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Innovation: France's Got Talent



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Innovation: France's Got Talent

REPORT - OCTOBER 2021

TABLE OF CONTENTS

Executive summary	 8

Т

 In less than 10 years, France has allowed a flow of capital necessary for the growth and development of its start-ups 	12
1. From the beginning of the 2010s, aware of its lag in innovation.	
France has implemented a proactive strategy to catch up.	
with increasingly visible results	12
1. A central player: the creation of Bpifrance has made it	
possible to set up a one-stop shop for financing and	
supporting start-ups, thus compensating for the initial	
relative weakness of private funding	12
2. An iconic brand: the French Tech initiative was launched	
in 2013, with the aim of structuring the French start-up	
ecosystem through a labelling system	17
3. Financing: the 2010 decade in France saw an exceptional	
mobilization of public funds, which has had a decisive	
leverage effect on the private financing of innovation	24
4. An enabling environment: tax and regulatory reforms aimed at	
further shifting French savings towards productive investment,	
particularly in start-ups	33
2. This ambitious policy has enabled France to catch up	
to a large extent, though without enabling it to match	
the most successful countries to date	42
1. Year after year, France has been able to build up real	
momentum in venture capital financing	42
2. To enable France to maintain its virtuous momentum, the	
development of venture capital must be further consolidated	49
3. Channeling French savings towards investment in innovation	
could be a new way to bolster the strategy implemented	
over the past ten years	56

There is no desire more natural than the desire for knowledge

 II – In the wake of the 2010 decade devoted to mobilizing capital for innovation, the 2020 decade in France must be one of unprecedented investment in human capital, the driving force behind the most innovative and competitive 	
companies	. 67
1. Tackling the talent shortage that threatens the development	
of French Tech through an exceptional effort to train	
and diversify profiles will be the challenge of the 2020s	67
1. Implementing a 10-year national training plan for new	
economy professions is essential to prevail in the international	~ -
competition for innovation	67
2. Promoting diversity among founders is a key issue	
for the performance and openness of the French ecosystem	70
In the years to come	72
2. Encouraging students and researchers to enter the world	00
1 Using the DEDITE hubs to help students become	02
antropropeurs	82
2 Encouraging researchers to enter the business world	02
is a sure way to increase the nool of talent and the number	
of founders especially in Deep Tech	87
3. Encouraging research, researchers and professionals	
in the field to focus on issues likely to generate breakthrough	
innovations	95
4. Anchoring start-ups in universities will not be a fully	
successful strategy unless financial resources	
and autonomy are increased	103

Ар	pendi	x 1:	Result	s of	the	qua	antitative	study	conducted	
		-								

by Accenture for Institut Montaigne	
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Appendix 2: Methodology	1	131
-------------------------	---	-----

Appendix 3: Country reports	134
Germany innovation ecosystem	
Estonian innovation ecosystem	
Israeli innovation ecosystem	
UK innovation ecosystem	
Swedish innovation ecosystem	
The Swiss innovation ecosystem	

Aknowledgements 1	7	1	1	ŝ)	ļ
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EXECUTIVE SUMMARY

In the early 2010s, France realized it was lagging behind its European neighbors in terms start-up creation numbers. A proactive strategy was implemented by the government, aimed at allocating resources – notably financial resources – essential to the success of French start-ups. This strategy is bearing fruit and success stories abound. France now boasts 18 unicorns, as many as in Germany and half as many as in the United Kingdom (weighing in at 31), not to mention the many promising French start-ups ready to take off in the coming years. It would be counterproductive to alter this trend or to want to change it on principle, since its effects are long-term; on the other hand, it would be an equal miscalculation not to prepare for the challenges of the coming decade.

Much has been written and discussed on the topic of unicorns and their funding. This study aims to determine the factors which contribute to success (or failure) in the emergence of resilient and effective innovation ecosystems. To this end, this paper compares France with its European and other international neighbors,¹ according to number of unicorns and, more generally, according to venture capital funds raised in excess of US\$ 30 million;² as well as by assessing the relevance of more explanatory factors, such as the availability of private and public funding, the founders' backgrounds, the quality of higher education and the value assigned to research activities (see the Methodology section).

This study offers nine recommendations to make France the most innovative country in Europe and enable it to create the most high-value start-ups. This

report is based on two principles shaped by the interviews and the quantitative studies carried out:

- 1. In France, funding for start-ups is now more reliable than ever and will likely increase in the coming years. At this rate, France already has the potential to generate 2 to 3 times more unicorns in the next five years than in the 2010-2015 period, as evidenced by the increased number of start-ups currently in the early stages of their growth cycle. It is nevertheless possible and beneficial to encourage French people to increasingly direct their savings towards supporting French start-ups. The challenge is of course financial but also cultural, since French savers are more inclined to choose very low risk investments;
- 2. The real challenge of the 2020s will be human capital, which is the key driver of start-up creation and growth in a highly competitive global environment. In this respect, France is still lagging behind: lacking forward vision when it comes to key skills and professions of the future, its start-up founders are too academically and socially homogeneous when compared to other countries (which hinders Deep Tech, the most likely to interest the French industrial fabric), and research areas bogged down by misgivings which are ultimately detrimental to the country as a whole.

In other words, this study aims to be as realistic as possible when it comes to France's performance in terms of innovative start-ups: acknowledging the successes of the last ten years thanks to an actionable innovation policy; but also recognizing the challenges in human capital for the years to come.

¹ The study sample includes Germany, Estonia, Israel, Switzerland and the United Kingdom, and on a solely quantitative level, Denmark, Finland and the Netherlands.

² This threshold was taken from the findings of the 2019 Tibi report, Financing the Fourth Industrial Revolution – Unlocking financing for technology companies, which emphasized that "as far as shares are concerned, overall start-ups do not struggle in financing their early stages of development. France has a promising collection of technology companies. However, their growth is slowed down by the lack of late-stage funding (raising more than €30-40m)".

RECOMMENDATIONS

1. Invest in human capital

To find out what skills are needed over the next 10 years, conduct an annual national survey and adapt higher education training accordingly. Successful start-ups are those that manage to attract and retain all essential complementary talents (scientific, technical, user experience, developers, Al experts, etc.). An annual survey could be conducted jointly to help higher education institutions adjust their programs, while also encouraging cross-curricula and high-level English courses.

Broaden the range of start-up creators to include as many talented profiles as possible:

- Encourage more university students to embark on entrepreneurial paths, as they tend to have more diverse backgrounds than students from the elite higher education establishments ("grandes écoles"). Notably, make PEPITE hubs (student centers for innovation and entrepreneurship) the strategic points for guiding students towards entrepreneurship. This means adapting how PEPITEs are run and setting the objective of increasing the number of student-entrepreneurs sixfold over the course of the next four years;
- Welcome international talent by doubling the number of French Tech Visa recipients over the course of the next two years;
- Promote the integration of foreign students into the French entrepreneurial world;
- Promote talented profiles from across the country, including those outside the traditional education system, by doubling the number of annual recipients of the French Tech Tremplin (Springboard) incubator program over the course of the next two years.

2. Strengthen the ties between research and entrepreneurship

Implement ambitious policies to promote and encourage researchers in public laboratories to create innovative companies. Further promote a culture of research dissemination in society and in the economy; and takeg this into account in the assessment of research institutions by the (High Council for the Evaluation of Research and Higher Education – HCERES) and in the assessment of researchers by the National Council of Universities (CNU).

Promote a culture of competitive project selection based on the American DARPA committee model; relying on existing operators and mindful of not creating new administrative structures.

Finally, in order to enable France to grow its pool of start-ups in universities and research, implement a financial plan of 5% of GDP allocated to higher education and research by 2030.

3.Sustain efforts to finance innovation by adding personal savings to already existing funds

Create an innovation passbook savings account ("Livret I") with user-friendly standard operating rules, available in all major financial networks and fully tax-exempt. The Livret I should support the already strong mobilization of funds in the French and European innovation ecosystem – particularly well documented in recent years – while familiarizing individual savers with the return opportunities in tomorrow's economy. IN LESS THAN 10 YEARS, FRANCE HAS ALLOWED AN INWARD FLOW OF CAPITAL NECESSARY FOR THE GROWTH AND DEVELOPMENT OF ITS START-UPS

- 1. From the beginning of the 2010s, aware of its lag in innovation, France has implemented a proactive strategy to catch up, with increasingly visible results
- 1. A central player: the creation of Bpifrance has made it possible to set up a one-stop shop for financing and supporting start-ups, thus compensating for the initial relative weakness of private funding

Created in 2012, the public investment bank Bpifrance is the culmination of a process which brought together various public sector operators supporting the financing of the economy. This reform has notably made it possible to create a one-stop shop throughout France, providing financial support (debt and equity) and guidance to innovative start-ups.

Bpifrance includes:

• Equity investment activities of the former National Agency for the Promotion of Research (turned Oséo in 2007);

- Debt financing from the former CPME (Confederation of Small and Mediumsized Enterprises, SME credits);
- Bank guarantees from SOFARIS (French Agency for SME Venture Capital Insurance).

In addition, Bpifrance covers activities less directly related to supporting innovative start-ups, including investments from the Strategic Investment Fund (FSI) or CDC Entreprises (within the Caisse des dépôts et consignations group) and the export guarantees of the former Coface³ (French Insurance Company for Foreign Trade, whose management was taken over by Bpifrance Assurance Export on January 1, 2017).

These tools enable Bpifrance to meet the financing needs of innovative start-ups at various stages of their development, following a very specific intervention policy:

• **Support for innovation,** through direct grants, notably in the context of innovation competitions or requests for proposals, and through interest-free loans without collateral;

13

- **Debt financing,** through loans co-financed with commercial banks for tangible or real estate investments, or direct loans for intangible investments and cash advances. These loan schemes can be coupled with public loan guarantees from commercial banks;
- Equity financing, either directly, by taking minority stakes alongside private players, or indirectly, through funds of funds.

This wide array of tools, as well as Bpifrance's broad territorial coverage, has made it a visible and credible contact, highly regarded by start-up creators throughout the country, as evidenced by the interviews conducted.

³ Coface is a credit insurance company whose mission is to help companies develop by insuring their customers' risk of insolvency. Until 2017, Coface acted on behalf of the State, granting public guarantees – this mission has since been taken over by Bpifrance.

At the same time, Bpifrance is implementing a **support** system, with training or thematic accelerators, and is developing tools to **support the internationalization** of companies, through direct financing (export credit and co-investment in foreign capital) as well as public export guarantees (formerly Coface).

International insights Opening capital to foreigners

Israel

Israel's Investment Law, enacted in 2010, enables foreign companies to benefit from a reduced company tax rate and investment grants. The government also provides employment grants for R&D centers and large businesses, offering a 4-year grant scheme covering on average 25% of the employer's employment cost for each new employee. The same law states that companies, whether big corporations or small startups, which meet certain eligibility criteria, are entitled to receive matching grants for the development of innovative, export-targeted products. Every project is judged by a panel of experts with two main considerations: the tech feasibility and the commercial viability.

Moreover, The Yozma program, a government-targeted policy to support R&D activities, established in 1993, invested around \$80 million for 40% stake in 10 new venture capital funds. To further attract foreign investors, the program offered them insurance covering 80% of the downside risk and gave them the option to buy out the government's share at a discount within five years. Yozma funds had induced private VC investments by stimulating co-investments. Israel's Yozma program has triggered the emergence of a domestic VC industry with a pool of human capital and VC support. This led to the development of Silicon Wadi. Bpifrance's total resources thus reached nearly €30 billion in 2020, a clear increase since 2013, particularly in terms of capital investments (see below).







Source: Bpifrance annual reports.

The purpose of Bpifrance's involvement is clearly highlighted when considering the financing profiles of French Tech leaders. Since their creation, 89% of start-ups in the French Tech 120 have received indirect equity financing from Bpifrance (funds of funds) and 37% have received direct equity financing.⁴

Bpifrance's pivotal role is closely linked to regional intervention.

Regions can grant subsidies to start-ups, either on their own or together with Bpifrance, and provide support programs to meet innovation priorities, particularly by setting up requests for proposals. For instance, the Auvergne-Rhône-Alpes Region supports innovative projects in mountain development, mountain equipment and outdoor activities (through grants); while the Occitanie Region has opened a request for proposals focused on the future of health and the Silver Economy within the framework of two competitiveness clusters on its territory (Cancer Bio Santé and Eurobiomed).

What are the results of the competitiveness clusters and what are the challenges for the regions?

The policy of competitiveness clusters was launched in 2004 in order to bring together local companies, research laboratories and training establishments focusing on the same areas of interest. The purpose of the competitiveness clusters is to support innovation through collaborative research and development projects. As of 2019, the government decided to regionalize this policy while continuing to guarantee the "competitiveness cluster" label and guality. There are currently 54 competitiveness clusters bringing together 2,000 laboratories and higher education institutions as well as 10,000 companies.

France Stratégie and the National Agency for Territorial Cohesion (ANCT) conducted a study in 2020 to determine the impact of the competitiveness clusters between 2005 and 2015. The following lessons were learned:

• A public subsidy of one euro received under this policy would have generated on average an additional 2.5 euros of R&D expenditure by the participating SMEs, but would not have had any leverage effect for medium-sized and large businesses;/....

• The clusters have made it possible to diversify relations and create overall cohesion between their members while boosting R&D spending, particularly when they include a large number of member companies, but have not generated any positive synergies with neighboring territories.

Moreover, several people we met for this report expressed their feeling of uncertainty regarding the future of competitiveness clusters and their ability to continue to be a driving force in major innovation areas due to the regionalization process that began in 2019.

However, while the creation of the Bpifrance one-stop shop model was a necessary step forward, it was also necessary to structure and identify the French innovation ecosystem which the new public bank was intended to support.

2. An iconic brand: the French Tech initiative was launched in 2013, with the aim of structuring the French start-up ecosystem through a labelling system

In 2013, the government launched the French Tech initiative. The initial aim was to better identify and structure the French ecosystem of innovative start-ups, both from the point of view of potential French and international investors and from a perspective of design and implementation of public policies. At the time, the French ecosystem was experiencing both a funding crisis and an identity crisis. On the financial front, in 2013, five years after the 2008 financial crisis, the annual amount of funds invested in private equity appeared to be down by 40% compared to the pre-2008 period.⁵ The ecosystem also felt challenged by changes in the tax system, which it considered unfavorable: opposition to certain provisions of the 2013 Finance Act relating to the taxation of share sales in innovative companies led to the emergence of the "Pigeon movement".

French Tech initially aimed to develop the French ecosystem of innovative start-ups, not through subsidies, but rather through a strategy of structuring, networking and identification designed to be as decentralized as possible. French Tech cities in France⁶ and French Tech hubs in other countries⁷ have thus been designated and labelled. In 2019, the taxonomy has been modified to include 13 French Tech capitals and 86 French Tech communities. A **French Tech Diversity** label was also created with the aim of promoting entrepreneurship in disadvantaged neighborhoods – since replaced by the **French Tech Tremplin (Springboard)** program which includes funding ("Incubation"), training ("Prépa", i.e., preparatory schools) and a mentoring system.

