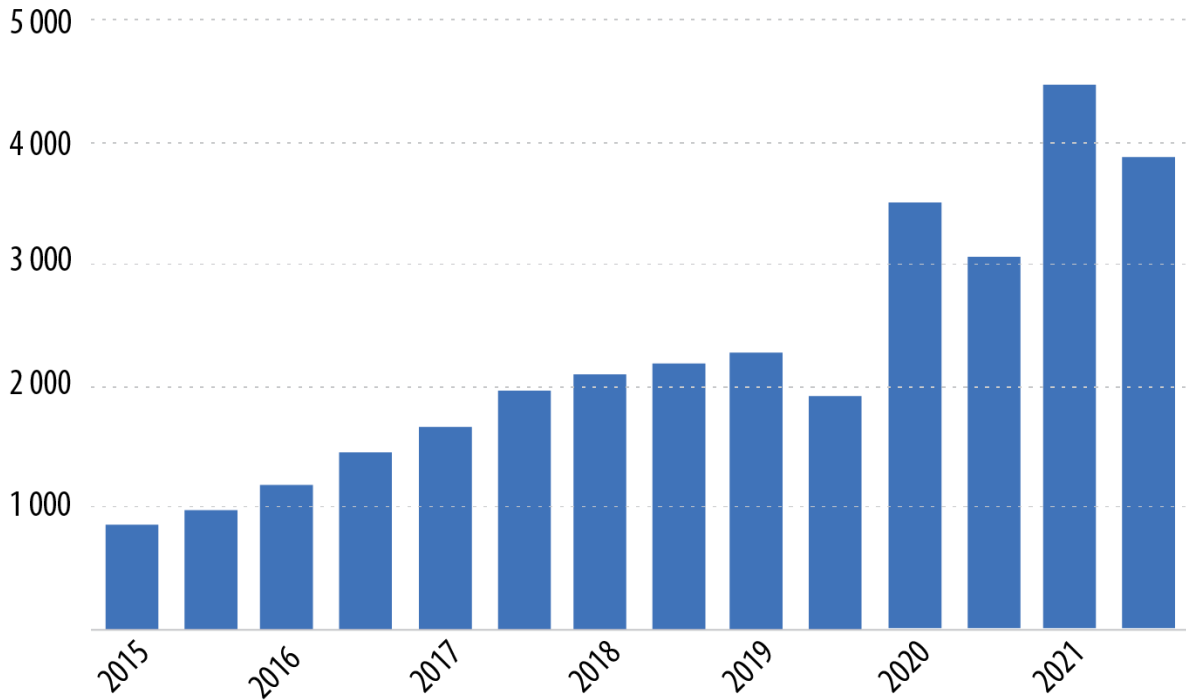
While the war in Ukraine has brought agricultural issues back into the spotlight, it must be said that it has also shown that the European Union, despite the CAP and because of the "Farm to Fork" strategy, is not self-sufficient in food. Yet Europe can position itself as the world leader in green agriculture, by developing regenerative methods, contributing to the fight against greenhouse gas emissions (by improving the quality of soils, such as their capacity to store CO₂) and promoting Europe's food autonomy.

Moving from an extraction economy to a production economy also applies to metals and raw materials. China has a head start in the extraction and exploitation of rare earths. But these are projects that take time to develop, often a decade. We need to improve and significantly increase the recycling of electronic waste, which is currently far too low, develop alternatives and new materials, and in the meantime examine the possibility of exploiting the resources that Europe has at its disposal in a sustainable way.

The third major pillar is health and medicine, the strategic importance of which was underlined by the Covid-19 pandemic.

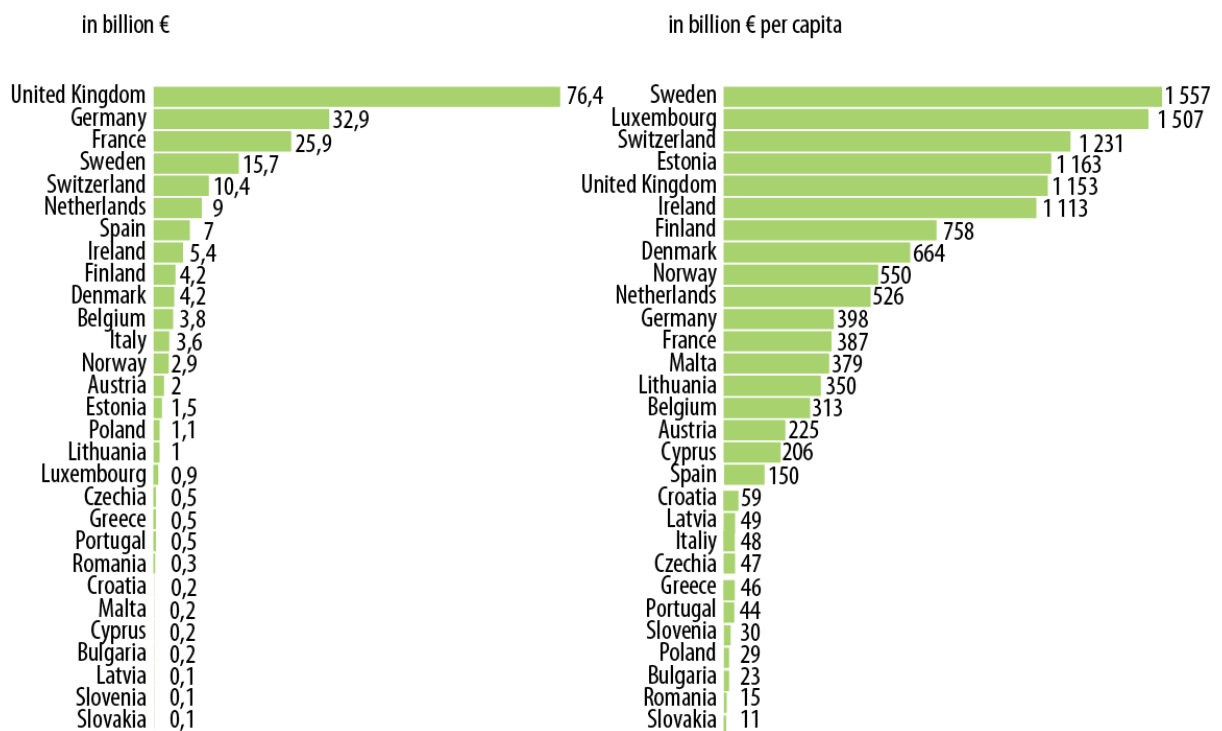
The potential for innovation in health, prevention, diagnosis, and care exists in Europe: we are the continent, along with the United States, that spends the most in this area, both collectively and individually. Within an appropriate ethical framework, the mobilisation of health data, for example on the microbiota, could lead to spectacular advances in terms of preventive and personalised medicine, which would help to break down the inflation of costs and the spectre of a deterioration in care conditions.

