REPORT OF THE FRANCO-GERMAN TASK FORCE ON BREAKTHROUGH INNOVATION

June 18, 2026

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commissioned by:
Ministry for the Economy, Finance and Industrial, Energy and Digital Sovereignty (France)
Ministry for Research, Technology and Space (Germany)

Bundesministerium für Forschung, Technologie und Raumfahrt

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FOREWORD

NICOLAS DUFOURCQ – CEO, BPIFRANCE

The world is accelerating. Technology now shapes the balance of power as much as diplomacy does. Whoever holds nothing in the critical value chains does not negotiate at the table. What is at stake is our model, that of a Europe determined to remain in charge of its own choices. This is why this mission, born in Toulon from a shared Franco-German ambition, matters.

I want to start with what binds us to SPRIND. Tenacity first: the tenacity it takes to make an independent model emerge at the heart of the public sphere, against habits, against procedures, against the comfort of the familiar. Ambition too, and the willingness to do things differently. On the new way to steer breakthrough innovation, our German friends have shown the way. They have proven that such a structure is possible in Europe, that it can recruit, decide, fund, stop, and start again. They are saving us precious time, and time is what we do not have. I thank Rafael Laguna, who has carried this adventure with contagious energy and co-chaired this mission with the same candor.

I also thank the sixteen experts who brought this work to life: five focus groups, twelve hours of dense, frank, sometimes contradictory exchanges. Exactly what we hoped for. This report owes them a great deal.

Their views converge on three requirements. Independence first: it alone guarantees a long-term vision. We see it every day at Bpifrance, wherever we hold real delegation, decisions are fast and results follow. The link to the market next: a breakthrough only counts when it becomes companies, jobs, and industrial positions, a link we have been building for fifteen years with investors and French industry. Cooperation lasts, rather than convergence: each country must build its own capability, so that we can challenge each other as Europeans, carry weight together, and leverage one another.

France knows how to run bottom-up at scale: thousands of startups financed every year. France knows how to run top-down: France 2030 has structured entire value chains. What it lacks is the third dimension, a dedicated entity where a small team of program managers receives full delegation and several years to pursue frontier technology bets. America invented it, Germany then United Kingdom adopted it, Netherlands is setting it up. It is the turn of France.

Because the message of this report comes down to a few words: we know how to do this. Many of the challenges identified by the experts are the ones we have been tackling all along. The point is not to undo what works, but to add the one entity that is missing, building on everything that exists. Discontinuity within continuity.

One condition: the means. Delegation, which is the heart of the model. Funding, equal to the ambition. Speed, because every year of waiting is paid for in lost positions.

RAFAEL LAGUNA DE LA VERA – CEO, SPRIND

Breakthrough innovations are not only a source of economic prosperity but are also increasingly relevant to technological sovereignty—and, by

extension, national security. In recent decades, the US and China have been highly successful in establishing new industries and dominating the associated supply chains.

Upon its founding in 2019, the Federal Agency for Breakthrough Innovation SPRIND was tasked by the German government with connecting its activities across Europe. After all, we Europeans are united by the values of the Enlightenment—liberty, equality, and fraternity—as well as a belief in the validity of scientific knowledge. We stand together for human rights, democracy, and the rule of law.

Since products—and digital services in particular—increasingly reflect the values of their providers, we Europeans face a growing challenge: reducing our reliance on non-European providers for cutting-edge technologies.

An obvious step in this direction is ensuring that the development—and, above all, the industrialization—of new technologies takes place consistently within Europe. The establishment of a French entity for breakthrough innovation is a positive step along this path. Many more must follow.

CONTENTS

INTRODUCTION

Europe is being outpaced on the emerging technologies that will define the next decade. The R&D gap between Europe and the United States or China has reached a point where it can no longer plausibly be closed incrementally, as measured for instance by national investment in R&D, in particular in AI capacities[1]. Still, Europe boasts world-class universities of comparable amount to the US [2], and the combined Franco-German market in particular carries significant scientific and industrial weight to shape these future technologies. A condition is to build, among other initiatives, the institutional capacity for promoting common disruptive innovation initiatives. This follows a key recommendation proposed in the Draghi report [3], urging Europe to escape the middle-technology trap[4] to avoid a slow structural economic decline.

Germany established SPRIND in 2019 as a dedicated agency for breakthrough innovation. France still lacks a dedicated ARPA-type entity with a clear mission to support breakthrough innovation by addressing identified market needs and creating new markets. Such an entity should be endowed with empowered program managers, rapid and flexible funding mechanisms that operate outside the traditional call-for-proposals framework, multi-year budgets with rollover provisions, genuine institutional autonomy, and a high tolerance for project failure.

SPRIND, after years of intense operational learning, now embodies this model in Germany with success. A French counterpart, designed for interoperability with SPRIND from the outset, would bridge this gap and open new avenues for bilateral cooperation in disruptive innovation with increased market opportunities. This cooperation framework could be open to other European agencies interested in developing partnerships on specific programs.

This report, commissioned by the President of the French Republic and the Chancellor of the Federal Republic of Germany within the framework of the Franco-German Ministerial Council, and mandated by the French Minister of the Economy, Finance and Industrial, Energy and Digital Sovereignty and the German Federal Minister of Research, Technology and Space, draws on the analysis of international practice in breakthrough innovation agencies and on insights of high-level experts on this field. It sets out the strategic diagnosis (part 1), existing models for breakthrough innovation (part 2), the need for a new initiative in the French innovation ecosystem (part 3), the design requirements and conditions for its success (part 4), and recommendations for Franco-German cooperation in breakthrough innovation (part 5).

[1] In 2024, gross domestic expenditure in R&D (relative to GDP – OECD data) in the US reached 3.44%, 2.23% in Europe, 2.69% in China (from just 1.98% in 2014). In AI alone, US private investment has reached €265 billion in 2025 (AI Index Report 2026, Stanford University), representing more than the entire public and corporate R&D effort of many European economies combined.

[2] In 2026, 34 European universities are among the top 100 universities worldwide (Times Higher Education), and 35 in the US.

[3] Mario Draghi, The Future of European Competitiveness, Report to the European Commission, September 2024

[4] Fuest, C., Gros, D., Mengel, P.-L., Presidente, G., Tirole, J. (2024). EU Innovation Policy: How to Escape the Middle Technology Trap. IFO Working Paper.

KEY RECOMMENDATIONS

SET THE AMBITION

The proposed ambition is to establish a mechanism that enables to attempt what others consider impossible: to achieve order-of-magnitude advances beyond the state of the art and transform them into new industries, new markets, and entirely new fields of economic activity.

CREATE A NEW ENTITY IN FRANCE, WITHOUT DELAY, INTER-OPERABLE WITH SPRIND

France should establish a dedicated breakthrough innovation entity designed from the outset to be operationally interoperable with SPRIND: similar empowerment of program managers, similar types of funding, similar speed of decision, similar solution-driven approach (starting from problems to be solved, not from projects to be supported), similar approach to intellectual property, and openness to all European candidates. This entity should build on existing ecosystems and complement the current instruments. Speed of launch will be key: the entity should start operating within months, not years.

MAKE AUTONOMY A NON-NEGOTIABLE FEATURE OF THE FRENCH INITIATIVE

Full institutional and operational autonomy, independence from political instructions or from any hierarchy or authority, multi-year budgeting with rollover, the right to allocate funds quickly on a program manager's conviction, and a public narrative for risk-tolerance must be built into the founding architecture.

BUILD A BOLD, AGILE CULTURE AROUND EXCEPTIONAL PROGRAM MANAGERS

The culture of the entity is a design choice: agile, bold, comfortable with risk and with stopping what does not work. The director must combine vision, senior technological and entrepreneurial experience, and international reach. The selection of program managers is the key operational element: exceptional profiles with a disruptive mindset, a demonstrated capacity to take risks and full independence in their decisions. A dedicated institutional setting, exemptions from civil-service hiring rules sufficient to offer industry-competitive terms, time-limited mission contracts of three to five years, and active investment in program manager training are the conditions to attract these talents and to guarantee the independence of the initiative.

TAKE PUBLIC AND PRIVATE NEEDS, OR THEIR POTENTIAL, INTO ACCOUNT AT PROJECT LAUNCH

Reaching the market efficiently requires a credible path to demand: either an identified customer and market need, or, where the market does not yet exist, a clear potential for one to emerge. The State is a possible customer, and public procurement capacity is decisive: without it, even the strongest demonstrators fail to generate the demand signal that makes a technology investable. However, the involvement of established industrial firms is even more important, as anchor clients, co-developers or first buyers, particularly in civilian domains where the State cannot plausibly commit to purchasing at scale.

PREPARE A LEARNING CURVE, AND ALLOW NON-STANDARD PRACTICES

Breakthrough-innovation agencies do not arrive fully formed. The first steps should be devoted to implementing best practices while the first challenges are launched. The objectives stated initially and explicitly should allow for a bootstrapping trajectory through phased expectations, and oversight bodies must accept non-standard practices. Performance should be assessed at the portfolio level, not project by project. Evaluations should be conducted based on the initiative's set-up: established procedures, recruited program managers and process performance such as time-to-money.

SECURE THE PATH TO SCALE-UP WITH DEDICATED FUNDING AND SUPPORT INSTRUMENTS

The continuum to market must be factored in from day one. What matters most is a facilitated access to growth actors, venture capital and industrial firms. Beyond funding, this requires active extra-financial support, access to first customers, introductions to VCs and industrial partners, and hands-on commercial guidance, throughout the support process.

FACILITATE PARTNERSHIPS BETWEEN FRANCE AND GERMANY, AND WITH OTHER EUROPEAN ARPA-LIKE INITIATIVES

The first step is to set up between SPRIND and the French entity a common mission framework and concrete early targets (e.g. coordinated Franco-German challenges). Based on the principle of European cooperation, the Franco-German tandem should attract other ARPA-like agencies (e.g. NADI in the Netherlands) as potential Challenge partners. A coherent European architecture can emerge from a network of lean, fast, open national agencies running joint challenges together

ACCELERATE INTELLECTUAL PROPERTY TRANSFER THROUGH SHARED TEMPLATES

Speed of intellectual property transfer is the most consequential variable in spin-off formation. Pre-negotiated template agreements, of the kind produced by the SPRIND-led IP Transfer 3.0 initiative, can compress release timelines from months to weeks. The new entity in France should develop a comparable standard template with the same principle: intellectual-property stays with the founding teams; the institution's license, where legally required, serves as a protection mechanism rather than a commercial instrument.