In addition to these geographical initiatives, a number of measures have been put in place to facilitate administrative procedures for start-ups. A French Tech Mission, supported by the General Directorate of Enterprises (DGE), part of the Ministry of the Economy, Finance and Recovery, has been set up with the aim of helping innovative start-ups in their dealings with public authorities, but also of facilitating start-ups' access to public services through a network of contact persons. One such example is the French Tech Central one-stop shop at Station F in Paris, which brings together some thirty public services. A French Tech Ticket has also been created to attract foreign talent on a competitive basis, and a French Tech Visa has been created to make it easier for foreign talent to obtain a residence permit.

The French Tech brand was subsequently linked to public funding mechanisms. The second part of the Future Investment Program (PIA) provides for a \notin 200 million French Tech Acceleration Fund. The French Tech grant, managed by Bpifrance subsidizes up to \notin 45,000 of start-up

expenses for highly innovative start-ups. These financial tools are in fact aimed at supporting the very early stages of start-up development, when private funding is more difficult to secure and at a time when support for promising ideas is especially crucial.

Since the end of the 2010s, the French Tech initiative has sought to reposition itself in scale-ups⁸ and internationalization to better take into account the growth of the French ecosystem of innovative start**ups.** In 2019, as a flagship initiative of this repositioning, two programs were launched, the French Tech Next 40 and the French Tech 120, bringing together the most promising scale-ups (or hyper-growth start-ups) each year. These two labels and their communication campaigns give visibility to the start-ups with the strongest growth potential and help them build up references for early adopters more guickly. These companies also benefit from support from high-level government contacts and, in some cases, they have the opportunity to participate in ministerial and presidential trips. The 2020 class of the French Tech 120 employed a total workforce of 37,500 people. 26,000 of whom were in France. In addition, a **Scale-up** Tour across Europe was launched in 2020 to enable French scale-ups to gain greater international visibility and to develop a network of investors, customers and partners. The initiative is jointly organized by Mission French Tech, Bpifrance, Business France and the Ministry of Economy, Finance and Recovery, and the Ministry of Europe and Foreign Affairs.

⁶ Label awarded to cities and geographical areas offering a favorable environment for the creation and development of French start-ups, but also attractive for investors and foreign talent (entrepreneurial culture, talent, technological mastery, financing, etc.).

⁷ Label attributed to a project 1/ led by a community of French entrepreneurs and investors established outside of France; 2/ supported by French public authorities in the territory in question; 3/ meeting the specifications of the call for labelling.

⁸ This indicates a change in scale of a company through a growth acceleration strategy, especially internationally, which generally applies to start-ups that have already graduated from start-up status but have not yet reached unicorn status.

From the Scale-up Tour to the Scale-up Europe manifesto

The Scale-up Europe initiative was launched in 2021, as a follow-up to the Scale-up Tour, with the aim of promoting scale-ups across Europe through networking between scale-up companies, clients and investors. Led by a pan-European network of start-ups, large companies and investors with the support of French public authorities, the Scale-up Europe Initiative led to the publication, in June 2021, of a Manifesto for European Scale-ups.

This manifesto notes that in ten years, from 2010 to 2020, the European start-up ecosystem has managed to increase its annual fundraising sixfold (raising more than \notin 40Bn by 2020), hatched more than 70 unicorns, and created more than 2 million direct and indirect jobs.

Above all, the European ecosystem has generally faired rather well during the Covid-19 crisis, despite some disparities between countries. It has thus continued its transformation from a "forest of bonsai trees to a forest of large trees," from seed to late stage.

The Scale-up Europe manifesto therefore aims to create 10 European tech companies with a value of over \in 100 billion by 2030. To help achieve this goal, the manifesto proposes four key measures aimed at:

- Supporting venture capital investment, notably to encourage latestage and exit;
- Developing the available talent pool and making the ecosystem more open to people from diverse backgrounds;

- Stimulating the emergence of Deep Tech;
- Fostering more efficient collaboration between existing companies and start-ups.

The proposals were submitted to the President of the Republic on 15 June 2021.

The structure initiated by the French Tech label has also contributed to the development of local, public, private or, most often, partnership initiatives. By 2021, France will have more than a hundred accelerators and incubators, compared with only thirty or so in 2012.⁹ The flagship of this network of accelerators, Station F, opened in 2017, aims to be the largest incubator in the world and also the French Tech showcase.

In this respect, the statistical analyses we carried out within the framework of this study on the basis of CB Insights data have revealed a very strong correlation (R^{210} coefficient of 0.9 for the entire sample of countries) between the number of incubators present in a country and the amounts raised. Nevertheless, at the level of each country, significant differences can be noted regarding this correlation: it is very strong in Switzerland (0.88), the United Kingdom (0.83), and Germany (0.81), but less so in Israel (0.75) and France (0.69), and much less so in Sweden (0.5), Finland (0.47) and the Netherlands (0.47).

9 According to Tracxn data.

^{.../...}

¹⁰ The R² is called the coefficient of determination in statistics and is used to judge the quality of a linear regression. This coefficient measures the strength of the relationship between a variable whose dispersion we wish to explain over several values (here, the number of fundraisings of more than 30 Mn US\$) and another variable that can explain this dispersion (here, the number of incubators).







Source: Institut Montaigne analysis with the assistance of Accenture (CB Insights data).

However, it is mainly in the financial sector that public resource commitments have spurred the creation of private funds, whose autonomy is growing.

3. Financing: the 2010 decade in France saw an exceptional mobilization of public funds, which has had a decisive leverage effect on the private financing of innovation

The origin of public funds dedicated to financing innovation, whether managed by Bpifrance or not, is diverse and meets several objectives. While the public bank may act on its own account, particularly for its loan financing activity, it also manages external funds, from specific budget lines, funds from the various Future Investment Programs (PIA), the Funds for Innovation and Industry (FII – see box), the Defense Innovation Agency (AID), or European funds (particularly the Juncker plan or the European Investment Fund).

The PIA (Future Investment Programs) and the Funds for Innovation and Industry are the latest major national financial support programs for innovation

The Future Investment Program (PIA), managed by the General Secretariat for Investment (SGPI), was launched in 2010 to finance innovative investments throughout the country and enable France to increase its growth and employment potential. The PIA can support any point of the innovation chain, from the ideation phase to the dissemination of a new product or service on the market, and applies to both public research and private companies. The PIA aims to leverage private funds by sharing investment risks. The first iteration of the PIA included €35 billion in public funds in 2010, supplemented by €12 billion for the second iteration in 2014, €10 billion in 2017 for the/...

third, and finally €20 billion for the fourth phase launched in 2020, including €11 billion imbedded in the French Recovery Plan.

In addition to the third phase of the PIA, in January 2018, the Government launched a tool more directly targeted at financing innovation, particularly high-tech innovation in industrial sectors: the Funds for Innovation and Industry (FII).

To this end, the FII reached ≤ 10 billion thanks to ≤ 1.6 billion in asset sales by Engie and Renault and ≤ 8.4 billion in contributions of shares by EDF and Thales. When the FII was created, the aim of generating an average annual return of ≤ 250 million was set, initially to finance:

- €70 million in individual aid as part of the Deep Tech plan;
- €120 million in funding for "Great Challenges", such as cybersecurity, mobility and Al;
- €25 million under the Nano 2022 plan;
- €35 million as part of the Batteries plan.

The FII was intended as part of a five year €4.5 billion public investment program targeted at funding disruptive innovation; this amount also includes other funding schemes.

Although the FII has been maintained and is now hitting its financing objectives, the French Recovery Plan and the $4^{\rm th}$ phase of the PIA have led to changes in the allocation of funds and priorities.

Source: Government.fr

Public financial support for innovation can also happen in ways other than direct support to companies through Bpifrance. The PIAs in France, and the framework programs for research and technical development at the European level, make research and innovation their priority. They also have a

much broader approach than just financing innovative companies, especially aiming to modernize universities, develop research laboratories, encourage partnership research, and build certain infrastructures. Thus, among the twenty or so billion euros actually committed under the first phase of the PIA, $\in 6.7$ billion was specifically earmarked for industry and SMEs, and $\in 1$ billion for digital technology.¹¹ Of the $\in 95.5$ billion of the Horizon Europe program, planned for the years 2021 to 2027, 13% is directly allocated to innovation (pillar 3), even though pillar 2, receiving 56% of the funds, also aims to strengthen competitiveness through the development of research partnerships.¹²

These different budgetary frameworks, primarily focused on financing companies managed by Bpifrance, have played a decisive role in the development of private financing for innovation in France.

Subsidies, co-financing and public guarantees have helped encourage commercial banks to become more involved in financing innovative start-ups by granting them loans. Although there are no reliable consolidated figures, several examples illustrate this trend. For example, the BPCE group, supported by the European Investment Fund (EIF), has offered loans to support innovation, from $\leq 25,000$ to ≤ 7.5 million, for SMEs. In addition to their loans, commercial banks have created centers of expertise to take into account the specificities of financing innovative start-ups, such as the WAI ("We Are Innovation") hubs of BNP Paribas.¹³ Lastly, French commercial banks have developed accelerators, such as Crédit Agricole's Villages, or structures to put innovative start-ups in touch with potential clients, such as Société Générale's Open Innovation Platform.

International insights Investment support tools

The United Kingdom

The **UK** Government has traditionally been a big supporter of many R&D intensive and innovative businesses from their inception through tax incentives, grants, loans and equity. The main 3 schemes are the following.

- The Enterprise Investment Scheme (EIS), launched in 1994, is designed to encourage investments in small unquoted companies carrying on a qualifying trade in the United Kingdom. Through the EIS, eligible investors can claim up to 30% income tax relief on investments up to £1 million per tax year.
- The Venture Capital Trusts (VCTs), first introduced in 1995, is a publicly listed, closed-end fund in the UK that allows individual investors to gain access to venture capital investments via capital markets. VCTs encourage small business growth, provide potential high returns through high-growth private companies, and have multiple tax advantages as well.
- The Seed Enterprise Investment Scheme (SEIS) was launched in 2012 to encourage investors to finance startups by providing tax breaks for projects they might otherwise deem too risky. Through the SEIS, investors, including directors, can receive initial tax relief of 50% on investments up to £100,000 and Capital Gains Tax, exemption for any gains on the SEIS shares.
- The £375 million Future Fund founded in 2021: to address the scale up gap for their most innovative businesses.

¹¹ Source: Evaluation of the first part of the future investment program (PIA, 2009-2019), P. Barbizet, C. Hemous and A. Siné.

¹² Source: Ministry of Higher Education, Research and Innovation.

^{13 60} clusters created since 2012 with over 100 innovation experts.

However, it is above all in the area of venture capital development that public financial support has been the most decisive. Learning from the relative failure of the so-called Allègre funds, launched at the end of the 1990s, because they were insufficiently ambitious in terms of amounts raised, the first phase of the PIA was the National Seed Fund (FNA), initially endowed with €600 million.¹⁴ The objective of this fund of funds managed by Bpifrance was to invest in private seed funds in order to leverage the amounts available in France for start-ups (see chart below, on the growth phases of start-ups). This fund of funds model was also intended to keep part of the risk in private funds which, while being supported by the government, were made responsible for their selection of projects. Today, this fund is considered a key element in the development of venture capital in France. It has invested in 29 private venture capital funds, with an average amount of €43.4 million¹⁵ and a leverage effect of 2.1. The total leverage for the companies in which the supported funds invested would rise to 8.7. In total, by 2019, 483 companies have been supported and have filed 1,076 patents.

Start-up development phases

Ideation	Concept	Engagement	Validation	Scaling-up	Establishment
 Service or product targeting a big enough market First financial viability assessment Single person or 	 Specific target for a minimum of 3 years Key milestones established Two or three founders, perhaps certain key contributors 	 Product/ service development (Minimum viable product) at minimal cost Team of founders ready and with comple- mentary skill sets Shareholder agreement between the founders 	 Growth in user base, in revenue, and/or in the ability to attract capital Aim of confir- ming the commercial value of the product/ service 	 Measurable and unde- niable growth in product/ service presence on the market Ability to scale-up quickly and/ or attract significant funding 	 Strong sustainable growth Ability to obtain resources reliably Willingness to continue operating with flexibility Founders leave or stay on
Origin		Star	t-Up	Gro	owth

29

28

After initial support from the FNA in the second half of the 2000s, private seed funds became partially independent from public funding. When PIA 1 was created in 2009, it largely overshot its set objective of a 2/3 rate in public funding, yet in 2019 the rate of public funding for private seed funds was only 45%. The FNA has enabled the emergence of major funds such as Partech, Demeter and Elaia.

¹⁴ Source: Evaluation of the first part of the future investment program (PIA, 2009-2019), P. Barbizet, C. Hemous and A. Siné.

¹⁵ The figures in this paragraph come from the evaluation of the FNA conducted by the evaluation report of the first part of the Future Investment Program (PIA, 2009-2019), P. Barbizet, C. Hemous and A. Siné.

While the market gap in seed funding seems to be closing, at least partially,¹⁶ public intervention has progressively shifted towards growth and late stage. This intervention follows two main approaches.

Initially, it tended towards financial support in the form of funds of funds, managed by Bpifrance, under similar terms to those of the FNA; it was set up to support the establishment of private funds. Launched in 2014, the Multicap 2 Fund thus targets minority stakes, from €20M to €60M, in large funds (€100M to €300M). Then came a similar fund with an international focus, the SME Internationalization Fund. However, support for investment in the growth, or even in the late stage, of start-ups cannot be perfectly modeled on the successful experience of the FNA in the area of seed capital. This fund was supporting a much smaller pool of companies and for much larger amounts invested, making it more difficult to diversify the portfolio in order to reduce the budgetary risk for the State.

30

Thus, in a second phase, the government adopted a policy to support late stage funds with the **Tibi initiative**¹⁷ launched in January 2020. This initiative is based on the observation that there is a twofold market failure in the late stage sector: a limited supply of late stage start-up shares due to insufficient means of financing their growth, as well as a limited demand for shares due to the insufficient placement of asset management funds in this type of risky asset. In partnership with financial investors, the French government has therefore approved late-stage private equity and global macro asset management funds, committed to investing \in 6 billion in funds for tech companies by December 2022, with the aim of generating a total of \in 20 billion in leveraged investment. The assessment carried out in June 2021, 18 months after the launch of the initiative, showed that more than \in 3.5 billion including all subscriptions to the

49 approved funds. These initial results have led Bruno Le Maire (Minister of the Economy and Finances) to raise the total target to €30 billion by the end of 2022, while Philippe Tibi emphasized the need to tap into employee and pension savings as well as long-term international investors (sovereign wealth funds, pension funds, foreign insurance companies and family offices).