Often referred to as the 'silent pandemic', antimicrobial resistance is growing: our antibiotics are becoming increasingly ineffective, and at the same time fewer and fewer antibiotics are being discovered and brought to market. We have seen with Covid-19 that unpreparedness is costly. Mobilisation is urgent, both in the North and the South. There will be further pandemics. It is imperative to draw all possible conclusions from Covid and to have the tools for anticipation, rapid diagnosis and accelerated development of medicines thanks to the digital revolution and artificial intelligence. The European BARDA ("HERA") needs to be there and foster an agile innovation ecosystem.



Total volume of investment in start-ups in Europe by semester (in billion \$)

Credits: Pascal Orcier for the Robert Schuman Foundation, January 2023.



Venture capital financing by country

Credits: Pascal Orcier for the Robert Schuman Foundation, January 2023.

The fourth pillar is digital, with the world having undergone a prodigious acceleration in its digitisation because of the pandemic.

While technology can pose a threat to our democracies (through deepfakes, cyber-attacks or the fragmentation of public space induced by social networks), it also represents a major tool for promoting democracy: during the Arab Spring and the Umbrella Revolution in Hong Kong, these networks helped citizens to assert their opinions and organise. In addition to regulating, Europe has a major role to play in developing democracy-supporting technologies (bypassing censorship, protecting users' privacy, etc.) not only to defend but also to promote its democratic values.

More generally, the issue of data confidentiality, both personal and professional, is crucial: homomorphic cryptology (the application of algorithms on a data set that remains encrypted) or the development of artificial intelligence on reduced datasets are prospects that could enable Europe to change the game in a context in which the GAFAMs have won the first round of the data battle. In short, an alternative path that respects privacy and confidentiality.

Another reality that needs to be admitted is that although we have grasped the strategic importance of microprocessors, the hubs of the digital world, and that we are developing a subsidy programme, the European Chips Act, like the United States, we remain far too short-sighted on how to turn the tables, while our market share is only 10%. This is because we are not mobilising the huge budgets needed for sub-10nm etching, and we lack qualified personnel. Faced with this, we have to think about the next step, whether it is quantum, optical or neuromorphic processors, whose architecture is inspired by that of the brain, and whose computing power is superior for a much smaller amount of required energy.

Finally, the fifth fundamental pillar: education. This is an area in which we need to work twice as hard, both because the next steps forward in Europe can only be made possible by a skilled workforce and because education itself is a field in the throes of a revolution.

Artificial intelligence provides an opportunity to personalise education (in terms of themes and skills), to promote interaction for pupils, and to focus teachers' work on their fundamental added value, i.e. detecting and supporting the most complex learning. More generally, the integration of AI into complex decision-making mechanisms (educational, but also political, strategic and economic) is a major innovation challenge, on which other innovations depend. AI has already played a fundamental role in biomedical discoveries, in the modelling of plasma for nuclear fusion and in the production of new materials. Tomorrow's breakthroughs will come at the intersection of several disciplines: it is this interdisciplinarity, the ability to bring together different perspectives that can and must once again become Europe's strong point, because it is its DNA.

Audacity, more audacity, always audacity

An Apollo 2.0 programme of this kind, which is targeted, ambitious, involving the whole of society, would be a truly European, technological response to the Sorbonne speech of French President Emmanuel Macron in 2017, as well as to the ambitions of a geopolitical Commission of Ursula von der Leyen. A return to the origins of European construction: did the Schuman Declaration not state that *"Europe will not be made all at once, or according to a single plan. It will be built through concrete achievements which first create a de facto solidarity"*?

Let us stop cultivating the anxieties of our European societies by wanting to "protect" them at all costs - a futile undertaking - but let us dare to give ourselves the means to develop solutions that will enable all our fellow citizens to have a better future. Whether it is using AI to renew the performance of our education systems and prepare our citizens for the jobs of tomorrow, producing new materials for our industries and avoiding new dependencies on China or other authoritarian countries, developing climate technologies that can be used throughout the world, changing our modes of agricultural and industrial production by entering an era of generation and not extraction...

Audacity, more audacity, and still more audacity, that is what we need. Then Europe will win.

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