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1 THE IMPERATIVE FOR ACTION

1.1 SHIFTS IN THE INTERNATIONAL TECHNOLOGY COMPETITION

Over the past decade, the technology landscape has dramatically changed. China has risen to the first rank in many fields (electric vehicles and batteries, 5G telecommunications, and solar photovoltaics, among others), and is gaining technological advance at a pace that requires a radical change in innovation policies, compressing timelines from decades into years. The United States is also massively investing into technologies that are shaping our future, and technology itself has become an instrument of geopolitical power. In a growing number of domains, Europe now finds itself in need of technology transfer from China (cf. recent negotiations over electric-vehicle and battery factories). Yet together, France and Germany have the scientific and industrial weight to shape the technologies that will define the coming decade by joining forces on common projects in emerging technologies.

Two strategic shifts, taken together, set apart the present moment from a decade ago. The first is the increasing overlap between technology and geopolitics (semiconductor supply chains, large language models, quantum technologies, drones, robots, and autonomous systems are at once industrial and strategic). The second shift is the acceleration of technological innovation [5] : the interval between a fundamental breakthrough and market dominance has narrowed from decades to a few years, maybe even less, as the post-2022 race in artificial intelligence has made plain.

The competitive divergence between Europe, on one side, and the United States and China, on the other, has reached a point where it is no longer plausibly described as a gap to be closed incrementally. The general investment in R&D (gross domestic expenditure in R&D) in the US represents 3.44% of its GDP in 2024 (OECD data[6]), Europe levels at 2.23% and China has jumped from 1.98 to 2.69% in 10 years only.

China has now secured its first place in terms of general innovation strength[7], overpassing the US in 2023 and far ahead of Europe. It now leads in 66 of the 74 critical technologies tracked by the Australian Strategic Policy Institute [8] , with the

[5] World Intellectual Property Organization (WIPO) Report: Technology on the Move. Geneva, 2026. DOI: 10.34667/tind.59025

[6] OECD Data Explorer • Main Science and Technology Indicators (MSTI database)

[7] EU innovation Scoreboard 2025: EU and Global competitors. Directorate-General for Research and Innovation (European Commission)

[8] Australian Strategic Policy Institute (ASPI), Critical Technology Tracker, 2024–2025 edition, Canberra. The 74 technologies span AI, quantum, biotechnology, advanced materials, energy, robotics and space.

remainder led by the United States, and without a single leader in Europe.

In particular, private investment in AI reached roughly €265 billion in 2025 in the US[9], representing roughly four times France's total public and private R&D spending and more than the combined public and corporate R&D effort of France, Germany and Italy.

Investment in deep tech (e.g. quantum, AI infrastructure, advanced materials, autonomous systems) reflects where major strategic advantages are decided, and US companies routinely raise capital at an order of magnitude larger than their European equivalents. Private deep tech investment in the United States rose from $34 billion in 2018 to $151 billion in 2025, while investment in Europe has grown from $9 to $20 billion[10]. In general, the United States produced roughly six times as many "mega-deals" in 2025 (147 vs. 25 respectively funding rounds above $250 million[11]) as the whole of Europe. The valuation of deep tech "unicorns" and decacorns in the US has reached extreme values compared to Europe (4.3 trillion vs. $180 billion respectively), thus aggravating the financial gap and market dominance. Yet, the point made repeatedly by those who work on these rounds is that more public money alone will not close the gap. One deeper cause is the fragmentation of the European market, and also the capacity of states and also large European companies to be customers of breakthrough innovation.

There is, finally, a question of timing intrinsic to breakthrough innovation. By definition, it means acting on a subject before it is obvious to everyone. By the time a technology is widely recognized as strategic, the window for a first-mover position has usually closed. Many of the relevant questions are already visible to those at the frontier, critical raw materials, the decoupling of AI from energy constraints, confidential computing, autonomous systems for ageing societies. We need to concentrate talent and resources on them early, and sustain that focus across political cycles. An instrument that can act only once political consensus has formed, or is dependent to political cycles is, by construction, ill-suited to this task.

None of this means Europe lacks the raw material for competitiveness. Europe's scientific base remains genuinely strong. European universities represent a comparable force compared to the US, with 34 European universities among the top 100 universities worldwide [12] and 35 in the US. Breakthrough patents, though predominantly filed by non-European applicants, cite scientific work produced in European universities in an estimated 30 to 40 percent of cases[13]. One of the problems is the weakness of institutional capacity to carry that knowledge to market at the speed of world class competitors. Therefore, one of the main tasks is to adapt the institutional capacities of European countries so that excellent European science is translated into scaled technology companies before others capture its value. This adaptation should also address the rising threat of the growing position of China in terms of scientific excellence (with now 7 Chinese universities the global top 100) and ambitions of technological dominance in key technologies (such as microprocessors, machine tools, scientific tools, software, advanced materials, bioproduction) as expressed in the latest Chinese 5-year plan[14].

[9] Stanford University, Artificial Intelligence Index Report 2026

[10] Source: Dealroom

[11] Source: Dealroom

[12] World University Rankings 2026, Times Higher Education

[13] A. Bergeaud, "The Past, Present and Future of European Productivity" and related work on breakthrough patents, 2024. The cited share refers to scientific articles authored in European universities among the references of the breakthrough patents studied.

[14] Report on the work of government - Delivered at the Fourth Session of the 14th National People's Congress of the People's Republic of China on March 5, 2026, Li Qiang - Premier of the State Council; "China pledges billion-dollar spending boost for science" (Nature article, March 11 2026)

1.2 IMPACT ON ECONOMIC COMPETITIVENESS IN EUROPE

The European economy is suffering from persistent weak growth. The technological gap with the United States and China is widening. Geopolitical tensions are intensifying competition in innovation and exacerbating one-sided dependencies on suppliers from the United States and China.

This critical situation is reflected in the current Report of the Commission of Experts for Research and Innovation (EFI)[15]: "The German research and innovation (R&I) system faces major challenges: Economic growth remains weak. New technologies, above all artificial intelligence, hold immense potential but also disrupt established business models. At the same time, digitalization is progressing slowly. Geopolitical tensions are intensifying competition in innovation as well as technological, often one-sided, dependencies on suppliers from the US and China. What is needed is a bold R&I policy..."

Consequently, there is an immediate and critical need for breakthrough innovations and deep tech. As highlighted by Philippe Aghion's research on disruptive innovation, policy must aggressively foster creative destruction to pull the economy out of this growth stagnation.

However, current institutional frameworks like the European Innovation Council (EIC) face structural limitations. As analyzed in the current report of the Commission of Experts for Research and Innovation (EFI, pp. 43-45), the EIC in its present setup is sub-optimal for fostering genuine breakthrough innovations. To remedy this, the EFI suggests reinforcing the European Innovation Council (EIC) and fostering direct bilateral or multilateral cooperation between agile national agencies. This decentralized, agency-led cooperation, already modeled by initiatives like the partnership between SPRIND and Vinnova, provides a flexible and impactful pathway for disruptive tech funding, complementary to initiatives at the European Union level.

[15] Commission of Experts for Research and Innovation (EFI), Berlin (Ed.) (2026): Research, innovation and technological performance in Germany - EFI Report 2026, EFI, Berlin.

2 ARPA-TYPE AGENCIES: INVARIANTS AND INSIGHTS

2.1 THE MODEL AND ITS INVARIANTS

DARPA was created in 1958 in response to the Sputnik shock, with one mission: to prevent the United States from being technologically surprised again. Over six decades it seeded the internet, GPS, stealth, autonomous vehicles and mRNA vaccine platforms. It does not work like a research-funding agency. It orchestrates breakthroughs, connecting frontier science to prototyping and adoption, rather than allocating grants by peer review.

Five features have stayed constant across its history and define the model: empowered program managers recruited on three- to five-year rotations with near-total autonomy and a flat hierarchy; mission-oriented, time-bound programs built around a capability gap, with several teams pursuing competing approaches; a high-risk, high-reward posture where many programs are expected to fail; connected science, where each stage from research to transition is linked; and institutional independence, with a direct line to the Secretary of Defense outside normal procurement bureaucracy. A detailed description of DARPA's organization, budget and signature programs is in Annex A.

Germany created SPRIND in 2019, the first serious European transposition of the model, on the premise that its innovation system excelled at incremental improvement but lacked the capacity for radical bets. SPRIND operates in the phase between proof of feasibility and market-ready prototype (roughly TRL 3 to 7). It was set up as a limited-liability company wholly owned by the federal state, to escape the rigidity of public administration, and the 2023 SPRIND Freedom Act gave it the operational autonomy that matters: private-sector financing instruments, faster decisions, and a workable balance in which project failures count as a normal part of the process.

Two features are most relevant for a French counterpart. (I) SPRIND funds through two routes: top-down Challenges (European-wide mission competitions, selection in about two weeks, multi-stage with go/no-go) and bottom-up proposals open to anyone at any time. (II) SPRIND's IP approach keeps the intellectual property with the funded teams, the agency retaining only the non-exclusive license required under state-aid law, which makes transfer fast. A detailed description of SPRIND's governance, funding instruments and evaluation is in Annex B.

2.2 COMMON CHALLENGES FOR ARPA-TYPE AGENCIES

Institutions built to promote breakthrough innovation tend to fail in a recognizable way. An initial phase of genuine agility and announced autonomy gives way to progressive bureaucratization and interference as the institution accumulates administrative capacity, reporting obligations, disorganized control and evaluation initiatives, and political visibility. The original DARPA, specifically charged with preventing technological surprises[16], had to invent its procedures accordingly.

Three failure conditions deserve particular attention:

- **Political interference.** Not only in the form of direct instruction, but, more insidiously, through normal and legal procedural constraints like compliance with public financial-engagement rules, the inability to carry budgets across fiscal years, reporting formats designed for parliamentary scrutiny rather than scientific assessment. This also means that **a breakthrough entity needs a "protector" capable of defending all the independence and autonomy principles, and change adapt the rules in accordance to what law permits.**

- **Deviation from objectives.** If an instrument is seen to work, the temptation to load it with further objectives is strong and nearly irresistible. An instrument built for high-risk early-stage bets cannot simultaneously be a regional-development tool, a social-cohesion mechanism and a vehicle for signaling commitment to a favored sector.