While this public intervention has had a significant impact on the development of venture capital financing in France (see the chart below), its leveraging effect will only be maximized if it succeeds in mobilizing French savings towards productive investment, particularly innovation. Venture capital financing offers developed so far have already mobilized institutional investors within the limits allowed by the regulations. Only a deep cultural revolution in the relationship between the French and their savings will unlock the situation. However, a regulatory and fiscal easing on hoarded savings now seems a necessary precondition for redirecting investments towards innovation.

¹⁶ Indeed, the Deep Tech sector, characterized by longer development times and a high level of uncertainty, still seems to have a market gap in seed funding.

¹⁷ Report by Philippe Tibi, Financing the Fourth Industrial Revolution – Unlocking financing for technology companies, submitted to the Minister of Economy and Finance and the Secretary of State for Digital, in July 2019.





Source: Bpifrance.

Top domestic VC funds

(by value of portfolio assets)

VC Funds	Value of assets in the portfolio (in €Bn)
Aglaé Ventures	244.9
Sofinnova Partners	234.7
Auriga Partners	213.1
AEC FinTech	143.9
Aster Capital	97.5
Innovacom	80.8
360 Capital Partners	48
Bpifrance	38.5
Partech	34.2
Kima Ventures	33.3

Top corporate VC funds

(by value of portfolio assets)

Corporate VC funds	Value of assets in the portfolio (in €Bn)
AXA Investment Managers	7.2
AXA Venture Partners	6.5
TotalEnergies Carbon Neutrality Ventures	5.6
ENGIE New Ventures	3.8
Orange Ventures	3.6
ALIAD (Air Liquide)	1.8
BNP Paribas Développement	1.7
Via ID	1.6
SNCF Digital Ventures	1.0
Opera Tech Ventures	0.8

Source: French Tech website.

4. An enabling environment: tax and regulatory reforms aimed at further shifting French savings towards productive investment, particularly in start-ups

France has a historically high household savings rate. Since the early 2000s, while according to Eurostat the average savings rate in the European Union is between 10 and 11% of gross disposable income (GDI),¹⁸ the savings rate in France has fluctuated between 14 and 16% of GDI, and even reached 21.4% of GDI in 2020 due to the restrictions triggered by the Covid-19 pandemic.

¹⁸ In national accounts, gross disposable income of households is the household's income available for spending or investment, after redistribution operations; this is the so-called primary income (income from employment and property) plus social benefits in cash and minus contributions and taxes paid.

However, the French remain largely risk averse and favor investments considered low risk – which is not very conducive to innovation, unlike the Germans who also have a high savings rate. In 2018, according to *Insee* (the National Institute of Statistics and Economic Studies), 62% of the \in 11,735 billion of net wealth (adjusted for private debt) of the French was invested in real estate.

Worse, of the nearly €5,200 billion in financial assets held by the French, 25% was invested in regulated passbook accounts or demand deposits. In total, less than 20% of financial assets, and therefore less than 9% of total French assets (movable and immovable) were invested in unlisted shares, including, albeit to a lesser extent, shares in innovative start-ups. The following charts illustrate this.

French savings outstanding in Q1 2020

(in €Bn)



Given this situation, since the early 1990s, and with a clear acceleration since 2017, ambitious tax and regulatory measures have been taken to encourage the shift of French citizen's savings towards investment in shares (listed or unlisted) and company shares (see next box).

Tax and regulatory measures implemented to direct French savings towards investment in companies

The Madelin tax reduction aims to support subscriptions to initial capital, or capital increases, in shares or corporate units, of SMEs under 7 years of age in the seed, start-up or expansion phases. Under certain conditions, this scheme is also open to investment in an SME over 7 years old investing in a new geographical or functional market. The Madelin income tax reduction is therefore aimed at a much broader pool of companies than just innovative start-ups, but it does include them.

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In return for committing to hold the shares until December 31 of the fifth year following the year of subscription, the Madelin scheme consists of an income tax reduction of 18% of the sums invested each year, up to €50,000 for a single person and €100,000 for a married or civil partnership couple. Since 2018, this tax break has been increased to 25% of the capital invested. The Madelin reduction adheres to the overall cap on tax niches of €10,000 per year per tax household.

The Madelin reduction is linked to measures to support investment in venture capital funds. In general, capital gains and income from **venture capital funds (FCPR)**, which include at least 50% of funds

invested in securities not listed on a regulated market, may be exempt from income tax after the funds have been frozen for a minimum of five years. In this case, only social security contributions will be levied. at a flat rate of 17.2%. In addition to this income tax exemption on exit, within FCPRs, local investment funds (FIPs), and especially in terms of innovation financing, innovation investment funds (FCPIs) allow investors to benefit, on entry, from the Madelin reduction. They benefit from it through a reduction in income tax at a rate, temporarily increased since 2018, to 25%, up to a limit of €12,000 for a single person and €24,000 for a civil partnership or married couple. Since 2014, FCPIs, funds specifically created to support innovation, must invest at least 70% of their funds in securities not listed on a regulated market and for innovative companies. The innovative nature of a company is demonstrated either by research and development expenses equal to at least 15% of tax-deductible expenses (10% in the case of industrial companies), or by proving the innovative nature and economic development prospects of a product, process or technique to Bpifrance, during the previous fiscal year. In 2020, approximately 70% of non-professional funds raised for venture capital were through FCPRs, 20% through FCPIs and 10% through FIPs. In addition to these three types of funds open to individuals, there are also professional private equity funds.

PEAs (stock option plans) and PEA-PMEs (stock option plans for SMEs), employee savings plans and retirement savings plans, such as the new Retirement Savings Plan (see box below), are also ways of holding unlisted shares and benefiting from the associated tax advantages. However, these investments in unlisted shares are still too few and far between. More broadly, since 2018, two flagship measures have been aimed at redirecting individuals' savings towards financial investments, whether listed or not. The solidarity tax on wealth (ISF) has been transformed into a tax on real estate wealth (IFI), thus exempting investments in securities. A single flat-rate tax (PFU) of 30% (17.2% for social security contributions and 12.8% for income tax) has been introduced for the taxation of income and capital gains on securities, replacing the progressive income tax scale. Although these two measures aim to support the development of financial savings for productive investment, they apply indiscriminately to securities, whether listed or risky, and therefore do not specifically target investment in innovation. As a consequence of scrapping the ISF, the termination of the ISF SME, a tax reduction aimed at investment in companies that are not listed on a regulated market, may have done a disservice to the prospect of redirecting financial savings towards unlisted companies and innovation (see box below).

In addition to these tax measures, regulatory measures have been included in the 2019 PACTE law, in order to support investment in unlisted companies, including innovative start-ups. Among the various measures adopted, the removal of the cap on investments in a life insurance contract in FCPRs (previously capped at 10% of the amount of the contract) and a stimulation of the constitution of funds of funds intended to invest more in unlisted companies while diversifying the risk portfolio, are particularly noteworthy. Thus, FCPRs, which are open to individuals, may now invest up to 35% of their funds in professional private equity funds (or similar funds, such as specialized professional funds), as opposed to the initial 10%, thus making it easier to mobilize private individual savings in professional funds.

The new retirement savings plan (PER)

By mobilizing very long-term savings in securities, the various retirement savings measures are an ideal way to increase the equity investment capacity of companies, especially French companies. It is with this in mind, combined with a desire to improve the French retirement prospects, that the 2019 PACTE Act has organized a thorough overhaul of savings options. A single retirement savings plan (PER) replaces the many different plans, with poorly harmonized rules (i.e., PERP, PRECO, Madelin contract, Corem, Préfon, etc.).

The PER is a unique tax package with three components:

- the individual PER, or PERIN, which replaces the individual supplementary pension contracts (PERP, Madelin contract, Préfon, Corem, etc.);
- the new collective PER, which replaces the former collective PER:
- the category-based PER, which replaces the former company pension savings plans.

On this basis, three types of payments are possible:

- voluntary, on an individual basis;
- from employee savings (profit-sharing, incentive schemes or time savings accounts);
- compulsory, on behalf of the employee or the employer in the context of categorical PERs.

The tax rules are thus harmonized and favorable, thanks to an income tax exemption.¹⁹

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A new transferability of plans

As a result of the standardization of operating rules, PERs can now be transferred from one provider to another in order to encourage free competition and improve returns.

A possibility of capital withdrawal

While the vast majority of old retirement schemes only provided for withdrawals in the form of life annuities, the new PER is more attractive as it makes capital withdrawals possible.

Extended early payment rules

While the early payment of sums invested in the old retirement savings schemes was limited to family related reasons (death of spouse, disability) or professional reasons (judicial liquidation, loss of unemployment benefits), the new PER allows for early withdrawals for the acquisition of a main residence.

This far-reaching reform of retirement savings has resulted in a significant increase in the attractiveness of these investments. According to the figures given by the Ministry of the Economy, Finance and Recovery at the end of May 2021, 2.8 million French people had a new PER, which led to the mobilization of an additional €32 billion invested in securities. The government hopes to reach its target of

3 million contributors in 2022 ahead of schedule. In total, the stock of retirement savings increased from €230Bn in 2018 to €269 billion at the end of 2020.

These various regulatory and tax measures are designed to redirect French people's savings towards securities, especially shares in innovative companies, but their overall effect at cruising speed can only be assessed in several years' time with sufficient hindsight. In addition to bolstering the funding available to innovative start-ups, it seems essential to implement a policy aimed at 39

19 Within the limit, for employees, of 10% of the net taxable income of the previous year and a maximum of €31,786 (in 2019). The rules are modulated for the self-employed. reducing costs, for a constant balance sheet size, of innovation and research investments for these start-ups.

Thus, tax measures have also been adopted to reduce the cost of business investment in innovation.

In France, various tax measures, both old and recent, aim to support business investment in innovation. These measures, which come as tax credits targeted at certain types of innovation-related expenditure, are combined with recent indiscriminate tax measures to promote business competitiveness: transformation of the employment competitiveness tax credit (CICE) into a permanent tax relief, an approach for lowering the main corporate tax rate (IS) from 33.33% to 25% by 2022 and a reduction, from 2021 onwards, of €10Bn per year in production taxes (business value-added contribution, business property tax and property tax on built-up properties).

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The research tax credit (CIR) reduces the corporate income tax of companies that incur research expenses: fixed assets, personnel expenses, operating expenses, or the cost of outsourcing research to external public or private laboratories. Created by the 1983 Finance Act, the RTC has been strengthened and readjusted by successive parliamentary majorities. It is now equal to 30% of eligible research expenditure, up to a limit of €100 million per year, and reduced to 5% above this threshold. The research conducted on the RTC²⁰ has drawn the following conclusions: 1/ the impact on corporate R&D is globally equivalent to the amount of the RTC (1.1 to 1.5 euros of expenditure for 1 euro of RTC); 2/ the impact of the RTC is not all that noticeable in terms of innovation and economic activity.

Moreover, in order to cover the first post-R&D industrial deployments, the 2013 Finance Act introduced the **Innovation Tax Credit (CII)**, which allows SMEs within the meaning of the EU regulation to reduce²¹ their corporate income tax for expenses related to the design of prototypes of new products or pilot installations of new products. Less favorable than the RTC, the ITC is equal to 20% of the eligible expenses retained within the limit of €400,000 per year.

The **Young Innovative Companies (JEI)** scheme, as well as the similar scheme for Young University Companies (JEU), are designed to reduce the social security and tax costs of independent SMEs under 8 years of age that carry out research expenditure in an amount at least equal to 15% of their tax-deductible expenses. JEIs can benefit from a 100% corporate tax reduction for their first tax year and 50% for the following year. In addition to this initial tax reduction, in certain areas, JEIs can benefit from an exemption from territorial economic contribution and property tax for seven years. Finally, in certain cases, JEIs can benefit from an exemption from employer contributions on the salaries of employees involved in research activities.

Finally, with what is commonly referred as the "Macron law" of 2015, the State introduced a **temporary and now defunct scheme for the overly generous depreciation of investments by SMEs in the digital and robo-tics fields.** This allows for a deduction from the taxable output of an SME up to 40% of the cost price of goods and software contributing to its digital transformation.

In total, from 2008 to 2018, the annual amount of tax aid directly aimed at innovation increased from ${\bf \xi}4.1Bn$ to ${\bf \xi}6.7Bn.^{22}$

²¹ Less than 250 employees and a turnover of less than €50 million or a balance sheet total of less than €43 million.

²⁰ The impact of the research tax credit, National Commission for the Evaluation of Innovation Policies, March 2019.

²² Reports on innovation aid, J. Lewiner, R. Stephan, S. Distinguin and J. Dubertret, March 2018.

As mentioned, these significant amounts of public aid, whether fiscal or not, and the wide variety of measures in place have responded to a market failure due to a lack of private financing for start-ups and innovative companies. Nevertheless, the dynamics now underway, with more and more funds being raised and of ever-increasing size,²³ will necessarily lead us to question the maintenance, evolution and redeployment of this public aid, not to mention the simplification and legibility of the overall panorama. It would not be economically relevant, or even consistent with European rules, to maintain aid systems that compete with, or even limit, private initiative.

- 2. This ambitious policy has enabled France to catch up to a large extent, though without enabling it to match the most successful countries to date
- 42

1. Year after year, France has been able to build up real momentum in venture capital financing

These various initiatives, mainly structured around financing, have helped make France the second largest start-up ecosystem in Europe today, behind the United Kingdom, but ahead of Germany in terms of the number of high-value start-ups.

Despite the lockdown and the health crisis, France has reached new records in fundraising amounts, standing at €5.39Bn for the whole of 2020 compared to €2.2Bn in 2015, and most notably an amount of €5.14Bn raised in the first quarter of 2021 alone.²⁴ Due to the lockdown, the number of transactions in 2020 contracted slightly compared to 2019, but

still settled at a level close to 600, compared to 400 in 2015 (as illustrated in the first graph below). It should be noted that since January 2021, French innovative companies have completed 416 fundraising initiatives, reflecting a strong recovery from the health crisis.

Amounts of funds raised in France from 2015 to the first half of 2021



43

Source: Ernst & Young Barometer of venture capital in France, 1st half 2021.

²³ Cf. the record-breaking €680M fundraising for French start-up Sorare, among the world's leaders in trading cards and fantasy sports games dedicated to soccer, on 21 September 2021.

²⁴ Source: Ernst & Young Barometer of venture capital in France, 1st half 2021.



Amount of VC fundraising by country (2000-2020)

Source: Institut Montaigne analysis with the assistance of Accenture (CB Insights data).