- **Absence of a global narrative for risk-tolerance** (a point already raised in Chapter 1 in the discussion of the conditions for success, and revisited here from the institution's side). Programs operating at the frontier will produce visible failures; without a strong and stable institutional capacity to explain why a given bet was rational, conservative forces will use those failures to argue against bold investment, gradually pushing the portfolio toward safer, more defensible projects.

An underlying requirement is the capacity to evolve. The technological frontier moves continuously and ever faster, and an institution designed to stay static will drift out of alignment with the frontier it is meant to address. The ability to attract new kinds of expertise, to revise its performance frameworks, to close programs and open new ones, is not a secondary nicety but a first-order design requirement. Being the feature most at odds with permanent-institution logic, it needs the most deliberate protection from the outset. SPRIND was not perfect at the start, but it has since 2019 accumulated experience and organizational knowledge that has very high value for German innovation policy. This experience has accumulated since 2016 when Chancelor Angela Merkel initially stated her belief that an independent agency was the right path to follow.

[16] Funding A Revolution: Government Support For Computing Research. Committee on Innovations in Computing and Communications, National Research Council. National Academy Press Washington, D.C. 1999

3 CREATING A NEW BREAKTHROUGH INNOVATION ENTITY IN FRANCE

3.1 THE FOUNDATIONAL HERITAGE OF FRANCE 2030

Launched in 2021 and endowed with a multi-year budget of €54 billion, France 2030 represents one of the largest public investment schemes in innovation, technology and industrial transformation in Europe.

A distinctive feature of France 2030 is the diversity of intervention methods employed. Rather than relying on a single innovation model, the program combines: mission-oriented innovation, bottom-up entrepreneurship and frontier scientific research. Across these approaches, support is delivered primarily through grants and repayable advances, complemented in some cases by innovative public procurement mechanisms and equity investments.

Mission-oriented innovation

The first category consists of mission-oriented programs in which public authorities define strategic priorities, technological objectives and expected outcomes. These instruments support different stages of maturity, from technology development and demonstrators to industrial deployment and scale-up.

The main tools include calls for proposals, technological challenges and innovative public procurement. The Proqcima program provides one of the closest French examples of a challenge-based procurement approach. Rather than simply funding research, the State acts as a future customer by procuring a fault-tolerant quantum computer meeting predefined performance requirements. All key French startups of the quantum computing ecosystem compete to reach the same objective, combining technology-push and market-pull mechanisms.

Bottom-up innovation

The second category supports innovation emerging from researchers, entrepreneurs and start-ups themselves.

The principal instruments are the innovation competitions i-PhD, i-Lab and i-Nov. Unlike mission-oriented programs, public authorities do not define a specific technological solution in advance. The objective is instead to identify promising innovations and support their progression towards

commercialization. These programs play a central role in deeptech entrepreneurship and technology transfer.

Fundamental and exploratory research

The third category supports the generation of new scientific and technological knowledge at lower technology readiness levels.

PEPRs structure national research efforts around strategic domains identified by public authorities, including artificial intelligence, quantum technologies, cybersecurity, hydrogen, batteries and health. Exploratory PEPRs complement this approach by investigating emerging scientific fields whose future technological importance remains uncertain.

France 2030 has also strengthened support for breakthrough science through dedicated Research-at-Risk programs implemented by major national research organizations such as CNRS, CEA, Inria, Inserm and INRAE. Unlike PEPRs, which are organized around priorities defined by public authorities, Research-at-Risk programs rely on a more bottom-up logic in which scientific opportunities are proposed by researchers themselves and selected by research organizations. These programs operate through multi-year funding frameworks and grant a high degree of scientific autonomy to project leaders.

Selected projects explicitly target highly uncertain research avenues with a significant probability of failure but potentially transformative outcomes. Although the primary objective remains scientific discovery, successful projects are expected to generate intellectual property, technology transfer opportunities and, in some cases, future deeptech start-ups. Research-at-Risk programs therefore represent the closest French equivalent to the "high-risk, high-reward" philosophy associated with ARPA-type organizations.

The Deeptech Plan

The Deeptech Plan also illustrates how this funding has been turned into a systemic intervention: close to €10 billion deployed since 2019, of which €6–7 billion in innovation grants and soft funding, €2.2 billion in direct equity investment and €2.1 billion in fund-of-funds commitments to private GPs. This continuum, implemented by teams at regional and national levels, helped French deeptech startups raise €20 billion over the period.

Deeptech investments multiplied by four between 2018 and 2025, making France the leading deeptech market in Europe. The position of French deeptech ecosystems in international rankings confirms this trajectory (2,300 active deeptech start-ups in France[17], and Paris ranking as Europe's leading start-up ecosystem[18]).

France therefore does not start from an institutional blank page when it comes to breakthrough innovation. Through France 2030, it already possesses many of the building blocks commonly associated with breakthrough innovation systems, including long-term and multi-annual funding, challenge-based approaches, support for high-risk research, deeptech entrepreneurship mechanisms and strategic public procurement. However, a different methodology needs to be added to the country's portfolio of support mechanisms.

[17] Dealroom data

[18] Dealroom Global Tech Ecosystem Index 2025

3.2 FILLING EXISTING GAPS IN THE TRADITIONAL INNOVATION POLICIES

Traditional innovation policies can be effectively augmented by an ARPA-like approach. ARPAs have demonstrated this complementarity in the United States, and SPRIND has shown that this method can be adapted to the European context.

Firstly, the potential exclusion of the best disruptive projects from existing mechanisms or the lack of attracting them in the first place represents a risk in the global technological competition. Calls for proposals can administratively be complex enough that small and mid-sized firms have difficulties responding without specialist intermediaries, with the risk that productive researchers and innovators stop applying due to lack of time. The application and reporting burden precisely slows down companies that could have succeeded without it. The implication is that the new breakthrough innovation entity should deploy money far faster, while being correspondingly rigorous in its scientific and technological assessment, and allowing for faster termination of funding if objectives are not met.

Secondly, the lack of equilibrium between technology-push and market-pull capacity and decision autonomy curtails the capacity to fast-track strategic innovations to the market. The prevailing model among Europe's major public innovation investors is demand-driven: funds flow to projects that meet pre-set criteria rather than bets on emerging technologies, and projects reviews are based on consensus between experts and government institutions. The ARPA and SPRIND models rest on program managers with full authority to make risky bets based on their technological conviction and demonstrated expertise, rather than committee-approved checklists. The absence of this feature from the current French approach to innovation policy is an institutional gap, not a funding gap. Allowing this level of decision freedom requires adequate institutional autonomy and shielding from political and institutional interference. SPRIND's experience shows that this autonomy is far easier to build into the agency's founding architecture than to acquire afterwards as it did through the 2023 Freedom Act.[19]

Thirdly, the demand side receives diffuse attention, although being a very binding constraint. European deeptech companies report consistently that finding a first customer in Europe is harder than in the United States. This matters not only for revenue but for the co-development relationships that are decisive in fields where market reach at scale can only be crossed through intensive interaction with end users. A high leverage response is to increase the capacity of States to become customers of innovation, not only funders. An even higher leverage response on the demand-side deficit would be to connect better start-ups to large companies.

And fourthly, traditional innovation policies are sometimes too weak on anticipation and foresight in market-oriented innovation funding tools. The fields that become breakthroughs may be precisely those with few publications and few established experts, which means any process relying on expert consensus systematically under-ranks them. A new instrument needs an anticipation capacity potentially decoupled from the expert consensus of the day. This is possible through close ties with academic research to source innovations, and requires the possibility to make bets and allow for project failure and quick project termination. The fail-fast strategy is a safe way to balance the necessary initial financial investment.

[19] Bundesministerium für Bildung und Forschung (BMBF), SPRIND-Freiheitsgesetz, BGBl. 2023 I Nr. 391, December 2023.

3.3 INCREASING THE FOCUS ON MARKET-CREATING INNOVATORS

A recurring source of innovation-policy failure is the tendency to treat fundamentally different candidates as if they were the same. Three categories of technology champions can be distinguished, and any breakthrough innovation policy must set its main target accordingly:

- Market-creating innovators that generate value by creating entirely new markets. They should be the primary focus of innovation policy, and require patient capital, regulatory flexibility and competitive experimentation. Rather than selecting a single winner ex ante, governments should support several competing approaches and let outcomes determine success.

- Strategic-asset firms that derive value from controlling critical technological bottlenecks. They may warrant targeted industrial support where clear security or resilience interests are at stake, but their rationale differs fundamentally from that of market-creating innovation.

- National-prestige players serving geopolitical visibility objectives. Supporting them may be justified, but doing so should not come at the expense of policies aimed at generating new markets and technologies.[20]

This categorization can be combined with the founding paper[21] that laid the strategic approach of what was going to become SPRIND. The proposed agency for the promotion of breakthrough innovations was designed to support the implementation of projects that are expected to be of great significance for the future resolution of a key challenge, promise novel approaches that go beyond the limits of current technologies and existing practice, and are fundamentally suitable for being translated by market players into new products and services or utilized by the state on a large scale. For a French breakthrough entity, **the central objective could therefore be to maximize the emergence of market-creating innovators, while treating the other two categories as exceptional cases requiring distinct justifications.**

It is worth noting that small and medium-sized firms and start-ups have been supported with success in France 2030 and Germany's High-Tech Strategy programs. This support has been delivered through the logic of classical innovation policy — market-pull, business-case-driven, risk-mitigating — rather than through a dedicated, ARPA-type approach designed for disruptive bets.

This approach is legitimate and is even necessary to support the vast majority of innovation projects with a wide impact on global competitiveness. Where attention and capital concentrate on a small number of already-visible firms, as can happen when a single national champion comes to symbolize a country's position in a field, the competing approaches that might have produced the next breakthrough receive comparatively little. For the market-creation category specifically, this picking-the-winner strategy may hinder valuable candidates with a viable breakthrough technology.

A further consideration concerns market positioning. Competing head-to-head with the United States and China where they already enjoy decisive scale advantages (e.g. AI large language models in 2026) is a strategy uncertain to yield European leadership. A differentiated strategy, targeting domains where European capabilities are already strong and where scale does not yet determine the outcome, should be privileged (e.g. AI small language models, where European teams have shown real competitive capability and where energy and efficiency constraints create a structural advantage).

The breakthrough instrument itself should be positioned with regard to a full map of what

[21] D. Harhoff, H. Kagermann and M. Stratmann (eds.), Impulse für Sprunginnovationen in Deutschland, Acatech DISKUSSION, Munich: Herbert Utz Verlag, 2018.

already exists, and tasked to deliver only what the existing system cannot. In particular, building "integrated champions" in the vertically integrated model of US Big Tech is probably not a desirable target for France and Germany.

3.4 COMPLEMENTARITY IN THE EXISTING ECOSYSTEM

A new entity dedicated to breakthrough innovation would therefore complement general innovation plans such as France 2030 (and its successor in the future) as a response to the new challenges in the international technology landscape, while keeping a high level of ambition in its organization and targets. This new instrument should work closely with Bpifrance teams in charge of the innovation continuum. Bpifrance operates financing instruments covering every stage of company maturity, from small emergence grants to equity investment, implemented by teams at regional and national levels, together with support programs on strategy, industrialization and access to European funding.

It would provide a different project sourcing method and competitive selection of the best talent and teams, to address specific technological challenges that are directly useful to a French economic sector (market-pull), within a specific framework of independence designed for maximum agility, risk-taking and therefore potential upside.

From the outset, it should adopt a cooperative approach with SPRIND in order to leverage their experience (more than five years of learning and adapting the DARPA model to the European context) and to reach a critical mass of science, companies and markets present in both countries.

This instrument would also be beneficial to the national research policy, by offering a complementary pathway and means of technology transfer for selected projects emerging from public laboratories that have demonstrated a very strong market potential.

4 CONDITIONS FOR SUCCESS OF A NEW BREAKTHROUGH INNOVATION ENTITY IN FRANCE

4.1 TRANSPOSING BREAKTHROUGH INNOVATION MODEL INVARIANTS IN A NEW INITIATIVE

International breakthrough innovation agencies show very specific invariant design choices: a culture of ambition where the working standard is to attempt what others believe impossible; genuine organizational and individual autonomy; program managers with vision, technological passion and real decision authority; resources concentrated at meaningful scale; and flexibility and speed in hiring, contracting and deploying funds. Experience from practitioners of such agencies indicates that the absence of any one of these features does not only weaken such an institution, but may lead to its failure.

What is contingent across these models matters as much as what is invariant, and is easy to underestimate.

DARPA's effectiveness has relied in a large part on the Department of Defense acting as the anchor customer, supplying the demand side that makes advanced market commitments and procurement-based prizes operationally credible (GPS being a familiar example). In most civilian sectors however, the State cannot plausibly commit in advance to buying at scale, so the pull mechanisms that work in defense transfer only with adaptation. This is the institutional-design counterpart to the demand-side deficit discussed in Chapter 1. The procurement reforms identified there, making the state a customer of innovation, opening public contracts to young firms, are what a civilian breakthrough instrument would need in order to reproduce, even partially, the pull that defense procurement gives to DARPA.

Moreover, some important requirements can be specified:

- **Resources have to be concentrated**, including between European countries. Individual DARPA programs run at portfolio budgets in the tens of millions of euros[22], sums that buy a set of mutually reinforcing projects pursuing one goal, not isolated grants. Adjusted for GDP, a German equivalent would warrant a budget several times SPRIND's current envelope, and any structure aspiring to Franco-German and European reach would need to be larger.

- **Capital spread too thinly across too many programs** must be averted to avoid reproducing the sub-critical pattern that characterizes disappointment in some innovation programs in Europe.

- **Flexibility must also be addressed at the legal level**. DARPA's Other Transactions Authority[23], defined by what it is not, neither a standard grant nor a conventional contract, provides a basis for almost any arrangement of mutual benefit between the agency and its partners, and is much of what makes fast funding and short milestone structures workable inside a public body.

- **Call-for-proposals system should be avoided**, as it tends to select organizations skilled at navigating complex application procedures.

- **A disruptive innovation program is intrinsically different from advanced scientific infrastructure platforms, but they may complement each other**. Synchrotrons, CERN and space observatories are mission-driven, led by a manager with a clear goal, and able to bring companies, start-ups and academics together while being flexible and long-term at once. They have arguably put Europe at the frontier in several sciences. A European bio-foundry (a shared engineering platform spanning agronomy, vaccines and DNA storage) would also be a concrete possibility in a domain where health, food and the bioeconomy represent around a quarter of European GDP and where European strengths are real. Cooperation with existing or future scientific platforms may an avenue to increase the reach of disruptive innovation and may be explored further.

4.2 THE ENTITY MUST BE ACCOUNTABLE BUT WITHOUT BUREAUCRATIC OVERHEAD

The first design choice concerns the unit of accountability, which must be suited to the targeted risk structure. In a portfolio where a small share of programs carries most of the value (roughly a tenth of the projects), judging individual projects against their expected outcomes sends misleading signals. Most programs will look like failures by conventional measures. **Reporting therefore has to operate at portfolio level,** focusing on the aggregate performance of the entity's bets rather than the outcome of each, and should be limited to the sponsoring ministry minimal requirements. Having a low rate of failures could be

[22] DARPA Agency Financial Report FY2024; the agency reports roughly 100 program managers and around 300 active projects, with individual program budgets typically in the tens of millions of euros once converted. The figures denote portfolios of mutually reinforcing projects, not single grants.

[23] Other Transactions Authority: a contracting mechanism defined by exclusion (neither a standard grant nor a Federal Acquisition Regulation contract), giving wide latitude to structure agreements with non-traditional partners. See DARPA contracting guidance.

a sign of insufficient ambition and overlap with already existing tools.

Performance indicators (KPIs) need to be fixed during the founding stage and left stable once programs are running. The appropriate benchmark is not only the number of projects funded or companies created but whether the entity is credibly expanding the technical frontier and opening paths from idea to deployment that would not otherwise exist.Phased expectations would be most suited: the bootstrapping years (roughly the two first years depending on national specificities) could demonstrate established procedures, appropriate program managers and first challenges, not yet disruptive technologies. The impact of a high level of process performance (as time-to money) is not to be underestimated, as well as the potential development of new approaches to governance efficiency model applicable to other operators.

Quantitative targets are nonetheless necessary. A challenge framed only in qualitative terms cannot be appropriately evaluated or used to guide strategy. **A disciplined way to set them is by asking, for each program, what is being attempted, what the limits of current practice are, what is genuinely new in the approach, and how success would be measured.**[24]

The 10x order-of-magnitude criterion, the idea that a solution should address a problem at least ten times better than existing technologies, ensures that the ambition is genuinely disruptive. Below such a threshold, the challenge is unlikely to produce outcomes that justify the institutional overhead of a dedicated program. Above it, the risk profile is consistent with the portfolio logic on which breakthrough innovation agencies operate. More generally, selection criteria include;

- The problem must carry deep strategic or societal stakes such as sovereignty implications, or social impact.
- The solution should have systemic downstream effects and exert general externalities
- An ecosystem of actors sufficiently mature to mount credible responses must exist, or be capable of being assembled.
- The domain must be characterized by high risk and fast technological competitive dynamics.

Quantitative indicators must be calibrated on results rather than the means employed. In terms of budget temporality, multi-year budgeting with rollover of unspent funds is the appropriate framework. An entity on annual cycles cannot sustain long-horizon programs or adapt to the variability of breakthrough innovation timing.

Another category of KPIs could address the development of the entity's links with the innovation ecosystem. Relationships that make the handover work, with procurement bodies, venture funds, industrial partners, is part of the entity's task. The wider conditions that determine whether fast-growing high-technology firms stay in Europe lie beyond the entity's authority but ultimately decide whether its outputs create lasting European value. **Engaging with them from the outset could be a strategic orientation made explicit in the entity's mandate.**

Administrative simplification must be a constant, deliberate and granular process to guarantee efficiency and rationalization of the workflow as well as preventing the transfer of misaligned rules. SPRIND's experience demonstrates the feasibility of this effort. For instance, one reform proved particularly useful: replacing mandatory application forms with documentation start-ups already produce (pitch decks, investment memos, data rooms) which carries the same information.

[24] On the questions a program should be able to answer — what is being attempted, the limits of current practice, what is new in the approach, who will care if it succeeds, and how success will be measured — see the "Heilmeier Catechism," after George H. Heilmeier, DARPA Director 1975–1977 (darpa.mil). The "10x" or order-of-magnitude target is better understood as a heuristic of moonshot culture (associated with A. Teller and Google X) than as a formal DARPA rule.

4.3 INDEPENDENCE SHOULD BE GUARANTEED ON A LEGAL, PERSONAL AND INSTITUTIONAL BASIS

Independence is a fundamental governance feature conditioning the entire initiative. An entity that cannot decide on programs without external validation, cannot carry budgets across fiscal years, and turns down ambitious projects in favor of safer ones cannot achieve its objectives.

The independence has to be institutional, grounded in legal status, financial autonomy and formal protection by administrative institutions from political interference. It must also be operational, with specific procedures from action rather than the standard procedures of a state operator. Independence does not however mean the absence of accountability: SPRIND combines explicit governance, documented decision processes and defined rights over fund allocation and program termination. These structures make its independence sustainable on a long-term basis.

The personal independence of the director is hard to secure in formal terms but is as important as institutional independence. In its early years SPRIND benefitted greatly from its director's exigency to refuse low-risk projects, to absorb criticism when experiments failed, and to resist the pull of political optics. A fixed and non-renewable term could prevent hierarchical interference and foster the possibility for a director to exercise such latitude. Depending on contextual specificitis, a hybrid governance could also be considered with a fixed five-year term and a possible eligibility for one reappointment. As for the supervisory board, its role should be to provide strategic oversight without stifling agility.

There is no consensus on the necessity of a dedicated law to protect the entity's independence. Many of the freedoms associated with SPRIND's 2023 autonomy law could in principle have been reached by other routes,[25] and access to a legal tool is not a guarantee in itself. Still, a dedicated legal basis offers stronger protection, clearer legitimacy and freedom from administrative inertia. If such a law is not immediately available, the design principle should be to integrate the independence requirement in the founding architecture rather than to build it ex post. On this subject, the long SPRIND experience is an asset for a future French ARPA-like entity.