This fundraising was primarily in the software and internet services sectors (50%).²⁵ While the software sector accounted for 140 deals, the internet sector accounted for 128 deals in 2020. Together they raised €2.8 billion.²⁶ The Life Sciences sector remains the third largest sector (€851M raised vs. €811M in 2019), and is expected to increase again in 2021. Finally, the FinTech sector is booming, with a growth of 57% between 2019 and 2020, to reach €622M of funds raised. Indeed, this sector can count on new success stories such as Allan, Oonto or Lydia.

Sectoral breakdown of VC fundraising in 2020

(in €M)

and IT services

Source: Ernst & Young's Barometer of venture capital in France in 2020.

45

Above all, a more detailed analysis of the structure of the funds raised **shows a more mature ecosystem.** French start-ups are raising much larger amounts than in the past and are attracting large foreign funds, particularly American. This is made apparent when considering France's catching up trend over the last ten years in terms of fundraising of more than €30M / US\$30M.²⁷ This growth is largely due to the number of financing cycles over €100M, which more than doubled in one year, from 4 to 9, for a total amount of €1.68Bn.²⁸ The average number of funds collected has increased from €6.9M to €8.7M between 2019 and 2020.²⁹ It is also expected that 2021 will outpace 2020 on this indicator.

^{1.600} 1.400 1,200 1 0 0 0 800 140 operations 600 operations 400 operations 49 200 operations operations 0 Life Sciences Software Internet services Fintech Cleantech

²⁷ This threshold was taken from the conclusions of the Tibi report, which emphasized that "as far as the supply of securities is concerned, start-ups do not generally have difficulties in financing their early stages of development. France has a promising pool of technology companies. However, their growth is slowed down by the lack of late-stage financing (raising more than €30-40M)" (Financing the Fourth Industrial Revolution – Unlocking financing for technology companies).

²⁸ Ibid.

Top 5 fundraising events by amount and investors involved



Source: Ernst & Young Barometer of venture capital in France in 2020.





with the assistance of Accenture (CB Insights data).

The maturing ecosystem also translates into greater international

clout. At the beginning of 2021, 40% of funds raised came from foreign funds, primarily American, but also, though to a lesser extent, Asian.³⁰ These foreign funds are primarily interested in the late stage, which explains the correlation between the internationalization of financing and the growth of French start-ups. Thus, foreign funds contributed 21% of the amounts raised for the US\$50-100 million bracket, 31% for the US\$100-250 million bracket and even 80% for those raised beyond US\$250 million.³¹ The most noteworthy recent deals include the investments in Shift Technology (Advent International),

30 Source: Les Echos, Les 5 raisons qui expliquent le succès de la Frenc Tech, june 16 2021. 31 Source: DG Treasury, Fundraising and uUnicorns: Where does France stand? June 2021.

Alan (Coatue Management), Ledger (10T Holdings), Contentsquare (SoftBank) and Back Market (General Atlantic). In 2021, this trend could accelerate, particularly with the arrival in Europe of American SPACs, these empty shell companies raising funds on the stock market in order to carry out mergers and acquisitions of growth companies. In May 2021, 422 American SPACs, having raised US\$134 billion, were seeking to acquire target companies.³²

In total, as of August 2021, France has managed to develop 18 unicorns.³³ While this number remains far behind the UK (31), France has managed to match Germany.

Valuation of French Unicorns



Source: Institut Montaigne and Accenture (CB Insights data July 2021, Ministry of the Economy, media reports).

32 Source: *Financial Times*, Wall Street's Spac gravy train hits the buffers, June 1, 2021. 33 Young company with a capitalization of more than one billion dollars.

2. To enable France to maintain its virtuous momentum, the development of venture capital must be further consolidated

In Europe, the levels of venture capital mobilization confirm that France lags behind the UK in number of unicorns. In 2020, while in France, \in 5.39Bn was raised in venture capital, in nearly 600 deals, in the UK, \in 12.7Bn was raised in 1,136 deals. Beyond the intra-European lag, it should be noted that Europe itself still falls significantly behind the US and Asia. In 2020, the total amount of venture capital fundraising in Europe reached \$41Bn, compared to \$74Bn in Asia and \$141Bn in the US.³⁴

These differences in fundraising can be explained above all by the more advanced level of maturity of the British ecosystem. The latter benefits from powerful assets and became the fourth largest ecosystem in the world in terms of number of unicorns.³⁵ Two reasons can explain this rise: a high-performance academic system which is attractive on a global scale, and the language, English is mastered by talent around the world.

The statistical analysis carried out as part of this study comparing France with several other countries, particularly in Europe, shows that the position of the French innovation ecosystem is still average/medium in the sample in terms of its ability to create high-value startups. Based on CBInsights data, we chose to reproduce a methodology created by CBInsights for the US ("The Venture Capital Funnel"³⁶), used by Atomico in its 2020 European Tech Report, which consists in illustrating the evolution over time of a sample of start-ups that have received seed funding during a given period.³⁷ Out of 100 companies that received seed funding between 2010 and 2015, 5 reached a 4th round of funding, 2 a 5th round and

37 Number of financing rounds completed, average amounts raised, number of years needed to achieve them.Number of financing rounds completed, average amounts raised, number of years needed to achieve them.

³⁴ Source: The State of the European Tech, Atomico, 2020.

³⁵ Datas from CBInsights.

³⁶ The Venture Capital Funnel (cbinsights.com).

less than 1 a 6th round. For the latter, it took almost 10 years to reach the 6th round, with an average total cumulative amount of \$272 million. These French performances are very close to the average and median of the sample, although slightly better in the first rounds of funding. Conversely, some countries, such as Switzerland and Estonia, have achieved excellent performance relative to their economic weight.





(100 Seed-funded VC-backed companies - 2010-2015)







Source: Institut Montaigne and Accenture (CB Insights data as of 23 November 2020).

Nevertheless, France is clearly catching up at the seed level. The number of start-ups receiving seed funding in France increased by a factor of almost 2.5 between 2010-2015 and 2015-2020, which shows the catching-up process that is underway, with other countries such as the United Kingdom at +59%, or Germany at +79%. With all things being equal, and with an unchanged performance in France's ability to grow start-ups, a potential of

2.5 times more high-value start-ups can be expected in the next 5 to 10 years with respect to the seed cohort between 2015 and 2020.



Number of start-ups financed at the seed stage between 2010-2015 and 2015-2020

The challenge today is to maintain this strong momentum on the one hand, and to consolidate and sustain the development of late stage financing on the other. Thus, it seems necessary to step up the growth in the number of fundraising events over $\in 100$ million.

the €18 billion mark in mobilizable funds was reached, the target was revised to €30 billion by the end of 2022. Nevertheless, it will be important to remain wary of the reality of the mobilization of these labelled funds during strategic fundraising operations for French Tech and to ensure that the implementation of late stage funds is a long-term process and makes up for the lack of supply which triggered the Tibi initiative. In this respect, the difficult IPO of the start-up Believe, ³⁸ in June 2021, has raised some questions about the mobilization of global tech funds. The actual mobilization of Tibi funds has yet to be confirmed.

Nevertheless, late stage financing is primarily based on foreign funds.

The share of foreign funds rises to 80% for fundraising over \$250 million.³⁹ The predominant share being acquired by non-European funds is in itself a sign of the attractiveness of the French innovation ecosystem. It supports the growth of French start-ups by offering capital, experience and prospects for conquering new markets. However, it is also important that France and the European Union develop their own funding levers. These are necessary to preserve control of certain companies, especially those considered strategic. More generally, preserving European control of EU start-ups is a way of maintaining the capacity to define our standards and practices according to our collective preferences. Finally, European late stage financing could facilitate exits from European stock exchanges, rather than from US stock exchanges. It is therefore important to continue to promote ambitious policies aimed at attracting foreign funds, while also developing our own capacities to support certain priority companies and sectors.

Overall, while a clear trend towards catching up with venture capital in France is emerging, the extent and sustainability of this trend are still uncertain. While the solidity of seed financing, aside from Deep Tech, seems to be a given, the sustainable development of late stage financing still needs

Source: Institut Montaigne analysis with the assistance of Accenture (CB Insights data).

To this end, the initial assessment of the Tibi initiative, aimed at supporting late stage funding, is encouraging. The initial aim was to mobilize \in 20 billion by the end of 2022, after a knock-on effect of 21 French institutional partners committing to contribute \in 6 billion. In May 2021, when

³⁸ The share price of Believe fell by more than 18% on its first day of trading, due to a much lower than expected demand for the stock on the secondary market.39 See above.

to be confirmed; as evidenced by the constant decrease in Bpifrance's share of private funds as well as in the analyses conducted for this report.

3. Channeling French savings towards investment in innovation could be a new way to bolster the strategy implemented over the past ten years

As mentioned above, two key measures at the beginning of Emmanuel Macron's five-year term were aimed at redirecting French people's savings towards productive investment in securities: the introduction of the single flat rate tax (PFU) and turning the solidarity tax on wealth (ISF) into a tax on real estate wealth (IFI). The PFU reduced the total tax and social security burden on the securities income of the wealthiest French citizens from 60.5% (45% for income tax and 15.5% for social security contributions) to 30%. The shift from the ISF to the IFI reduced the annual net tax burden of French taxpayers from \notin 4.23Bn to \notin 1.29Bn between 2017 and 2019. However, according to a study by IPSOS,⁴⁰ 70% of the gains among people surveyed were reallocated to financial savings or direct investment in companies.

While these two tax measures may have had a significant impact on fostering savings invested in securities, have in fact hardly benefited start-ups if not at all. Indeed, the transition from the ISF to the IFI has led to the removal of the ISF-PME scheme, ⁴¹ which aimed to direct the savings of the wealthiest French people towards investments in SMEs that are less than seven years old or that are entering new markets. To this end, the ISF-PME consisted of an ISF reduction equal to 50% of the amount of cash and in-kind contributions made to eligible SMEs. The ISF reduction was capped at €45,000 per year, with no carry-over. The ISF-PME reduction could be applied

to direct investment in SMEs or by FIPs (local investment funds) or FCPIs (innovation investment funds).

If maintained, the Madelin income tax reduction scheme will, in its current form, only have a limited leverage effect compared with the ISF-PME. The Madelin reduction currently amounts to only 25% of the amounts invested, compared to 50% in the case of the ISF-PME. Above all, in addition to a cap on eligible payments of \notin 50,000 per person per year (\notin 100,000 for a married or civil partnership couple), the Madelin reduction is subject to the annual cap on tax exemptions of \notin 10,000.⁴² In a 2018 report by the General Inspectorate of Finance on innovation aid, it was pointed out that "the disappearance of the ISF-PME niche, although partially and temporarily compensated by an increase to 25% in the rate of SME income tax, poses a risk to the mobilization of private funds for start-ups and innovative SMEs. This means that \notin 300 million to \notin 400 million in tax incentives will disappear, and probably more in terms of mobilizing resources. The mission suggested raising the rate of the SME income tax to 30% up to a limit of \notin 100,000 for a single person and \notin 200,000 for a couple.

Therefore, analysis of empirical data since the implementation of the IFI and the PFU shows contrasting effects on the development of private equity in France. According to France Invest, ⁴³ there was no abrupt halt to the development of private equity, as some might have feared. On the contrary, between 2017 and 2018, fundraising increased by 17% to €18.7Bn. The amounts invested also continued to grow over the same period, from €14.3Bn to €14.7Bn.

⁴⁰ Study conducted by Ipsos, including 300 respondents, for the Fondation des apprentis d'Auteuil (Auteuil Apprenticeship Foundation), April 2019.

⁴¹ Introduced by the TEPA law (Work, Employment, Purchasing Power) of 21 August 2007.

⁴² Unless investing in a socially responsible real-estate company or a socially focused company. In these cases, the cap is raised to $\in 13,000$.

^{43 30&}lt;sup>th</sup> edition of the French private equity players' activity report, 28 March 2019.



Source: 30th edition of the French private equity players' activity report, March 28, 2019.



Amount invested

Source: 30th edition of the French private equity players' activity report, March 28, 2019. However, a more in-depth analysis tends to nuance this initial observa-

tion. First, within private equity, the share of innovation capital has stabilized, with growth limited to 1%, compared to 26% for growth capital. Secondly, a significant part of the growth in funds raised comes from abroad, while the share of funds coming from within France has fallen in 10 years from 62% to 52%. In this respect, while the introduction of the PFU and the transformation of the ISF into the IFI have helped to continue to grow private equity in France, their indiscriminate nature has been less favorable to innovative capital than to other investments in securities, whether listed or unlisted. Thus, in 2018, the collection of FCPIs and FIPs was divided by three, reaching €209M and €147M respectively⁴⁴ Fundraising has shifted elsewhere, lacking the benefit of an entry tax credit and less specifically targeted at innovation capital, as opposed to a new version of limited partnership companies (sociétés de libre partenariat) and financial holding companies, whose inflows grew by 6% and 8.6% respectively in 2018 (i.e., total amounts of €302M and €136M).

Therefore, while the PFU and the IFI should be maintained, because they encourage the redirection of savings towards investment in companies, additional measures could be developed to focus on fostering innovation capital. However, these measures should not hinder the coherence of the reforms implemented in recent years by restoring tax niches, which could generate windfall effects and increase inequalities. On the contrary, when it comes to funding innovation, it is necessary to encourage the broadest possible citizen participation. Share acquisitions by French people will not only be a lever for the massive mobilization of financial resources, which our start-ups still lack, but also a way to involve the middle classes in the national economic successes of tomorrow. France during the *Trente Glorieuses* (1945-1975) was able to reconcile its large companies with the French people by encouraging citizens to acquire shares. Similarly, France in the new "20s", with the end of the health crisis, must involve as many people as possible in the disruptive innovations to come. To this end, it will be necessary to tap into the nearly €142Bn of additional savings⁴⁵ that the French have accumulated during the lockdowns of 2020 and 2021. To date, venture capital fundraising continues to be the wealthiest canal, as involvement in professional funds requires a minimum entry fee of €100,000 according to the legislation.

All in all, three major limitations explain the virtual absence of middleclass participation in venture capital financing:

- Firstly, the possibility of capital losses is a legitimate factor of mistrust for households whose capacity to absorb losses is limited. Thus, only 9% of total French wealth is invested in non-listed shares;⁴⁶
- Secondly, the regulatory and fiscal framework for investing in innovative start-ups remains particularly complex and poorly understood by the uninitiated. The funds through which venture capital investments can be made are numerous, their asset allocation rules and tax benefits are heterogeneous, and their names are based on acronyms that are difficult to identify (FCPR, FCPI, FIP, FPCI...). This lack of clarity is an obstacle to understanding these tools, not only for individuals, but also for bank advisors, who remain the main point of contact for the French in terms of financial investment.⁴⁷ As a result, peoples' lack of knowledge when it comes to investment opportunities in the non-listed sector is only very partially addressed by the distribution networks;
- Lastly, the average entry fee for non-traded funds is far too high in relation to the average annual savings level of French households.
- This high entry fee is explained by the low liquidity of non-traded funds, which, in return for a lock-up period, seek to optimize their fundraising by imposing significant minimum entry fees. Through its Bpifrance Entreprise 1 fund, Bpifrance has succeeded in broadening the pool of investors through

a lower entry fee. The public bank has nevertheless maintained a minimum level of €5000. This amount remains high when considering that French households save on average less than 3500 € net per year.⁴⁸

Recommandation #1: Create an easy-to-use innovation passbook ("Livret I") with standardized operating rules, distributed by all major financial networks and fully tax-exempt. This Livret I should increase the mobilization of funds in the French and European innovation ecosystems, while familiarizing individual savers with the return opportunities in the economy of the future.