Linked with the issues addressed above, the supervisory board raises a genuine and unresolved tension. A board mixing independent experts with ministerial representatives (SPRIND model) can hold the director accountable for mission performance while staying out of program decisions, combining accountability with operational insulation. The opposing view holds that any board layer between the state and the director departs from the ARPA model, which runs through a direct line to a senior political figure with no supervisory board. The appropriate architecture depends on institutional context, the nature of the addressed markets (military, dual, civil), the sponsoring government's risk tolerance, and the trust established at the founding stage. The German board format may reflect German circumstances, and whether France needs an equivalent or should grant the director greater direct freedom from the outset is left open. What both views share is that the board must not become a program committee.

[25] Bundesministerium für Bildung und Forschung (BMBF), SPRIND-Freiheitsgesetz, BGBl. 2023 I Nr. 391, December 2023. See also the discussion of legal autonomy in Chapter 2.

4.4 BUILDING TRUST WITH THIRD PARTIES IS AN ESSENTIAL CONDITION FOR SUCCESS

Strong trust between the entity and its supervising ministry requires sustained performance, transparent process and relationship management. For SPRIND, it is the result of 7 years of organizational learning. As the agency and the involved ministries differ in culture, time horizon, risk aversion and benchmarks, trust must be built. Some practices consistently lower the risks of conflicts such as frequent contact, inclusion of ministry staff in the entity's event and visible sharing of credit for success. Joint media appearances presenting a ministry-entity tandem could be valuable. Capable people on both sides can fail to build trust if the institutional setting is too adverse, and many classical innovation policies badly designed on governance have experienced these kinds of setbacks, generating systemic under-performance.

It also helps to agree in advance on the domain of legitimate disagreement. Some matters are mandatory, in particular abiding to applicable legal frameworks, basic accountability, and fidelity to the founding mandate. But the entity must be free to diverge from any form of authority linked to the political sphere, in the specific bets it makes or the projects it funds or rejects. Two SPRIND episodes illustrate healthy disagreement: a procurement instrument used in a legally valid way that the sponsoring ministry first refused, validated via another ministry before being accepted; and challenges that ministerial leadership openly called unreasonable but which the agency pursued anyway. In both, resolution rested on a prior shared framework separating what was subject to ministerial authority from what was not.

The hardest trust problem is often more inter-ministerial than between the ministry and the entity. The implication for any new institution is that the quality and commitment of the ministerial team that champions the entity within government is at least as important to success as its own governance.

Trust, finally, has to extend to the institutions positioned further along the innovation chain, which will carry technologies onward once the entity's programs have delivered their output. For instance, Norway's arrangement, in which projects are deliberately passed from one body to another as they move from experimental to scaling stages, is one reference for managing that handover without losing continuity[26]. Designing the handover logic at the founding stage, rather than improvising it later, is a governance choice that materially affects the entity's ultimate impact on the system.

4.5 THE STATE'S ROLE SHOULD BE BOTH AS A PROTECTOR AND CUSTOMER

The state's role is not to manage programs but to lay out the conditions under which the entity works, to co-define its mandate and defend its independence. Scrutiny is not illegitimate in itself

[26] Norway operates distinct bodies along the innovation chain — the Research Council of Norway (Forskningsrådet) upstream, Innovation Norway for enterprise development and scale-up, and Siva for incubation infrastructure — with projects passing between them as they mature. The arrangement is cited here as an illustration of a deliberate handover logic, not as a turnkey template.

but could collapse the accountability bargain and the basis for responsible risk-taking. A shared sponsorship, with different ministries, can strengthen the entity's position and negotiating power (an approach used in Austria) but could decrease the will of a ministry to act as a protector due to a dilution of responsibilities.

The state's role is also to serve as a customer for the innovations it helped foster. A strong structural gap in current European designs, identified in the German experience and confirmed comparatively, is the missing link to public procurement. DARPA's Other Transaction Authority, which lets it operate outside standard acquisition rules connects development and deployment. It makes DARPA's model a benchmark in defense. Europe's pre-commercial procurement instrument is a first step. The next step, procurement of products the state helped develop, is a difficult challenge: ARPA-E is often judged a weaker variant of the model precisely because this downstream link is thin.

However, it is also important to note that procurement is double-edged for the small teams best placed to produce breakthroughs. Procurement delivers a strong demand signal and early revenues but remains complex and uncertain, potentially becoming a burden for the start-ups it seeks to help. Moreover, it raises the question of artificial public demand and wrong market orientations. An example of practical move is to identify one public entity that already procures innovative technology at scale, in defense, health or energy infrastructure, and to engage it as anchor client from the outset, giving both a concrete market signal and a testing ground for more flexible arrangements

An important tradeoff concerns the output for the entity's direct investment. The demonstrator approach, used in most ARPA-like agencies, argues that the entity should limit itself to bring the technology to the point where an investor can take over for product development. This concentrates the effort in the high-risk early phase where it is most needed. The MVP (Minimum Viable Product) suggests that the entity should bridge the gap to an MVP to facilitate private investment. This could be left for decision by program managers depending on technological domain: for breakthrough hardware technologies with long development horizons, the demonstrator standard is more appropriate; for software-intensive or platform technologies, the MVP threshold may be reachable within the operational scope.

4.6 BRIDGING BREAKTHROUGH INNOVATION PROGRAMS AND MARKETS

A breakthrough program that produces excellent demonstrators but with no market value has solved the wrong problem. The connection to the market therefore has to be designed into a program from the outset, not assembled once a technology reaches demonstrator stage. The most important systemic lever is demand: demonstrated demand activates liquidity, liquidity attracts private capital, private capital permits greater technological risk-taking and sustains the specialized funds deep tech requires. Demand can be boosted by public procurement and by enhancing the connection of disruptive innovations with large European industrial companies when opportunities are identified.

Advanced market commitments and challenge prizes are structurally distinct from both grants and standard procurement. They pay out contingent on demonstrated performance rather than on the mere existence of a product, committing public money toward an outcome while leaving the method open, such as "develop a safe and effective vaccine and we will buy 300 million doses". Their

proven use in the vaccine domain, drawing private co-investment toward a defined target before the technology existed, shows their wider potential. However, they require exactly the anticipatory, goal-setting capacity that European governments have found hardest to sustain. Some European countries experience with more direct demand-side tools, such as feed-in tariffs for solar power, is a reminder that generic subsidies are politically costly and poorly targeted at breakthroughs; instruments designed specifically for breakthrough performance behave differently. A complementary idea raised is a joint public-private financing vehicle in which public money, banks and other financiers enter together, with the public side leading, rather than operating in separate silos, so as to assemble larger pools of capital along the path to market.

Market fragmentation and lack of financial continuum in Europe is a risk for breakthrough innovators. As long as the continental upside available in the United States or China exceeds Europe's, investors will be attracted there, and the largest European deeptech rounds will keep being led by non-European capital. A large, risky bet is rational only if the reward at scale is proportionate, and a purely national upside is too small for the risk: any new structure should therefore be built to offer investors a genuinely continental upside.

Two design implications follow. First, breakthroughs are typically assembled from innovations originating in several places, not carried from a single idea. The mRNA vaccines are the consequential illustration: the decisive step was not only the core platform but the parallel funding of lipid-nanoparticle delivery, developed across several countries, without which the vaccines could not have been administered [27]. Constraining a program to national borders, or to the scope of one lead team, forecloses the assembly of exactly these complementary pieces. SPRIND has funded European cooperation from the start. Second, the valley of death between demonstrator and scaled product has been crossed, in the successful cases, not by picking a team but by funding the technological goal and assembling around it the parallel technical components and commercial connections a full system needs. Scale-up investments in a breakthrough innovation initiative are also needed for success.

4.7 ADDRESSING THE PROGRAM MANAGER BOTTLENECK

The potential lack of people who have the background to act as program managers may constrain an ARPA-type instrument. Their role has little in common with its conventional public-sector namesake specialized in managing either research program or classical market-pull scale-up support programs. **An ARPA program manager is a radical thinker, proponent of a technological challenge, and is personally responsible for delivering real-world results. They formulate an ambitious technical goal and demonstrate credible capacity to deliver. They exercise wide discretion over portfolio composition and partners, make technological bets that bypass peer-review consensus, and treat a high failure rate as an expected feature of their work.** A conventional program manager, by contrast, funds the highest-scoring reviewed proposals and ensures procedural compliance. These are different occupations and both of them are needed in a global innovation policy.

[27] On the mRNA case and the role of complementary lipid-nanoparticle delivery technologies funded in parallel across several countries, see Renaissance Philanthropy, International Benchmark of Coordinated Research Programs, January 2026, and the program literature cited therein.

As Europe has until recently had no ARPA-type institutions, no pipeline of people has been established, no career path has formed around it, and no setting has existed to train or even to recognize these profiles reliably. The difficulty is compounded by a self-selection effect noted by practitioners: the people who fit (the fraction combining drive, anticipation and technical depth) tend not to join institutions that do not already contain like-minded people, which makes a dedicated institution something closer to a precondition than a consequence. And the profile required today is arguably more demanding than in 1958 when DARPA was created: modern program managers must be polymathic, technically rooted across several disciplines, opinionated, embedded in the ecosystem rather than desk-bound, and willing to work without the financial upside available in a big tech company.

In order to address the possible shortage, a dedicated institutional setting must be designed to attract the talents, offering exemptions from civil-service hiring rules sufficient to offer terms competitive with industry. Time-limited mission contracts of three to five years keep managers focused on the program rather than on career advancement. Working in such positions should be recognized in itself as a valuable addition to one's career.

This requires a highly visible and reputable profile of the organization, with a culture in which failure in pursuit of ambitious bets is publicly explained and fully acknowledged. Particular attention should be given to the identity and branding of the agency, which must project an image of exceptional ambition and liberty.

4.8 A JOINT SETTING FOR INTELLECTUAL PROPERTY AND INDUSTRIAL VALORIZATION

Empirical evidence on IP management in public programs shows that public entities' attempts to extract returns from IP increases the risk of program failure. Stanford and MIT (the reference cases) succeed by distributing IP to founding teams and recovering value through the tax base of the companies they help create, in addition to alumni donations, and not through direct IP revenue.[28] Such evidence suggest that IP generated by joint programs should stay with teams, and the institution's license should work more as a protection than a commercial instrument.