In the form of a single, standardized tax envelope, the Livret I would allow up to €12,000 of savings (the limit for the Livret of sustainable and inclusive development) per adult to be invested in securities, particularly in unlisted companies. Like the Livret A (savings account) and the Livret of sustainable and inclusive development, it would be completely exempt from income tax and compulsory deductions both on entry and exit. In order to benefit from tax and social security advantages, the minimum blocking period for funds, from opening date, would be 5 years,⁴⁹ which would allow sufficiently long term financing for start-ups while strongly limiting opportunistic tax optimization behavior on the part of individual investors.

61

This "Livret I" must be able to address these three aforementioned barriers:

• The risk taken by investors, in a savings product that can result in capital losses, would be rewarded and encouraged by a total exemption from income tax and social security deductions on entry and exit. In addition, in order to mitigate the very high volatility of venture capital

⁴⁵ Source: Banque de France, June 2021.

⁴⁶ Source: Banque de France, Household savings, 2021.

⁴⁷ The French model of universal banking is an important national characteristic to be taken into account in the distribution of savings products, as most French people are used to a single provider for banking and investment services.

^{48 3,279€} per year in 2016 according to Expert Market.

⁴⁹ This minimum duration could also be 7 years to be consistent with the average duration observed in investment funds.

investments, only one-third of the funds would actually be invested in shares of unlisted companies (see box below). Among these non-listed shares, late stage investments in innovative companies should be favored;

- Access would be standardized, easy to use and clear in its purpose. The standardized tax and regulatory package could be disseminated and/ or managed by banking networks (credit institutions), insurance networks (insurance companies) or other authorized investment service providers. These different players would thus compete to offer the best-performing Livret I passbook accounts, both in terms of yield and various management fees. Only one Livret I at a time could be held by a resident of legal age. The simplicity of the product would make it easier to understand for both savers and distributors; on the other hand, the high risk nature of this investment, with no guarantee of return, would require full compliance with MiFID 2⁵⁰ regulations and, in particular, a Know Your Client approach prior to the subscription of the Livret-I in order to ensure that the investor has full knowledge of the instrument, of the risks of capital loss associated with it and that he is able to cope with them ("informed investor").
- Finally, access to the savings vehicle would be made accessible to the middle classes. FCPRs require a large front loaded entry fee, which implies a high capacity to mobilize cash, largely excluding the middle classes. The Livret I, like the Home Savings Plan (PEL), would only require a minimum monthly payment of €45. This amount, combined with a minimum holding period of five years to benefit from the exemption from income tax and social security contributions, should make it possible to target a fairly broad audience of savers. This mechanism would also give Livret I account managers some visibility on their cash flow constraints, since this is a means used to invest in unlisted shares, which are by definition not very liquid.

50 Directive 2014/65 / EU of the European Parliament and of the Council of May 15, 2014 on markets in financial instruments.

Financial management scheme for Livret I accounts

To be successful, the Livret I must be easy to use, offer attractive long-term returns while mitigating the risk of capital loss, and allow capped withdrawals. In economic terms, the primary objective of the Livret I will be to finance innovation through investments in shares of unlisted companies. However, these shares are by nature illiquid and their value is highly volatile. The management of the Livret I must therefore be based on a scheme that reconciles all these constraints.

Each financial service provider wishing to manage Livret I passbook savings accounts will have to set up a regulated Livret I management fund (FGLI) approved by the Financial Markets Authority. This fund will have to set a target of one-third investment in non-European companies, within a margin of 25 to 35%, in order to maintain the flexibility needed to ensure the fund's liquidity. Innovative companies in the late stage will be favored, both because it is in this segment that a market gap persists, and because, by targeting companies with a proven business model, it is less risky for investors than seed investment.

The remainder of the funds raised will be invested in (i) a listed equity component to boost the return on Livret I, with a focus on innovative companies, (ii) a bond component to reduce the risk of volatility in the value of Livret I, and (iii) a relatively large cash component to manage the inflow and outflow of the Livret I. Each FGLI will be able to make its investments through a fund of funds.

In addition to the risk diversification model of the FGLI, two other operating rules will make it possible to take into account the financial constraints of less liquid investments. In order to benefit from the

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tax and social security advantages of the Livret I, a 5-year holding period will be imposed from the opening date. In addition to this 5-year holding period, a mandatory minimum payment of €45 per month will give the FGLI manager long-term financial visibility.

In terms of risk, both the liquidity and the bond components, which together can account for up to 50% of the funds, should make it possible to mitigate the volatility of the valuation of investments in non-listed shares. However, there are no plans to offer a government guarantee; in addition to the fact that this could incur a significant cost for public finances, it would cause the Livret I to lose its objective of accustoming people to risk investment. The counterpart of risk-taking will be the tax and social security exemption of profits.

This Livret I will therefore be based on a realistic balance between the objective of investing in innovation and the interests of savers. The partial lock-in period of 5-year (to benefit from tax and social security advantages) and the mandatory minimum monthly payment of \notin 45 will not be considered attractive to all French people, but will still lead to a significant share of investment in unlisted funding. Funds invested in bonds or held in cash will reduce the share of funds invested in unlisted funds, but will maintain a sufficient level of liquidity and a modest entry fee, while mitigating risks, in order to make it attractive to the general public.

FGLI managers will compete to offer the best returns. They will be able to offer Livret I accounts directly or manage distributors' Livret I accounts.

This structuring scheme will only concern FGLI managers. It will be painless for investors, who will only have to take an interest in a \dots/\dots

savings option that is extremely easy to use. In addition, the low entry fee and the potentially large number of savers will constitute a first safeguard against the capture of popular savings by FGLI management companies in the form of management fees, which could be supplemented if necessary by a specific framework related to the regulated nature of Livret I passbook savings accounts. For example, the amount of interest and fees received by the Caisse des Dépôts et Consignations for the centralization of Livret A, Livret de Développement Durable and Livret d'Epargne Populaire funds amounted to \notin 893 million as of December 31, 2020, for \notin 283 billion in deposits centralized in these three instruments.⁵¹

The government could set an ambitious target of providing 5 million Livret I accounts in 3 years,⁵² representing an additional €30 billion to fund French start-ups, assuming a realistic average amount of €6,000 invested per Livret I after 5 years,⁵³ €30 billion in funds could be mobilized. Given the obligation to diversify investments, at least €10 billion would be available for investment in unlisted late stage companies and at least €5 to 8 billion for investment in listed companies.

The Livret I would therefore be a significant additional tool to contribute to French late stage funds, compared to the objective of \notin 20 to \notin 30 billion of Tibi labelled funds to be invested in Tech.

Above all, the Livret I would be an instrument to accustom the French to the hyper-growth economy and to risk-taking. It should enable the

⁵¹ Rapport financier 2020, Caisse des dépôts et consignations.

⁵² Compare this with the opening of 4.6 million sustainable and solidarity development passbooks (LDDS) between 2017 and 2019 according to the annual report of the regulated savings observatory.

⁵³ This is more ambitious than the average outstanding amount of an LDDS of €4,600 in 2019 according to the annual report of the Observatory of regulated savings.

emergence of a more inclusive French Tech, allowing the middle classes to benefit from the returns of start-ups, just as profit-sharing used to allow them to benefit from the profits of large companies. While offering easy to use regulated passbook savings accounts, the Livret I should give the French a taste of the economy of tomorrow.

In this respect, the Livret I consolidates a financing trend that has already been set in motion and offers broader participation in sharing of the risks and rewards of hyper-growth. The numerous political, fiscal and regulatory measures taken in recent years have created a virtuous dynamic for the development of venture capital. The challenge today is no longer to create new measures, but to ensure the longterm stability of the regulatory and fiscal framework, beyond national electoral deadlines, in order to be able to anchor the expectations of economic agents in a sustainable and favorable manner.

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IN THE WAKE OF THE 2010 DECADE DEVOTED TO MOBILIZING CAPITAL FOR INNOVATION, THE 2020 DECADE IN FRANCE MUST BE ONE OF UNPRECEDENTED INVESTMENT IN HUMAN CAPITAL, THE DRIVING FORCE BEHIND THE MOST INNOVATIVE AND COMPETITIVE COMPANIES

- 1. Tackling the talent shortage that threatens the development of French Tech through an exceptional effort to train and diversify profiles will be the challenge of the 2020s
- 1. Implementing a 10-year national training plan for new economy professions is essential to prevail in the international competition for innovation

The interviews conducted as part of this study confirmed that the number one issue for start-up founders now has less to do with obtaining

funding and more to do with securing the best skill sets. Several analyses were conducted to identify the role played by certain key skills, in coding, user experience, data analysis, marketing (especially digital), and knowledge of certain industries. There seems to be a big gap between a great idea and that idea materializing into a real solution, especially a technologically innovative solution, and one that is above all capable of meeting a need in the market.

Several key professions have been identified for the coming years, but they are not precisely monitored statistically, especially when it comes to content and number of positions available in the various related French higher education courses. This deficit does not make it possible to ensure that the offer meets the demand nor does it allow for the implementation of appropriate strategic levers (creation of courses, increasing enrollment capabilities, adapting course content, measures to retain the right profiles in France, etc.).

A few examples of jobs that are increasingly present in start-ups

- Chief Marketing Officer (CMO), who manages the company's marketing activity on online and offline media;
- Chief Technical Officer (CTO), who leads the technical team and is responsible for improving the company's offerings and services from a technological perspective;
- Customer Success Manager, who is the reference contact for the customer to provide customer support and follow-up;
- UX/UI Designer, who is the guarantor of customer experience and whose role is to identify and resolve all user pain points;
- Content Manager, who creates, manages and distributes the startup's content (articles, videos, Instagram posts);
- Product Manager (PM) / Product Owner (profession born in Silicon
 .../...

Valley), who must ensure that the team ships the best possible product, at the intersection between technology, business and design;

- Growth Hacker, who, by dint of experimentation, finds potential growth avenues in a limited time;
- Business Developer, whose main mission is to convert a maximum number of leads into customers for his company.

Source: According to Unicorn Society, Complete Guide to Startup Jobs

These jobs are a real asset for start-ups able to attract them. In this respect, a statistical analysis was conducted on the Github platform⁵⁴ about coders. It shows that the cumulative activity of coders listed on the platform correlates with fundraising of more than US\$30 million, whether in terms of the cumulative number of registered users or the number of projects.

⁵⁴ American software development and service company that has created an eponymous platform allowing people with computer coding skills to promote themselves and recruit.



Correlation analysis between new users on Github and the number of fundraising events of more than US \$ 30 million (2000-2020)

Cumulative number of new users on Github (in thousands)

Note: there is a positive correlation between the number of new Github users and the number of fundraisers over 30 Mn US \$.



Source: Institut Montaigne analysis with the assistance of Accenture (Github data).

Correlation analysis between new projects on Github and the number of fundraising events of more than US \$ 30 million (2000-2020)



Source: Institut Montaigne analysis with the assistance of Accenture (Github data).
Recommandation #2: Conduct an annual national survey to determine the skills needs over the next 10 years and adapt higher education training accordingly. Because a successful start-ups is one that manages to attract and retain talent (scientists, technicians, marketing experts, user experience, product managers, etc.), it is essential to identify the skills of tomorrow and the training required. An annual survey could be carried out, in partnership, to help higher education institutions define their training offer, while also encouraging cross-curricula and high-level English courses.

2. Promoting diversity among founders is a key issue for the performance and openness of the French ecosystem in the years to come

The background and level of education of unicorn founders varies greatly between the sampled countries, highlighting certain French specificities.



Courses followed by unicorn founders

Source: Analysis by Institut Montaigne with the assistance of Accenture.

Unicorn founders' degrees

73

Number of founders 120 100 Based on the public profile of 80 243 founders in September 2021 70 60 50 40 30 20 0 Master Bachelor MBA Doctorat

Source: Analysis by Institut Montaigne with the assistance of Accenture.

Results of the OECD PISA 2018 surveys

The breakdown by country highlights significant disparities which may explain why France creates fewer successful start-ups in certain cutting-edge tech sectors that require specific profiles: half of unicorns founders in the United Kingdom have a background in natural sciences or computer sciences, half of the founders of German unicorns have an engineering or computer science background, while in France the vast majority of unicorn founders come from a general engineering background (48%) or a business school (51%). It is worth noting that in the United States, the leading country in the creation of successful start-ups, founders have followed a variety of courses. For example, Mark Zuckerberg holds a double degree in computer science and psychology, and knew how to apply user psychological springs when he created the social network Facebook.⁵⁵ There is thus no standard model of education that automatically favors the creation of startups. Although France ranks relatively poorly in the OECD's PISA surveys on education, especially in mathematics and science, it is ahead of Israel, which nonetheless has a particularly dynamic innovation ecosystem.

74



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Source: analyse de l'Institut Montaigne avec l'aide d'Accenture.

⁵⁵ Hooked: how to create a product or service that anchors habits, Nyr Eyal, 2013.



Start-up founders' academic background by country

Unicorn founders' academic background by sector



Source: Analysis by Institut Montaigne with the assistance of Accenture.

In the world of corporate R&D as in the world of start-ups in France (and more generally in the OECD) the profiles remain far too male dominated. In 2018, out of 630,400 people involved in R&D activities (such as researchers or support staff), 203,600 were women, (i.e., only 32%).⁵⁶ Yet this average reveals an even greater source for concern. Women are much more present in support positions (41%) than in research jobs (only 28%). Above all, women participating in research activities are even less likely than men to turn towards the business world. In 2018, while 47% of the staff in public research organizations were women, only 23% of the staff in corporate research were women. Sectoral disparities can nevertheless be observed. The health and chemical sectors have achieved parity. Conversely, women are a very small minority in research in the nuclear, electronics, transport and digital sectors.

Participation in R&D activities in 2018

77



Source: Report on the state of higher education, research and innovation in France, 2020.

56 The data in this paragraph are all taken from the report on the state of higher education, research and innovation in France. 2020.

According to a study by Atomico, ⁵⁷ in 2020, 85% of the founding teams of European start-ups were all male. Moreover, these results concur with those of previous years and do not suggest any clear positive evolution in the medium term.

In terms of social diversity, French start-ups, just like higher education, are still not inclusive enough. 63% of children of executives or intellectual profession parents have a higher education degree, whereas only 32% of children of blue collar workers or employee parents do. While data is more scarce for start-ups, according to Atomico,⁵⁸ 81% of European start-up founders claimed in 2020 that they had comfortable living standards before embarking on their entrepreneurial adventure.

Finally, this low level of openness to diversity is even more pronounced in terms of the internationalization of talent in innovative companies. In

France, only 2% of researchers in companies have a foreign degree and only 6% are foreign nationals. This result is all the more disappointing given that 39% of doctoral students in France are foreign nationals. France is therefore training a large number of foreign students in research, but is unable to attract them to its private innovation ecosystem. If we take a closer look at the founders of unicorns, a comparison between France, the United Kingdom, Germany and Israel clearly highlights a lag in international openness, whether this is reflected in studies abroad or in the attractiveness of France as a place of establishment for foreign start-up founders.

Start-up founders' international background

	Have the nationality of this country	Have at least one degree from this country	Have studied abroad
UK	58%	84%	36%
Germany	71%	67%	74%
France	95%	97%	26%
Israel	98%	100%	24%

Source: Analysis by Institut Montaigne with the assistance of Accenture.

International insights Attracting international talent

UK

Around 42% of UK fintech workers are from overseas, 49% of the UK's fastest growing businesses and nine of the UK's 14 unicorns have at least one foreign-born co-founder. To ensure the continued competitiveness of their high-growth in innovative sectors, the UK needs to outpace global competition with a visa offering that can attract and retain the best and brightest from around the world – Brexit means that EU citizens must also have a visa to work in the UK at the beginning of 2021, the UK Government launched the new points-based system to create a single, global immigration system. This skills-led system delivers a new route for skilled workers and specialist work routes for business founders and those with recognized or high-potential talent in their field.

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57 Source: The State of the European Tech, Atomico, 2020. 58 *lbid*.

Estonia

In 2014, Estonia launched a very ambitious plan to attract new talents. It rests on several pillars:

- Very low taxation: Estonia benefits from an attractive tax policy, based on a simple system, with no taxation of profits reinvested in the company (and a rate of 20% on dividends paid).
- E-residency: Estonia provided online access to Estonia's public services for both Estonians and foreigners alike. Estonian citizens could pay taxes, sign documents and access doctor's prescriptions online, while foreign entrepreneurs could establish a company and open a bank account in Estonia in 18 minutes.
- The country adopted a complement of the 2014 e-residency in June 2020 with the "digital nomad visa" which allows individuals to come to the country as tourists, while continuing to work for a foreign employer or as a freelancer. The goal is therefore to promote e-so-lutions, but also to diversify the IT community, while having positive impacts on local businesses. 1,800 people could already benefit from this new program. Today, 31% of the founders of Estonian startups are foreigners.

However, this lack of diversity in the French Tech talent pool, in addition to leading to increased inequality, tends to reduce the performance of start-ups. Poorly diversified teams are less creative and less able to understand potential markets. In response to these risks, two main initiatives have been launched at the national level.

The French Tech Visa aims to attract more talent from outside the **European Union**. This program offers three-year residence permits granted to three target groups: founders of start-ups whose project has been selected by a recognized accelerator or incubator, employees of start-ups recognized as innovative, and international investors wishing to settle in Paris. In addition

to granting residence permits, the administrative procedures are simplified and accelerated. In the same way, some incubators offer, via external partners, services to help in setting up (completing administrative procedures, finding accommodation, opening an account, finding schools, etc.).

The French Tech Tremplin (springboard) aims to promote the integration of under-privileged social categories into the world of entrepreneurship. This program is divided into two parts. The first part consists of a six-month intensive "bootcamp" training course. This training should both teach basic entrepreneurial skills and allow participants to build a professional network. A second component allows participants to benefit from the incubation of their start-up project for a period of 11 months. This incubation is accompanied by a free investment of $\leq 30,000$ and individualized support. The French Tech Tremplin is intended for people living in priority districts, refugees, people receiving social benefits, students with scholarships, as well as project leaders selected by partner associations.

We believe it is important to perpetuate and grow the reach of these two initiatives. To this end, an ambitious goal of doubling the number of annual beneficiaries of the French Tech Visa and *Tremplin* could be set within two years. However, these two initiatives are not enough on their own, since they are still too largely based on a palliative approach – aiming to make up for our inability to diversify the ecosystem of innovative start-ups in a more spontaneous manner. 81

Thus, it is urgent to get rid of the current elitism and to foster talents from universities, still far too underrepresented in start-ups (see above).

The first and most powerful lever for diversifying start-up profiles is to get university students involved in entrepreneurship. For France, having 39% foreigners among doctoral students, but only 6% foreign researchers in companies is a huge waste. It is therefore essential to encourage foreign doctoral students to choose a path of entrepreneurship in France. This also implies implementing a policy of granting long-term residence permits that is more

open to young foreign entrepreneurs. At the same time, a major effort must be made to promote entrepreneurship among students from modest income backgrounds. Finally, it should be noted that language remains an important barrier, with still too few courses offered in English and French today.

In order for things to change, a profound overhaul in the relationship between French universities and entrepreneurship is needed. This is the focus of the rest of this report.

Recommandation #3: Double the number of annual French Tech Visa and French Tech Tremplin (springboard) beneficiaries over the next two years.

Recommandation #4: Encourage the integration of foreign students into the French entrepreneurial world.

Recommandation #5: Encourage university students to become entrepreneurs on a much larger scale.

2. Encouraging students and researchers to enter the world of entrepreneurship

1. Using PEPITE hubs to help students become entrepreneurs

The desire to become an entrepreneur is not an innate quality. It requires awareness, support, coaching, and the opportunity to interact with successful role models with whom one can identify. The ability of the United States to give so many young people, generation after generation, a taste for entrepreneurship mainly comes from a culture of public promotion of entrepreneurship and systematic interconnections between the worlds of education, research and business.

This finding led to the creation, in France, of 33 student centers for innovation, transfer and entrepreneurship (PEPITE), set up in 2014. These hubs are intended to be open to the business ecosystems of their regions by associating higher education institutions (universities, business schools, engineering schools), economic players and association networks. To join a PEPITE hub, a student with a bachelor's degree or equivalent must acquire the status of student-entrepreneur from the center's Commitment Committee. This status is granted according to the feasibility and quality of their entrepreneural project, whether individual or collective, economic or social, technological and innovative or not.

In return, the student-entrepreneur of a PEPITE hub will receive:

- A pragmatic management training course geared towards the preparation of an entrepreneurial project;
- Support, notably based on coaching by professionals from the business world;
- Access to the material resources of the PEPITE hub (co-working spaces, incubators, digital resources, etc.).

In keeping with this principle of openness towards the outside world and the business world, PEPITE hubs also have alumni groups and operate through networks. Finally, PEPITE hubs organize entrepreneurship competitions with grants of up to $\leq 10,000$.

The creation of PEPITEs have had two goals: to spread a culture of entrepreneurship among students, all the while increasing the involvement of higher education institutions in the economic ecosystems of their regions.

In 2018, an initial system assessment was conducted, nearly five years after the launch of the PEPITE centers.⁵⁹ While the concept has clearly proven its worth, it could stand to be developed considerably.

⁵⁹ Report to the Minister of Higher Education, Research and Innovation, 2018, A. Meige, Cristelle Gillard, Philippe Perrey.

PEPITE hubs have thus been able to find interested and motivated participants. While there were 627 graduates in the class of 2014, they were as many as 3700 graduates by 2018.⁶⁰ The class of 2016-2017 graduates created some 713 companies.⁶¹ Moreover, the hubs have been able to implement turnkey services and benefit from best practices thanks to the National Foundation for Business Management Education competition.

However, three main difficulties currently hinder PEPITE hubs' ability to develop student entrepreneurship, as detailed in the papers referenced above.

- 1. Students, teacher-researchers and companies are often unaware of the existence of these PEPITE hubs. sThere is an essential need to raise awareness among these three categories of players, all working hand in hand within these hubs.
- 2. The funding granted to PEPITE hubs varies greatly from one institution to the next though some universities have made significant efforts to enhance the value of their PEPITE hubs by providing substantial funding. However, the establishment of a PEPITE requires substantial resources both in terms of equipment (co-working space, digital resources) and personnel (payment of teaching, support, and administration costs, and covering costs of external service providers).
- 3. The effectiveness of these PEPITEs varies greatly from one centre to another, both in terms of the selection process of student-entrepreneurs and of services provided to them. These differences in performance may be due to a lack of commitment from the universities to which they are affiliated, but also, in some cases, to an increase in student applications, which these centers, due to their small size, can no longer handle.

It appears that while PEPITE hubs sometimes provide a quality of service with room for improvement, they remain an interesting platform for encouraging entrepreneurship.

It is therefore possible to make PEPITEs the pivotal access point for university students entering the world of entrepreneurship and innovation. The aim must be to increase the number of student-entrepreneurs selected each year in PEPITE hubs by six over the next four years, in order to maintain the growth observed between 2014 and 2018.

To this end, PEPITE hubs must be given the means to achieve their ambitions. It will be necessary to adjust, year after year, the budgetary envelope that universities will be able to allocate to PEPITEs, based on performance criteria (number of companies created, etc.) and follow-up; any financial commitment would thus be conditional.

At the same time, a National Steering Committee with an operational secretariat could be set up. This light structure should ensure the management of the network and promote a smooth continuum of services to student-entrepreneurs. The secretariat would also be responsible for defining certain educational and technical supports, in order to reduce production costs through economies of scale. 85

The Steering Committee would ensure that the network of PEPITE hubs is strengthened in order to guarantee that the structures are as open as possible. This openness will have to be achieved from the outside, by systematically pairing financial players (local commercial banks, venture capital funds and Bpifrance) with support systems (CCI, but also Business France in order to spread a culture of internationalization as early as possible). Above all, this should be targeted in the broadest possible way at businesses. A significant investment, both in terms of human resources and monitoring and steering tools, should be made to seek out partnership opportunities. Finally, this endeavor should systematically include contact with alumni who are most likely to encourage and to support new projects.

This network system, while outward looking, must not exclude education and research contributors. In this regard, two aspects seem to have been underestimated to date. On the one hand, although most often attached

been underestimated to date. On the one hand, although most often attached to universities, PEPITE hubs seem to often be insufficiently connected to the research environment. It will therefore be necessary to avoid excluding research laboratories from their paired institutions – this criticism has been made, for example, in the case of certain SATTs hindering the desired continuity between teaching, research and innovation. Similarly, too few synergies seem to have been developed with the *grandes écoles* (the private, post-baccalaureate schools that form most French elites), many of which have taken the lead in developing incubators or alumni associations. Therefore, it seems essential to fully link together universities and *grandes écoles*, notably by fully including entrepreneurship training into existing curricula, and reaching out to those that are furthest from the business world (e.g., humanities and social sciences).

This development strategy for PEPITE hubs will not be possible without strong political backing. It is therefore crucial to make student entrepreneurship a priority for the next five years and to conduct a large-scale communication campaign to make PEPITEs known to students, researchers, investors and companies. The mobilization of human and financial resources will require an ambitious and sustainable commitment from the Ministry of Higher Education and Research on the one hand, and the Ministry of Economy and Finance on the other.

Recommandation #6: Make PEPITE hubs a focal point for encouraging students to pursue an entrepreneurial occupation. To this end, adapt the way PEPITEs operate and set a target of a six-fold increase in four years in the number of student-entrepreneurs.

2. Encouraging researchers to enter the business world is a sure way to increase the pool of talent and the number of founders, especially in Deep Tech

Since 2002, most researchers in France have worked in companies In 2017, 62% of researchers in France were working in companies.⁶² In 2018, 188,800 researchers, in full time equivalent (FTE), were working in companies in France. The number of researchers has grown at a much faster rate in companies than in public laboratories in recent years. Between 2017 and 2018, the number of FTE researchers working in companies increased by 4.2%, when the number of researchers working in public organizations increased by only 1%.

These results show the development of research is more geared towards innovation and valuation. However, a more detailed analysis of these figures reveals that the number of researchers in the economic world could be greatly increased in three areas.

- Firstly, while many researchers choose to work for laboratories, usually in large companies, few choose an entrepreneurial career (see below). Therefore, too few researchers ultimately create new companies (see point relating to the career path of the founders of unicorns).
- 2. Secondly, private research attracts far too few people with PhDs. Only 12% of researchers in companies have a doctorate, while 57% come from an engineering school. Moreover, some areas of study still include far too few courses on business research and entrepreneurship. For example, only 3% of corporate researchers work in social science fields. However, in the United States, innovative companies massively recruit staff with social science training in order to develop, among other things, their marketing strategies, their communication strategies, their service design or their customer experience.

⁶² The data in this paragraph and the next are all taken from the report on the state of higher education, research and innovation in France, 2020.

3. Lastly, research in France reaches far too few economic sectors. Out of the 32 branches in which researchers work, 4 sectors employ half of the researcher manpower: scientific and technical activities (14%), IT services (14%), the automotive industry (12%) and aeronautical and space construction (9%).

To encourage researchers to enter the business world, the CIFRE agreement, created in 1981, is unanimously regarded as a success for its simplicity, its subsidized nature and its stability. It allows a company to receive a three-year grant in exchange for recruiting a doctoral student (see the following box).

CIFREs

An Industrial Convention for Training through Research (CIFRE) brings together a company, a doctoral student and a research laboratory which supervises the thesis. In return for recruiting the doctoral student and paying a minimum gross salary of €1,957 per month, a company established on French soil wishing to benefit from a CIFRE agreement receives an annual grant of €14,000 per year for three years. The agreements are managed by the National Association for Research and Technology (ANR), on behalf of the Ministry of Higher Education, Research and Innovation (MESRI).

The expenses generated by a CIFRE agreement are eligible for the research tax credit (CIR), after deducting the grant received.

Since their creation in 1981, the CIFRE agreements have brought together 9,000 companies, more than 4,000 laboratories and 25,400 doctoral students, to work on applied research

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projects. In addition to being subsidized, a number of reports⁶³ have highlighted the attractiveness of this system due to its simplicity and stability over the past 40 years.

In addition to a private law doctoral contract aimed at providing legal security to companies recruiting doctoral students under CIFRE agreements, the 2021-2030 research programming law (LPR) aims to increase the number of CIFRE agreements by 50% by 2027.

Source: MESRI

The 1999 law on innovation and research, known as the Allègre law, had attempted to remedy this situation. It makes public administration researchers more readily available to help those wishing to create a company, allowing researchers to combine their research activity in a public administration with support from private companies, providing that the researchers be limited to 20% of their working time in the company, and also authorizes them to participate in corporate governing bodies. In 2019, the PACTE law expanded the possibilities for researchers moving from the public sector to the corporate world. This goal has been pursued and expanded with the 2020 Research Programming Law. Its stated goals include: increasing of the number of CIFRE agreements by 50%, creating private law work-study contracts and post-doctoral contracts, and including scientific culture dissemination activities in the assessments conducted by the High Council for Evaluation and Research and Higher Education (HCERES – see the following box).