SPRIND has already embraced this idea as a key operating principle. In their Challenge format, funded teams own the IP and SPRIND retains only a non-exclusive, non-commercial, non-sublicensable license, required under European state-aid law. Another provision gives it the right to use the technology only if the firm relocates outside Europe as protection against the risk of

[28] Both Stanford's Office of Technology Licensing and MIT's Technology Licensing Office operate on the principle that the highest public return on publicly funded research comes from rapid spin-off creation rather than maximal direct licensing revenue. Standard practice is a non-exclusive license granted on lean, pre-negotiated terms to the founding team, typically with a modest royalty and a small equity stake (commonly in the range of 1 to 5 percent of founder equity), the value to the institution and to the state arising primarily from the corporate and personal tax base, regional employment effects and philanthropic returns generated by the resulting companies. The Bayh-Dole Act of 1980, which clarified university ownership of federally funded inventions while encouraging rapid licensing, is the legal foundation of this model in the United States.

delocalization, and not as a commercial tool. This is consistent with the objective of minimal extraction to maximize the probabilities of success. This is expressed in pre-set contract templates for the SPRIND laureates and with non-negotiable conditions for IP transfers, thus enabling faster processes in the challenges.

Speed is a critical variable for IP management. When transfer processes are too slow (in months or even years), it pushes away the investors at the moment when speed of incorporation and financing matters most. Compressing the standard IP release timeline to a matter of weeks, using pre-negotiated template agreements rather than renewed negotiations for each case, is achievable.

The SPRIND-led IP Transfer 3.0 initiative has, since 2022 and together with seventeen universities and research institutes, produced a shared toolkit of model contracts, IP scorecards and negotiation guidance, adopted as a standard by the institutions concerned in the Berlin–Brandenburg area and replacing renegotiation from scratch. [29] France's more fragmented IP-management landscape would require a specific effort to reach comparable interoperability with SPRIND's approach.

[29] Coordinated by SPRIND with the Stifterverband and the Fraunhofer Institute for Systems and Innovation Research (Fraunhofer ISI), the IP Transfer 3.0 initiative, launched 2022, has produced a shared toolkit (the "Pocketknife Transfer") that includes an IP scorecard, an IP-Wahl-O-Meter for founding teams, model contracts for the main transfer arrangements (license, equity, hybrid), an adapted Harvard-style negotiation method and an international comparison. Seventeen universities and research institutes form the pilot group; participating institutions in the Berlin–Brandenburg area have adopted these templates as a standard, replacing case-by-case renegotiation. Source: SPRIND, IP Transfer 3.0 — New Approaches to IP Transfer (sprind.org).

5 FRANCO-GERMAN COOPERATION IN DISRUPTIVE INNOVATION

Cooperation between France and Germany on breakthrough innovation has obvious appeal: combined market scale, complementary industrial bases, the political weight to push reforms neither country can carry alone. It also entails failure risks: reproducing at bilateral level the coordination logic that risks being too bureaucratic, installing a classical cooperation approach rather than a convergence one. The main questions are which forms of cooperation maximize the impact and which dilute it; what operational frameworks enable joint programming to make sense; how to prevent intellectual property from being a source of friction; and on what calendar and subjects could cooperation be initiated. The answer to none of these is structural in the first instance: **cooperation will come more from doing concrete things together and less from designing the architecture of cooperation in advance, except for a few basic prerequisites such for example as independence and autonomy of a French counterpart of SPRIND.**

5.1 COMMON OBJECTIVES OF A JOINT FRANCO-GERMAN INITIATIVE

The assessment of the situation in France and in Germany is convergent, especially regarding the structural weaknesses of European national innovation systems, the growing geopolitical dimension of technology, the persisting and difficult institutional gaps. Differences appear at the operational level, reflecting deeply embedded features, and should be considered as complementary capabilities to be leveraged.

France has a long tradition of state-led industrial strategy, concentrated public financial capacity and strong political intent, and more recently, very dynamic start-up ecosystem mainly due to successful public policies ("French Tech" approach

and the global state awareness of the importance of start-ups brought by the Mission French Tech, and the action of Bpifrance in structuring the VC ecosystem). Germany has a dense base of medium-sized industrial firms with deep technological and technical expertise, a different relationship between public institutions and private enterprise, and direct experience of institutional autonomy for a public agency, as the autonomy law granted to SPRIND in 2023. Both countries possess world-class scientific research.

These structural differences are not an obstacle to the alignment of national strategies in France and Germany in disruptive innovation and deeptech. These domains need in both countries an autonomous, mission-driven, ARPA-type capacity. This is precisely the cooperation that leading economists have called for. Philippe Aghion, whose work on creative destruction and frontier innovation underpins much of this report's diagnosis, has argued for a Franco-German DARPA as the natural vehicle for European innovation at the frontier.[30] Mario Draghi in his 2024 report also called for a European "ARPA-type agency", supporting high-risk projects with the potential of delivering breakthrough technological advances[31].

Nevertheless, aligning on the technological and societal challenges, while letting each country deploy their instruments suited to their own institutional context, is more realistic in the short-term as interoperability does not require strict and complete symmetry, but only a strict alignment on central features of any ARPA-type initiative (i.e. autonomy, speed, agility, processes, risk).

A Franco-German approach also carries value beyond its own output, as a political enabler and accelerator for wider reforms. Market fragmentation, the weakness of the limited-partner base for patient capital, the demand-side constraints and the regulatory framework are European problems that no single country can resolve alone. From the founder's and investor's perspective, this fragmentation, across customers, procurement rules, financing, standards, regulatory practices and exit pathways, fundamentally alters the risk-return equation by comparison with the United States or China. It is therefore not a secondary issue but one of the conditions of success for any ambitious European breakthrough-innovation strategy. A coordinated bilateral initiative can move these issues forward even without full consensus of all European countries.

5.2 INSIGHTS FROM SPRIND EXPERIENCE

SPRIND has acquired visibility beyond Germany and is explicitly referenced in the Draghi Report as a relevant instrument for strengthening European innovation capacity. This European dimension provides a strong rationale for closer Franco-German cooperation in the field of breakthrough innovation

In order for the French initiative for supporting disruptive innovations to be able to cooperate with the German Federal Agency for Breakthrough Innovation, SPRIND, in an effective and efficient way from the outset, several successful SPRIND-inherent characteristics have to be taken into account when designing the French solution:

- **Mission-oriented approach**: SPRIND pursues an open-minded, ambitious and cross-disciplinary approach to emerging topics and technologies while remaining technology-neutral with

[30] Franco-German Council of Economic Experts (FGCEE), Joint Report on Innovation and Competitiveness, August 2025. On frontier innovation, see also P. Aghion, C. Antonin and S. Bunel, The Power of Creative Destruction, Harvard University Press, 2021.

[31] Mario Draghi, The Future of European Competitiveness, Report to the European Commission, September 2024

regard to potential solutions, supported by an agile and flexible mode of operation. With a substantially higher tolerance for risk than conventional funding programs and a high degree of autonomy.

- **Speed and agility**: SPRIND is distinguished by its fast and agile decision-making processes, with funding decisions typically taking days to weeks rather than the months or years often associated with traditional public funding programs.

- **Operational autonomy and risk tolerance**: SPRIND combines a high degree of organizational autonomy with a substantially higher tolerance for technological and market risk than conventional public funding programs. This flexibility is essential for supporting breakthrough innovations whose outcomes and commercial potential remain uncertain.

- **European cooperation**: SPRIND makes funding decisions based on excellence, rather than nationality, thus enabling European cooperation from the outset. This approach facilitates the formation of cross-border teams and strengthens European technological sovereignty by bringing together the best talent and capabilities regardless of national origin.

As a consequence, the following conditions can be considered as mandatory for any new instrument in France designed to be interoperable with SPRIND:

- **Establish a dedicated breakthrough-innovation instrument designed from the outset to be operationally interoperable with SPRIND** regarding the same logic of empowered program managers, same speed of funding, same approach to intellectual property and the same approach to international cooperation and funding based on excellence. This level of similarity is what makes joint programs workable in practice. This does not exclude national specific features in other tools deployed by both national agencies.

- **Ensure genuine institutional and operational autonomy, independence from political instruction or any form of hierarchy or authority that is dependent on political decisions**, multi-year budgeting with rollover, the right to allocate funds quickly on a program manager's conviction, and a public narrative for risk-taking must be built into the founding architecture. SPRIND's experience shows that autonomy is far easier to construct from the start than to win afterwards.

- **The new instrument must be calibrated to attempt what others believe impossible (order-of-magnitude advances beyond the state of the art, taken up to a stage at which the technology becomes investable)**. The relevant benchmark is not the number of projects funded or unicorns produced but the credible expansion of what is technically possible. A portfolio with no visible failures is a signal that ambition was set too low.

- **Ensure that European openness is a founding design principle.** The new instrument should be built to attract existing or emerging ARPA-type institutions in Europe (e.g. Vinnova in Sweden or NADI in the Netherlands,) as joint-challenge partners from the outset, based on the principles of international cooperation and funding of excellency that SPRIND already applies. A coherent European architecture is more likely to emerge from a network of lean, fast, open national agencies running joint challenges together than from a new centralized structure.

5.3 CONDITIONS AND PITFALLS IN COOPERATION

The French instrument is designed first to answer a French need, and cooperation with SPRIND will extend its reach. Similarity on a few core aspects, such as approach to intellectual property or speed of funding, is what makes joint programs workable in practice, but symmetry is not required on all dimensions for both ARPA-type agencies. For example, it is important to align, at least partially, on main technological challenges while leaving each entity the latitude to use its own networks and other specific national tools judged necessary to benefit from combined scale and reduce coordination costs. Joint challenges designed under this principle, with shared juries and, where appropriate, shared procurement commitments, can finance ambitions that neither national ecosystem could sustain alone, without flattening the autonomy that makes each entity effective.

Some specific forms of cooperation create a critical mass and have strong added value. Early **co-investment** combines venture capacities and sends a signal to private investors that neither institution could make alone. **Demand pooling** through aligned procurement pilots could create a pull mechanism of continental significance: joint adoption by France and Germany is qualitatively different from any single-country signal. **Alignment in regulation** would harmonize and accelerate permission-to-operate and make France and Germany a reference point in Europe. From a founder's point of the view, the combined market represents the value of 160 million people and €8 trillion of GDP, the required mass needed to start in most fields.

Combining cross-border talents into research groups and teams multiplies the value of European research. Europe educates a significant share of the world's leading researchers in machine learning, quantum systems, synthetic biology and other breakthrough-relevant fields.[32] However, there are few mechanisms that combine these talents across borders into groups of critical mass. Joint laboratory work as a condition to access to the largest instruments creates a valuable concentration of talent with minimal administration constraint. Personnel exchanges between a future French entity and SPRIND, similar to those already operating in a limited form, builds the mutual reference points that make later operational alignment cheaper.