63 See for example the report of the Mission on Innovation Campuses, written by Jean-Luc Chalumeau, in June 2019.

Research Programming Law (LPR) 2021-2030: Measures enabling business innovation

In addition to a significant financial effort in research by 2030 (see below) and a target of doubling the number of CIFRE agreements by 2027, three types of measures provided for in the latest LPR are particularly interesting for supporting business innovation.

Specific contracts for each research project

In order to consolidate the professional status of engineers and technicians involved in research projects, while increasing the attractiveness of such positions and reducing the all too high turnover rate, specific employment contracts have been created in the form of permanent contracts (CDI). The "assignment CDI", a public law contract, is targeted at public higher education and research establishments (EPESR), while the "project CDI", a private law contract, is aimed at public industrial and commercial establishments and foundations recognized as being of public interest and undertaking a research activity. The contract ends when the research project or mission is completed.

Similarly, the creation of post-doctoral contracts under private law allows the post-doctorate to be legally recognized and to ultimately promote the long-term integration of doctors into the business world.

The LPR introduces residence agreements in order to reinforce France's attractiveness for purposes of research and \dots/\dots

innovation; in particular by simplifying the procedures and securing the applicable legal framework. These agreements are reached between the host institution and the foreign doctoral student for a maximum of 3 years.

Integrating research dissemination activities into the evaluation of universities and research institutions

The LPR 2021-2030 strengthens and modernizes the High Council for the Evaluation of Research and Higher Education (HCERES). It has been turned into an independent public authority and can now evaluate public institutions whose statutes provide for a research mission, in addition to universities.

Above all, the HCERES has been given the task of "ensuring that the activities of disseminating scientific, technical and industrial culture are valued in the careers of higher education and research staff" (new article L114-3-1 of the research code).

Aiming to strengthen ties between the world of research and business

To a certain extent, the LPR opens up the possibility for civil servants or contractual employees working in the public research sector to participate, as partners or managers, in the creation or management of a company whose purpose is to ensure the valuation of research and teaching work – within the scope of a contract signed with a public person, a public enterprise or a legal person mandated by them.

Similarly, the latest LPR extends the possibility of combining part-time work and secondment of public research staff to private companies. Above all, these services are taken into account in the calculation of pension rights.

With regard to profit-sharing, the LPR allows public scientific and technological establishments (EPST) to create individual bonuses for investment in partnership research missions. These bonuses already existed in higher education research centers.

Source: MESRI

However, the data of the Ethics Commission reveals that very few researchers actually move from public laboratories to companies. Less than 10% of these transfers are aimed at researchers creating companies. France is thus depriving itself of an important pool of start-up founders in Deep Tech.

The measures taken by the PACTE law and the latest Research Programing Law are encouraging in that they aim to facilitate, at the regulatory level, the creation of companies or scientific assistance to companies by researchers from public laboratories. However, we believe that, although these measures were necessary, they alone cannot fully do the job.

As several people we have talked to have pointed out, a prerequisite for any move towards the private sector is the desire to become an entrepreneur. However, this is somewhat frowned upon in the research world. A real cultural revolution should therefore be arranged in the world of research, by promoting the technical applications of research activities for the benefit of the greatest number of people.

Bpifrance's DeepTech Tour and the initiatives launched by various universities or research centers, such as the CNRS, are a key first step. These promotional campaigns must be systematic and regular, notably by using local success stories, allowing researchers to identify with their peers who have succeeded in entrepreneurship.

The Deep Tech plan, a first attempt to encourage the creation of disruptive technology start-ups

Launched in 2019 and managed by Bpifrance, the Deep Tech plan aims to make France the leading European breeding ground for tech start-ups, ahead of the UK. In addition to offering to promote entrepreneurship in universities and research centers, and to support researcher-entrepreneurs, the Deep Tech plan initially aimed to raise €2.5Bn by 2023 to finance tech start-ups.

This amount targets three stages of development:

- The emergence of new projects through continued support for SATTs (technology transfer acceleration companies) and the incubation of Deep Tech projects. A French Tech Emergence grant of up to €90,000 has been created for this purpose;
- Technology transfer and start-up creation, by focusing more of Bpifrance's funding of Deep Tech and using the French Tech Seed post-maturation fund;
- Finally, achieve an investment target of €1.3 billion in equity capital, which will be increased to €2 billion by 2022.

In 2020, thanks to this program, 200 tech start-ups were created and 400 were financed, for a total amount of \in 220 million, in addition

93

to \in 221 million invested in direct equity, and \in 218 million in funds of funds. 270 tech start-ups have benefited from various forms of support over the same period.

Source: Bpifrance

Once this entrepreneurial spirit has been developed, other regulatory obstacles will have to be removed to make public-private transfers seamless.

Young researchers can be encouraged to make contact with the business world. It will thus be necessary to ensure that the objective of increasing the number of CIFRE agreements by 50% by 2027 is effectively implemented. Also, similarly to Germany, the validation of a doctorate could include more research experience in the business world.

Research development activities could be even more strongly supported. Despite some disparities among referral centers, these research promotion activities are still not fully taken into account in the evaluation of researchers. Worse, it appears to be marginal when it comes to promotions and career paths, as several of the people we met for this study have pointed out. It is therefore essential to make the recognition of research activities a determining criterion in the evaluations carried out by the National Council of Universities, but also for promotion prospects. The example of the French Atomic Energy Commission (CEA), which has created a professional stream of experts alongside the academic streams, could be followed in this respect. In the same way, researchers in public laboratories could be more interested in the development of their work. Although, in theory, a rather generous bonus system exists, the uncertainties of its calculation methodology often make it a weak incentive.⁶⁴ It is therefore important to reinforce the variable parts linked to the valuation of research and to clarify their calculation methods, by extending the profit-sharing basis to all income generated by the invention.

Finally, it is important to facilitate the return of researcher-entrepreneurs to the public sector. Not everyone will want to return, and some will choose to never return; however, the importance of guaranteeing safe return to civil servants who, before leaving for the private sector, had job security and guarantees of promotion, seems to have been underestimated to date. Although researchers who have left for the private sector can, for a certain number of years, return to the public sector, this return remains difficult. Indeed, they will have lost promotion opportunities and will have reduced their publication numbers – which is decisive in the field of research. It is therefore essential to implement an ambitious policy of career reconstitution for researcher-entrepreneurs returning to the public sector.

Recommandation #7: Implement an ambitious policy to promote and facilitate the creation of innovative companies by researchers in public laboratories. More generally, encourage the establishment of a culture of dissemination of research in society and the economy, fully taken into account in the evaluation of research institutions by the HCERES and of researchers by the CNU. 95

3. Encouraging research, researchers and professionals in the field to focus on issues likely to generate breakthrough innovations

The 1980s questioned the so-called vertical public intervention policies, which consisted in choosing sectoral innovation priorities and financing them, or even having them carried out directly by public structures. This old paradigm has been replaced by a new one, based on horizontal intervention strategies aimed at fostering a regulatory, fiscal and educational environment favorable to innovation. In this model, direct government

⁶⁴ The removal of maturation expenses incurred by SATTs from the basis for calculating the income generated by the invention is, in this respect, particularly disincentivizing.

intervention is limited to closing identified market gaps, for example in the funding of basic research.

However, since the beginning of the 2010s, the context of increasing international competition in terms of innovation, particularly between the United States and China, and the growing costs incurred to finance certain fields of research (AI, quantum computing, biotech) have led to the revival of a modernized form of vertical intervention. For the theorists⁶⁵ of this new public policy of innovation, the State has, by virtue of its democratic legitimacy, the responsibility to define and implement societal missions based on collective choices. Pragmatically speaking, these interventions are also defended as a necessity, either to fight against unfair competition from other States that practice them themselves, or to catch up offensively with countries that have taken the lead in the development of new technologies.

International insights Deep tech

Germany

The German government has set up a number of grants to encourage Deep Tech innovation. In December 2019, the German government formed a commission and funded the Federal Agency for Disruptive Innovation. This new agency is charged with launching innovations with radically new technologies. The Foreign Trade and Payments Ordinance, which entered into force in May 2021, also tightens Germany's FDI control regime. "Critical technologies" such as artificial intelligence, robotics, semiconductors, cybersecurity, aerospace, defense and many others will require Mandatory FDI notification for foreign investment. The new rules have a strong impact on future foreign investments and M&A activity in Germany.

While these new approaches once again legitimize a form of vertical intervention, or even industrial policy, in their implementation, they differ greatly from the interventions that France experienced after WWII. It is no longer about taking direct charge in developing entire sectors by way of company nationalization. With the contribution of economic research on competition largely integrated, these new approaches aim to combine democratic choice, technical expertise and the free functioning of the market. To this end, two fundamental principles of implementation are required.

97

- 1. The first principle is to not solely favor a sector or a technology (techno-push approach), but to also solve a problem (problem-solving approach). Politicians simply set general societal guidelines; committees of experts, bringing together researchers, investors and entrepreneurs, are responsible for defining the operational problems to be solved. For example, a policy-maker might make the inclusion of the elderly a priority; the committees may, for example, seek to promote the accessibility of certain medical services at a distance. This approach, based on the problems to be solved rather than on the technology to be developed, avoids favoring what already exists while promoting a cross-cutting approach between sectors that too often work in silos.
- 2. The second principle, which builds on the first, is to base selection on competitive requests for proposals. Thus, rigorous work must be carried out in setting up selection committees in order to encourage diversified,

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⁶⁵ See to this end, The Entrepreunarial State, Mariana Mazzucato.

multidisciplinary and, as far as possible, international expertise. These committees must remain independent, both in terms of the problems selected to be solved (in line with the major societal missions defined by the policy), and in terms of the choice of project leaders.

This theoretical renewal of the vertical innovation policy has led to increasing calls for the creation of French and European DARPAs in recent years. This American agency for innovation in the defense sector is regularly heralded as an example to follow. Already in the 2000s, this model was used, in a much less ambitious form, to establish the European Defense Agency (EDA). After having inspired the defense sector with, among other things, the creation of the Defense Innovation Agency in France, DARPA is now hailed as the ideal solution for the development of Deep Tech. DARPA projects are thus multiplying: for example, the new European Defense Council is inspired by them; some want to create a health DARPA,⁶⁶ others an energy DARPA, and others still are interested in a more general DARPA.

DARPA

Created in 1958 in the United States, the Defense Advanced Research Project Agency was originally intended to maintain the American military technological lead over the Soviet Union.⁶⁷

To this end, an original organizational model has been implemented. While being linked to the armed forces, to which it must be able to \dots / \dots

provide solutions, DARPA enjoys a high level of independence in order to avoid any selection bias based on existing technologies already in use. DARPA focuses its strategy on dual-use technologies that can be used in both military and civilian fields, and thus authorizes the marketing of any innovations to the general public in a controlled manner.

In terms of operations, DARPA has a light and particularly agile structure. Project leaders and selection committees are recruited on a project-to-project basis for a limited period. They have considerable autonomy in their work. In order to encourage multidisciplinary work, requests for proposals are made on the basis of a problem to be solved, and not a technology to be developed.

Finally, DARPA has substantial financial resources (the 2021 budget is \$3.5 billion); its mandate allows it to take significant risks, resulting in regular but accepted failures. This strategy has proven particularly effective and DARPA has been at the heart of major innovations such as ARPANET, the ancestor of the Internet, or GPS. More recently, it has contributed to the development of the autonomous car.

99

While certain characteristics of the American DARPA model are worth following today, we disagree with the overly simple idea of duplicating DARPA in France to catch up our lag in technology. This approach does not sufficiently account for the historical and national context of DARPA's development. DARPA's success is intrinsically linked to the role of the American client State, which alone constitutes the main outlet for the American military industry. However, even in the military sector, where the client State plays a predominant role, European States are limited outlets for start-ups which must instead aim for rapid internationalization and multinational or continental markets. While joint orders on a pan-European scale are an interesting prospect, they too often come up against diverging interests or the search for a fair return from each State involved in the project.

⁶⁶ Biomedical Advanced Research and Development Authority (2006): Office of the US Department of Health and Human Services responsible for the acquisition and development of medical countermeasures, primarily against bioterrorism, including nuclear, radiological, biological, and chemical (NRBC) threats as well as pandemic influenza and emerging diseases. Budget 2020: \$1.6 billion.

⁶⁷ Source: The DARPA Model for Transformative Technologies: Perspectives on the U.S. Defense Advanced Research Projects Agency, William Boone Bonvillian, 2019.

Secondly, the creation of DARPA in 1958 took place at a time when public support structures for innovation were virtually non-existent. On the contrary, despite a recent streamlining effort, France and the European Union have increased the number of support structures for research and innovation. It is therefore important not to add new structures, at the risk of creating an organizational layer cake. Finally, digital platforms now offer the prospect of networked research and innovation, no longer necessitating a single steering structure, as was the case in 1958.

The implementation of the Future Investment Programs (PIA) was aimed at developing this type of support for research and innovation. using competitive requests for proposals with selection committees of independent experts. However, although the PIAs have made it possible to develop this strategy in France, they still fall short compared to the DARPA model. Indeed, requests for proposals are still too often aimed at developing a sector or a technology rather than seeking to solve a problem. While the European Union tends to develop problem-solving approaches, particularly within the framework of the European Innovation Council (EIC), in France techno-push approaches do not seem to be losing ground. Thus, while the Industrial Innovation Fund (FII) program planned to solve "major challenges", the Recovery Plan has once again focused on a series of sectors and technologies (electric cars and the hydrogen sector in particular). Secondly, the share of funds actually granted by committees of autonomous experts outside the administration remains too low. The assessment of the implementation of the first part of the PIA⁶⁸ reveals that more than 40% of the disbursable investments were allocated according to schemes similar to ordinary administrative management: "window-booth logic", management by operators, or even selection committees made up solely of public service employees.

68 Evaluation of the first part of the Future Investment Program (PIA), Patricia Barbizet, 2019.





Source: Evaluation of the first part of the Future Investment Program (PIA), Patricia Barbizet, 2019.

Therefore, rather than setting up new bureaucratic structures to mimic DARPA, it would be better to promote the project committee practices that have made DARPA so successful.

Vertical State support for innovation, as provided for in the PIA or the Industrial Innovation Funds (FII), may have a role to play in stimulating disruptive innovation. However, in order to reduce selection errors or the capture of public subsidies by certain sectors, while also promoting a collaborative and multidisciplinary approach, certain fundamental DARPA principles should be implemented:

- The establishment of time-bound and largely independent review committees of requests for proposals. The General Secretariat for Investment Programs (SGPI) should remain an agile and light coordination structure;
- A diversified structure for the requests for proposal committees, combining technical and economic, French and international expertise;
- A definition of requests for proposals on the basis of problems to be solved rather than technologies to be developed, in order to encourage multidisciplinarity and avoid any selection bias.