Some forms of cooperation, however, would dilute value rather than multiply it. Excessive governance layering such as standing bilateral committee to manage joint decision would recreate the coordination failures that affected other innovation policies. Building the joint structure before France's national initiative is operational and credible would deprive its energy in coordination rather than execution. Excessively strong pre-programming in terms of standards, priorities or governance arrangement creates inadequacies that are difficult to adapt or revise after they become visible though practice. It is by working together on concrete programs that value emerges, not from anticipating the architecture of cooperation in advance.

The Franco-German tandem also has a defining role in the wider European architecture as a front-runner. It should attract resources from existing structure but not seek to compete with them for legitimacy. In particular cooperation and complementary with the European Innovation Council will have to be explored and developed.

The Franco-German cooperation can work as the prefiguration of a European-wide innovation capacity. Interoperability is already well defined in existing European-wide practice. In order to tackle the coordination problem, four interoperability principles should be guaranteed: (1) European-wide

[32] On machine learning: according to Stanford HAI's AI Index 2024, Europe educates approximately 25 to 30 percent of the world's top-tier AI researchers at doctoral level, but retains a markedly smaller share of them. Source: Stanford University, Artificial Intelligence Index Report 2024, Stanford HAI.

funding eligibility, with selection of projects based on excellency rather than nationality, (2) no retention of intellectual property by the funding institution, (3) no burdensome monitoring of team expenditures, and (4) shared jury capacity. An example of inter-agency cooperation is SPRIND's joint challenge with Vinnova[33].

A minimal prior alignment is needed for selection criteria. A discussion on the range of breakthrough innovation, target impact and program termination condition are needed before the first joint program. This discussion may be difficult in a close cooperation process and should concentrate on creating a common ground for managers to distinguish jointly fundable opportunities. More precise criteria will emerge through the first challenges.

5.4 SELECTING TARGETS FOR FRANCO-GERMAN COOPERATION

Two configurations will need to be examined to set up specific Franco-German cooperation programs that can produce distinctive value:

- **The first is the domain in which neither country holds a position so dominant that the other's participation would be marginal,** and where the combined industrial and research depth of both ecosystems covers complementary dimensions of the same challenge. For example, aerospace, mobility, energy systems, security technologies, and food and life sciences each fit this pattern: industrial depth on both sides, a European go-to-market logic from the outset, and complementary strengths that can be activated rather than duplicated.

- **The second is defined by scale rather than complementarity**. Fields in which a single national talent pool or funding base is structurally too small to generate critical mass, and were reaching across France, Germany and the Netherlands, Sweden and others is an operational necessity rather than strategic preference. AI infrastructure and advanced semiconductor architectures are the immediate examples. SPRIND's AI challenge and the semiconductor initiative under development illustrate the logic. The signal value of joint programs in these domains goes beyond scale. By exposing each national ecosystem to a continental benchmark, they reduce the risk of self-referential national positioning, useful in fields like quantum where each country may believe itself to be leading in Europe.

- Cooperation should be built incrementally and remain adjustable: each joint step is tested in practice before the next, rather than fixed in advance.

[33] SPRIND and Vinnova signed a Memorandum of Understanding in mid-2025 establishing a strategic partnership for radical innovation; the first joint Challenge, "Anti-Drone Response 2.0," was opened to European participants in late 2025/early 2026 with no national quota on either side. Sources: SPRIND website, and Vinnova press release, "Sweden and Germany launch joint effort on anti-drone technology" (19 December 2025; Science|Business).

CONCLUSION

Europe risks falling behind in the emerging technologies that will define the coming decade. Yet it possesses world-class research capabilities and a market with sufficient scientific and industrial strength to play an active role in shaping these future technologies. To do so, however, it must build the institutional capacity needed to promote joint disruptive innovation initiatives.

In 2019, Germany established SPRIND, a dedicated agency for breakthrough innovation. France has yet to create a comparable approach. Establishing a French counterpart, designed from the outset to be interoperable with SPRIND, would create new opportunities for bilateral cooperation in disruptive innovation and expand market opportunities. This cooperation framework could subsequently be opened to other European agencies interested in developing partnerships around specific programs.

The window of opportunity for making these choices is narrower than it may appear. Many of the technological positions that will shape the landscape in 2030 are being decided now. **If led properly, Franco-German cooperation could constitute a change of paradigm in the way European countries design and implement disruptive innovation policies over the coming decades**.

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APPENDIX A:

THE DARPA MODEL

The Defense Advanced Research Projects Agency was created in direct response to the Sputnik shock of 1957, with an explicit mission: to ensure that the United States would never again face a technological surprise due to failure to invest in breakthrough capabilities. Over more than six decades, DARPA has played a central role in some of the most transformative technologies of the modern era, from the internet and GPS to stealth aircraft, autonomous vehicles, mRNA vaccine platforms, and advanced AI.

DARPA's organizational model is fundamentally different from conventional research funding agencies. It operates as an "innovation organization" rather than a research funding pipeline[34]. It does not simply allocate grants based on peer review; it actively orchestrates technological breakthroughs by connecting fundamental science with development, prototyping, and pathways to adoption, and public purchasing

The agency operates through a small number of thematic offices (information technology, biological technologies, defense sciences, microsystems technology, strategic technology, and tactical technology), each containing approximately ten program managers. With an annual budget of approximately €4 billion (€4.0 billion) and an internal staff of about 200 (including about 100 program managers) DARPA achieves leverage ratios of approximately 20:1 to 100:1 when measured by the economic value of technologies it has helped create relative to its cumulative budget: GPS alone has generated over €1.3 trillion in U.S. economic benefits since 1984 from a cumulative public investment of approximately €11 billion (RTI International/NIST, 2019), yielding a return exceeding 100:1; DARPA's internet research through its IPTO office cost approximately €460 million over 1963–1986, seeding an ecosystem now worth trillions annually. Its flat organizational structure (PM to Office Director to Agency Director) minimizes the bureaucratic layers between an insight and an investment decision.

A distinctive feature of the DARPA model[35] is the central role of the quality of its program managers and on the institutional culture that supports their autonomy. DARPA's human resources policy (recruiting the best technical minds from academia and industry on short rotations, paying competitive salaries, and providing extraordinary operational freedom) is as important to its success as its budget.

DARPA does not fund basic research without application potential (that is the role of the National Science Foundation). It does not fund commercial development or market deployment (that is left to the private sector and to Department of Defense procurement programs). And it does not manufacture or produce anything. DARPA occupies a very specific position in the innovation system: it connects the frontier of

[34] Bonvillian, W.B., Van Atta, R., Windham, P. (eds.) (2019). The DARPA Model for Transformative Technologies: Perspectives on the US Defense Advanced Research Projects Agency. Open Book Publishers.

[35] NSF and DARPA as Models for Research Funding: An Institutional Analysis. Michael J. Piore, Phech Colatat, and Elisabeth Beck Reynolds. MIT Working Paper Series July 2015 (MIT-IPC-15-005 WP)

scientific possibility with specific capability needs, prototypes solutions, and then hands them off to others for production and adoption. To scale DARPA-demonstrated technologies, the agency relies on the "deep pockets" of the Department of Defense procurement system, and on the unparalleled scale of US venture capital market.

The DARPA model rests on several distinctive organizational features that have proven remarkably consistent across its six-decade history:

- Empowered Program Managers: DARPA recruits approximately 100 program managers, typically distinguished scientists or engineers from academia and industry, on short rotations of 3–5 years. These individuals have near-total autonomy to identify problems, design programs, select performers, and manage portfolios. The flat hierarchy — PM to Office Director to Agency Director — minimizes bureaucratic friction.

- Mission-oriented programs: Each DARPA program poses a specific, ambitious question aimed at a clear capability gap. Programs are not open-ended research grants but time-bound efforts (typically 3–5 years) with aggressive milestones and multiple performers pursuing competing approaches.

- High risk, high reward: DARPA deliberately funds projects at the frontier of feasibility, where the probability of individual failure is high but the potential payoff from success is transformative. The agency's culture explicitly embraces the possibility that many programs will fail.

- Connected science: Rather than operating a pure "pipeline" model (fund basic research and hope for applications), DARPA connects each stage of innovation, from fundamental science through prototyping to transition. Program managers actively cultivate relationships with potential adopters throughout the program lifecycle. This handoff is structured (DARPA plans technology transition from the start) but relies on the DoD's procurement and on US venture capital to carry technologies onward, rather than on the agency accompanying them to market itself.

- Institutional independence: DARPA reports directly to the Secretary of Defense and operates outside the normal procurement bureaucracy. This independence protects the agency from short-term political pressures and institutional capture.

DARPA Success Stories: Technologies That Created Major Markets

- The Internet (ARPANET, 1969–1990s): DARPA funded the creation of ARPANET, the precursor to the modern Internet. What began as a ~€1 million research project to connect four university computers became the foundation of a global digital economy worth over €15 trillion today. The TCP/IP protocol suite, developed under DARPA funding, remains the backbone of all Internet communications. No private investor would have funded this project: there was no market, no business model, and no demand. DARPA's program managers saw the potential and acted.

- GPS (Global Positioning System, 1973–1995): DARPA co-funded the development of satellite-based navigation, originally designed for military precision targeting. The decision to open military GPS signals (much more accurate) to civilian use in 2000 created an entirely new industry: the global GPS market is now worth over €300 billion annually, powering navigation, logistics, precision agriculture, ride-sharing (Uber, Lyft), autonomous vehicles, and financial trading synchronization. Without DARPA's initial investment and the subsequent dual-use decision, none of these markets would exist.

- DARPA's Autonomous Vehicle Grand Challenge vs. DOT's Intelligent Vehicle Initiative. In 2004, DARPA launched the Grand Challenge for autonomous vehicles with a €0.9 million prize and approximately €18 million in program costs. The first competition saw all entrants fail, but by 2005, five vehicles completed the course. The 2007 Urban Challenge produced technology that directly spawned Google's self-driving car project (now

WAYMO, valued at over €27 billion). By contrast, the US Department of Transportation's Intelligent Vehicle Initiative (1998–2005), with a substantially larger budget distributed through conventional grants and cooperative agreements, produced incremental safety improvements but no transformative autonomous driving capability. The difference: DARPA set an audacious, measurable goal (drive 240 km autonomously), used competition to attract unconventional teams (including university students), and tolerated total initial failure as a stepping stone.

- mRNA Vaccine Platforms (2011–2020): DARPA's Biological Technologies Office funded early research into mRNA-based therapeutics through its ADEPT program, providing critical funding to MODERNA and supporting foundational research that BioNTech also built upon. When COVID-19 emerged in 2020, this pre-existing DARPA-funded research enabled the development of effective vaccines in record time. The mRNA vaccine market generated over €90 billion in 2021 alone and is now expanding into cancer treatment, representing a permanent new pharmaceutical platform. This example is particularly relevant for the Franco-German initiative: BioNTech, a German company, leveraged American DARPA-style funding to achieve a breakthrough that European funding instruments had not supported at comparable scale.

APPENDIX B:

THE SPRIND MODEL

Development of SPRIND – The German Federal Agency for Breakthrough Innovation

The Federal Agency for Breakthrough Innovation (SPRIND) was established in 2019 following the Innovation Dialogue initiated by Chancellor Merkel in 2017. Its creation reflected a frank acknowledgement that Germany's innovation system, while outstanding for incremental improvement, lacked the institutional capacity to support the kind of radical, high-risk innovation needed to maintain technological leadership.

SPRIND funds and accelerates breakthrough innovations, focusing on high-risk, high-impact projects with the potential to create new markets, transform existing industries, or address major societal challenges. Rather than supporting basic research or early-stage ideation, SPRIND primarily operates in the critical phase between experimental proof of feasibility and market-ready prototypes (typically TRL 3–7). By validating technological potential, supporting prototype development, and helping innovators navigate the "valley of death" between research and market adoption, SPRIND de-risks breakthrough technologies and prepares them for private investment and large-scale deployment.

To enable agile, flexible, and low-bureaucracy operations in funding high-risk breakthrough innovations, SPRIND was established as a Limited Liability Company (GmbH), distinguishing it from rigid traditional public administration structures. Its sole shareholder is the Federal Republic of Germany, represented by the Federal Ministry of Research, Technology and Space (BMFTR). SPRIND operates on behalf of the federal government under a contractual mandate and currently manages an annual budget of over €300 million, including both its core budget and additional funds from different other federal ministries.

The SPRIND Freedom Act 2023

In December 2023, the SPRIND Freedom Act was adopted, significantly enhancing the agency's operational flexibility. The act enables SPRIND to operate with greater independence, make use of private-sector financing instruments, reduce bureaucratic hurdles, and accelerate decision-making processes.

The objective was to strike a balance between granting SPRIND the necessary freedom and ensuring appropriate oversight of taxpayers' money. The control instruments include SPRIND evaluations, supervision by the BMFTR, oversight by the supervisory board, audits conducted by the Federal Audit Office, and additional mechanisms. If the balance between freedom and oversight is implemented effectively, the overall risk-tolerance towards SPRIND increases. Thus "project failures" can become an essential component of an innovation-driven process.

SPRIND Design

SPRIND employs around 170 internal staff members. Roughly half work in scientific and technical roles, while the remainder are engaged in administration or dedicated project work carried out on behalf of other federal ministries. SPRIND's personnel model is inspired by agile, high-risk

innovation agencies such as DARPA. It emphasizes temporary, highly autonomous experts tasked with driving breakthrough innovation projects.

A defining feature of this model is the role of Innovation Managers, who function as program directors. These are temporary hires on three- to five-year contracts, selected for deep technical expertise in fields such as quantum technologies, biotechnology, or artificial intelligence. Innovation Managers enjoy a high degree of autonomy: they scout global talent, validate high-risk ideas within weeks rather than years, assemble interdisciplinary teams, allocate budgets flexibly—often amounting to several million euros per project—and pivot or terminate initiatives based on clearly defined milestones.

Management and Operation of SPRIND

SPRIND's governance is structured around three tiers that balance independence with accountability:

Tier 1: Shareholder

- Composition: sole shareholder is the Federal Republic of Germany, represented by BMFTR
- Role: The shareholder can issue instructions and could even change the purpose of the company. BMFTR nonetheless tries to restrict its own influence, so as to preserve SPRIND'S operational freedoms

Tier 2: Supervisory Board

- Composition: consists of ten representatives from science, industry, the federal ministries, and the Bundestag
- Role: provides strategic oversight without stifling agility. The board approves major investments (> 10 Mio.€), oversees challenge portfolios, and ensures sound governance

Tier 3: Management (scientific and commercial)

- Composition: Scientific Director and Commercial Director
- Role: Operation of SPRIND

From the outset, it was clear that SPRIND's success would require extensive operational freedoms. To create an organisation capable of fostering disruptive innovation, several key conditions had to be met:

- **High autonomy and flexibility for management**: Leadership needed freedom in selecting personnel, defining strategic topics, and managing budgets.

- **Openness to unconventional approaches**: Teams crossing technological, disciplinary, and industry boundaries had to be encouraged and supported.

- **Extensive decision-making freedom for project managers**: Innovation managers required authority to steer projects independently, paired with competitive compensation to attract top talent.

- **Strong organisational and personnel reputation**: This included relevant memberships of management in high-ranking federal committees, regular contact with ministry management levels and potentially with the Federal Chancellor, and public recognition by the ministry.

- **Consistent complementarity with other funding initiatives**: SPRIND needed to focus specifically on supporting high-risk, breakthrough innovations without duplicating existing instruments.

These conditions were essential to ensure that SPRIND could act nimbly, attract the right experts, and drive projects with the potential for profound societal and economic impact.

Evaluation of the SPRIND Model

An evaluation of SPRIND, conducted from August 2023 to December 2024 by an independent team, aimed to assess the agency's funding approach, process efficiency, governance, and the effectiveness of its instruments for promoting and financing breakthrough innovations prior to the SPRIND Freedom Act—primarily Spin-Offs, validation contracts and Challenges. The evaluation also examined the anticipated effects of

the Freedom Act. Findings confirmed SPRIND's relevance and complementarity within the German innovation system, highlighting its unique role in bridging scientific and technological development to market introduction. The agency was praised for fostering agile structures, enabling rapid decision-making, and cultivating a dynamic culture distinct from traditional funders. Funded projects frequently attracted significant follow-on capital from venture capitalists and public agencies.

SPRIND Funding Models

SPRIND has two main mechanisms for allocating funds to projects: The top-down Challenge format, and the bottom-up submission of project proposals:

SPRIND Challenges are mission-orientated innovation competitions, designed to address society's most pressing problems by fostering competition among visionary teams to deliver breakthrough solutions capable of transforming industries and improving lives across Europe. Rather than prescribing specific technologies, Challenges define ambitious, clearly articulated goals and enable multiple teams to pursue radically different approaches in parallel. This model attracts diverse talent from universities, start-ups, and established companies and helps identify the most promising pathways towards technological breakthroughs while contributing to an ecosystem by connecting key actors, increasing visibility for emerging technologies, and creating positive spill over effects that accelerate progress across the entire field.

The process begins with careful planning. SPRIND identifies an urgent challenge, formulates a precise objective, and launches a call for applications open to teams from across Europe, typically allowing six to eight weeks for proposal submission. By attracting participants from multiple European countries, Challenges address the whole European talent pool, strengthen cross-border innovation networks and contribute to European technological sovereignty. This is followed by a swift selection phase, lasting two weeks on average. An initial assessment by SPRIND's internal experts in the field identifies the most promising applications, which are subsequently invited to present their concepts to an independent expert jury. Based on these pitches, the jury selects the teams that will enter the first stage of the Challenge. Funding contracts are awarded immediately after teams are selected through a highly streamlined pre-commercial procurement framework that significantly reduces administrative burdens and accelerates decision-making.

Selected teams—often up to ten or more in the first stage—advance through two or three development stages, each stage typically lasting between several months to a year. Each stage provides **substantial, Challenge-specific funding tailored to the technological ambition of the programme,** alongside hands-on coaching from the internal team and external expertise, access to expert networks, business guidance, and team-building support. At the end of each stage, the jury rigorously evaluates progress, advancing only the most promising teams to refine and scale their solutions.

Teams that reach the final stage can receive ongoing, tailored support, including equity or grants to de-risk commercialization, assistance attracting private investors, and resources to transform prototypes into market-ready innovations. This multi-stage approach ensures bold ideas are rigorously tested, nurtured, and propelled toward meaningful economic and societal impact

Project funding and validation contracts: In addition to participating in Challenges, anyone can submit project proposals to SPRIND at any time. Funding is typically directed toward technologies at the stage between experimental proof of concept and market-ready prototype, roughly corresponding to Technology Readiness Levels 3 to 7. Any type of institution may submit a project. To ensure equal treatment of all applicants, preliminary informal assessments are not provided. After submission, applicants receive immediate confirmation, and the project is logged and prepared for expert review. Within approximately 12 weeks on average, applicants receive an initial decision indicating whether the project falls outside SPRIND's scope, merits further discussion

and exploration, or will be considered for potential support.

Each submission undergoes a multi-step evaluation against defined criteria, including the potential to transform markets, macroeconomic, ecological, and social impact, risk–opportunity profile, position between research and market, team resources, type of innovation, and contribution to societal development goals. Internal and external experts assess both the technological foundation and the entrepreneurial potential. Only a small fraction of proposals reach the next stage, as truly disruptive innovations are rare.

For projects that fit SPRIND's remit, Innovation Managers collaborate with the team to refine the concept and validate its breakthrough potential before it reaches the internal decision-making committee. This committee then can issue a positive recommendation. If the planned budget for the project exceeds €10 million, the project is additionally presented to the SPRIND Supervisory Board, which makes the final determination on whether and in what form cooperation and funding will be provided.

Funding Instruments

SPRIND employs a range of flexible financing instruments designed to support breakthrough innovations in a targeted, efficient, and low-bureaucracy manner. Unlike traditional grant agencies, SPRIND does not operate according to restrictive funding programs; instead, it develops tailor-made funding structures for each project.

The primary financing instruments used by SPRIND include validation contracts, equity investments, mezzanine financing (a hybrid of debt and equity), grants and pre-commercial procurement. These tools enable the agency to back high-risk, high-innovation-potential projects that often struggle to secure private market financing due to insufficient market maturity. SPRIND frequently acts as a *pari passu* investor, sharing risks with private partners and exiting once a project has reached sufficient maturity for full private-sector financing.