It is therefore important to avoid creating numerous new structures, making the innovation process more complex for entrepreneurs and creating silos detrimental to the multidisciplinarity that is consubstantial to innovation. Project selection committees are temporary, light and agile structures, not new agencies responsible for guiding entrepreneurs and researchers. At the same time, promoting requests for proposals, first contact and orientation must be rationalized so that only two offices are involved: the National Research Agency (ANR) for research projects and Bpifrance for innovation projects.

International insights The army's role in the ecosystem

Israel

102

Military service is mandatory from 18 to 21 years old (nearly 45% of the population is under 24) and contributes to the training of citizens in elite high-performance technological units which play a role in the creation of startups. Soldiers develop products, tools, codes and \dots/\dots

algorithms, in the service of the state. The products developed during military service – patents, lines of code – belong to the army. More than 1,000 companies have been founded by 8,200 alumni, from Waze to Check Point, and 90% of the intelligence material in Israel comes from the alumni of this military service. The Innovation Authority together with the Ministry of Finance put in place a dual-purpose technology incentives program, called MEIMAD, which supports the development of innovative solutions for the defense and commercial markets. The military service's key contribution is that it encourages the systematic scanning of schools for the country's best talent. The training enables the population to develop an entrepreneurial culture as well as hard and soft skills that are key to starting a business.

Recommandation #8: Develop a competitive project selection culture based on the American DARPA committee model, with ties to existing operators and without creating new administrative structures.

4. Anchoring start-ups in universities will not be a fully successful strategy unless financial resources and autonomy are increased

In 2018, France spent €31.8 billion in public expenditure on higher education. In constant euros, the average expenditure per student is 1.4 times higher than in 1980.⁶⁹

⁶⁹ See also the report of the Institut Montaigne, Higher Education and Research: Time to Act! April 2021.

The total level of annual spending (public and private) on higher education per student puts France just above the OECD average, at around \$16,000 in purchasing power parity (PPP). While Germany is above France with over \$17,000, the UK is well above, nearing \$25,000.

The total cost of a student's education also reflects why France is lagging. While France spends only about \$60,000 in PPP per student, the United Kingdom and the United States spend \$70,000 and \$80,000 respectively on each student, ⁷⁰ even though the average course of study is shorter.

In total, France spends about 1.5% of its GDP on higher education.



Higher education annual expenditures per student in 2016

(in \$PPP)

Source: Higher education expenditure in OECD countries – State of Higher Education, Research and Innovation in France #13 (enseignementsup-recherche.gouv.fr) However, a breakdown of the structure of French spending by type of higher education further supports the observation that France risks falling behind. While in recent years France has spent nearly \notin 16,000 per year on students in preparatory classes for the grandes écoles (CPGE), it has spent barely \notin 10,000 per year on university students.

In addition to raising questions about fairness, this difference in treatment between students in preparatory classes and university students must also be seen as a direct brake on our ability to develop innovation ecosystems. This chronic under-investment in university students' training will only lead to limiting the pool of high-potential students who can launch themselves into innovative entrepreneurship.

Average expenditure trend per student between 1980 and 2018

105



Source: Education expenditure for higher education – State of Higher Education, Research and Innovation in France #13 (enseignementsup-recherche.gouv.fr). France's delay in investment in higher education is mirrored in R&D and innovation. In 2017, domestic research and development expenditure by companies (DIRDE) amounted to €33Bn, and that of administrations (DIRDA) to €17.6Bn. In 2017, France devoted only 2.2% of its GDP to research and development, far from the 3% target set in 2000 by the European Union's Lisbon Strategy for the knowledge economy. While France is above the EU average, and even ahead of the UK, it remains slightly below the OECD average (2.4%), and especially far behind the US (2.8%), Germany (3.05%) and Japan (3.2%).

Domestic R&D spending in main OECD countries in 2017 (as % of GDP)



Source: Unprecedented resources for research: At least 3% of GDP devoted to research – Ministry of Higher Education, Research and Innovation (enseignementsup-recherche.gouv.fr). However, not only are the amounts mobilized for R&D in France too small, but its R&D is also too poorly integrated, both in education or in companies.

French public R&D remains largely binary, with universities on the one hand and various types of public research establishments on the other – the most important of which is the CNRS. These institutions may be public scientific and technical establishments (ESPT) or industrial and commercial establishments (EPIC). Although in recent years the development of partnership research has largely contributed to bringing the two main public research spheres together, this duality still prevails. Consequently, France must not only encourage exchanges between the public and private research worlds, as other developed countries must, it should also address the limited integration of education and research. Without a better interconnectedness between research and education, France risks developing an education system that falls behind the latest advances in research.





(in €M)

International insights **Investment in R&D**

Switzerland

The Swiss private sector accounts for more than two-thirds of Swiss R&D spending, which currently amounts to about 3.4% of GDP, or about CHF 16 billion. The division of labour between public and private sectors is clear: the fact that almost two-thirds of Swiss R&D is financed by industry not only ensures efficient technology transfer - internal pipelines are the shortest route between scientific discoveries and competitive products – but also allows the public sector to focus on general basic research. Swiss companies invest heavily in R&D, encouraged by the various tools at their disposal: for example, cantons have the possibility of introducing a deduction of up to 150% of R&D expenditure generated in Switzerland. These R&D expenses include personnel expenses that can be directly allocated to the R&D activity plus 35% of other R&D expenses. This deduction is limited to the actual amount of the company's expenses. In addition, 80% of fees paid for (Swiss) research mandates may also benefit from this deduction. Another example is the "patent box" regime at the cantonal level, which allows for a reduced taxation of income generated by patents developed in Switzerland, and for a reduction of the taxable base of such income by up to 90%.

Israel

In 1969, the Israeli government established, within the ministry of economy and industry, the Office of the Chief Scientist (OCS), tasked with implementing government policy to support and encourage industrial R&D projects undertaken by private firms. In early 2016,

Source and details: domestic spending on research and development – State of Higher Education, Research, and Innovation in France #13 (enseignementsup-recherche.gouv.fr)

However, French R&D partnerships between public and private bodies

are still too few. With a share of 65% of research carried out by companies. France is at a significantly lower level than the United States (73%), the OECD average (71%), Germany (69%) and the United Kingdom (68%). The size of these gaps, in relation to a more limited aggregate level of investment in R&D in France, highlights the fact that French companies still invest too little in R&D. It may also be a symptom of research that is still insufficiently applied and insufficiently focused on innovation.

109

the Israeli government replaced the OCS with an independent public entity, the Israel Innovation Authority (IIA) with a broader objective than the OCS and an expanded scope of its incentive programs. With an annual budget of around 400 million dollars, the IIA has been essential in providing the nation's entrepreneurs with the funding they need and with a variety of support programs, some notable ones include:

- The R&D Fund, which offers Israeli corporations and startups R&D grants of up to 50% of the approved R&D program cost in established companies, and up to 66% for startups.
- The Magnet program, which has managed partnerships between academic and commercial R&D programs and has supported knowledge transfers since 1994. With a budget of more than 50 million euros a year, it supports the development of generic technologies in fields in which Israeli industry has a competitive advantage. The grant provided is up to 66% of the approved budget for an industrial company and 100% of the approved budget for a research institution.
- The Nofar program, which aims to bridge the development gap between academic knowledge and industry needs in the fields of biotechnology and nanotechnology, by providing support and guidance to the academic institutions. This program assists academic research groups that carry out applied research, and the results of which are not mature enough to be supported by the industry. The grant provided is up to 90% of the approved budget for a period of 12 months.
- The historical R&D Collaboration with Multinational Corporations program (MNC), which offers a framework for technological cooperation between MNCs and innovative Israeli companies. Around 60 companies, such as Stellantis recently, have already established an agreement with Israel through this program in order to equally invest in pre-selected R&D projects, conducted jointly by the MNC and the company.





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111

Source and details: Domestic research and development expenditure – State of Higher Education, Research, and Innovation in France #13 (enseignementsup-recherche.gouv.fr).

Public policies in favor of higher education and research should never be limited by financial parameters. However, financial mobilization is a prerequisite for any ambitious policy supporting education and research.

In the field of research, significant efforts have been made over the **past fifteen years.** Between 2008 and 2018, domestic spending on research and development grew by 1.6% per year, i.e., at a higher rate than GDP (+0.9%).⁷¹ This progress has enabled France to move out of the category of "moderate innovators" (formerly "follower countries") in the European

⁷¹ State of higher education, research and innovation in France, 2020, Sheet n°14.

INNOVATION: FRANCE'S GOT TALENT

112

Commission's Innovation Scoreboard. However, France is only just above the EU average in 2020. It is still far from the group of "innovation champions". More significant efforts must therefore be made.



Source: Innovation Scoreboard 2020, European Commission [European Innovation Scoreboard 2020 (europa.eu).

Based on this observation, the 2021-2030 Research Programming Law (LPR) has set a target of at least 3% of GDP devoted to R&D and 1% of GDP devoted to public research and development by 2030. To this end, the LPR plans to mobilize an additional €25 billion in public funding by 2030. Highly innovative countries such as Germany, Japan and Korea are already well above this 3% target. In its 2021 report on higher education and research, Institut Montaigne recommends setting a target of 3% of GDP dedicated to research. The analyses conducted for this report nevertheless lead to a cautious assessment of the link between R&D expenditure and the creation of high-value start-ups. The first observation is that there is no systematic and identical correlation for all the countries in the sample studied (as the first graph below illustrates). The data is strongly dispersed around the regression line and does not lead to the conclusion that there is a clear link. On the other hand, a country-by-country study shows a more robust correlation, albeit one that reflects strong disparities: thus, \$1Bn of additional investment in R&D in France contributes to an increase in the number of high-value start-ups of 0.7, whereas the same amount is linked to an average number of 2 in Israel and 2.6 in the UK. Thus, behind seemingly identical amounts invested in R&D, there are differences in outcomes from one country to another, although it is not possible to objectivize them quantitatively in the **absence of available data:** earmarking of funding for projects that may result in innovations vs. general research; regular allocations vs. competitive funding, etc.

113





Linear regression Coefficient by country

(Coefficient = # high value VC transactions (>30m) relating to a \$1bn increase in R&D investment)



As regards the financial effort in favor of higher education, France is in an even more serious situation (see above). Not only is France lagging behind in research but, unlike the research sector, the trend for higher education has deteriorated during the 2010s. In constant euros, in 2015, the level of annual expenditure per student in France was \in 11,800, compared to \in 12,340 in 2009, a decrease of 4.4% in 6 years.

In this context, France must aim to increase the proportion of GDP devoted to higher education to 2% by 2030,⁷² compared with approximately 1.5% in recent years. This exceptional effort cannot be undertaken by public administrations alone and must leave more room for financing by students and the private sector. The counterpart of this increase in financial resources must be a much greater autonomy for universities.

⁷² This is the objective recommended by the Institut Montaigne in its report *Higher Education* and Research: Time to act!

In total, France must therefore aim to increase the proportion of GDP devoted to higher education and research from 3.7% today to 5% in 2030 (i.e., 2% for higher education and 3% for research). This substantial financial effort in favor of higher education and research is a requisite condition for expanding the pool of innovative French start-ups.

International insights

The links between research and entrepreneurship

Switzerland

Switzerland is one of the countries with the highest spending in R&D in relation to its GDP. Switzerland also spends 30% of its public budget on basic research. The Federal Law on the Promotion of Research and Innovation (LERI), implemented in 2013, requires institutions responsible for promoting research to give special weight to the promotion of basic research. The Swiss National Science Foundation (SNSF), which was founded in 1952 to promote research, has CHF 1.3 billion available for funding basic scientific research (which represents 49% of these funds). According to the European Innovation Scoreboard 2020, Switzerland is at the top of its European ranking of innovative countries, thanks in particular to its attractive research and education system. The applied and professional nature of Swiss higher education and research makes it a system that builds a highly skilled workforce capable of transforming a patent into an "industrializable" product. Switzerland strongly supports the creation of start-ups founded by university students and researchers, in particular through the Swiss Innovation Promotion Agency (InnoSwitzerland), which mainly supports projects carried out jointly by companies and research institutions. InnoSwitzerland finances the direct costs of projects and contributes 15% of the indirect research costs – the company contributes at least the same amount.

Israel

Israel is also a country which converts researchers into entrepreneurs. Researchers are encouraged to launch a "spin off" of their patents in the industry. The Encouragement of Industrial Research and Development Law of 1984 states that a faculty member working in the industry on an R&D project during his or her sabbatical year will pay taxes up to 35%, when the marginal tax is 55%. The Israel Innovation Authority implemented many programs to encourage the researcher to become an entrepreneur:

- the KAMIN program finances the proof of concept of academic inventions and serves as a bridge between basic and applied research transforming basic research achievements into technologies with commercial application. The aim of the program is to assist researchers from Israeli universities, colleges and other research institutions that seek to conduct applied research, and the results of which must be applicable to industries in Israel and potentially have high added value for the economy;
- the Tnufa program supports entrepreneurs in formulating and validating an innovative technological concept and reaching the R&D stage.
- From 2021, the Technology Incubator program provides support through grants of up to NIS 5.2 million per project from the initial concept, and promotes commercialization of groundbreaking technological knowhow originating in academia. Technological incubator operators, who are selected following a competitive process, receive a grant of up to NIS 2 million for the establishment

.../...

of a central laboratory and assist entrepreneurs in developing and testing products, assessing technological feasibility, marketing development, etc., during a concession period of up to 5 years with an option for a 3-year extension.

UK

The UK coped with the difficulty of translating the pioneering intellectual property developed in universities' labs into commercially viable products and to support academics to become entrepreneurs, by creating the Knowledge Transfer Partnerships (KTP) scheme in 2003. This program enables a business to bring in new skills and the latest academic thinking to deliver a specific, strategic innovation project through a knowledge-based partnership. The UK Government has gone further in commercializing public sector knowledge assets recently in May 2021. It has set up a new strategic capability unit (The UK Government Office for Technology Transfer) that helps start-ups identify sources of funding.

Recommandation #9: Enable France to expand its pool of start-ups in universities and research, strive to reach 5% of GDP in funds devoted to higher education and research by 2030.

APPENDIX 1

RESULTS OF THE QUANTITATIVE STUDY CONDUCTED BY ACCENTURE FOR INSTITUT MONTAIGNE





Number of VC fundraising events over US\$30 million

Number of startups that received seed funding between 2010 and 2015 and reached subsequent rounds of VC funding

(normalized to 100)

Capacity	Seed	To 2 nd	To 3 rd	To 4 th	To 5 th	To 6 th
UK	100	36	16	6	2	1
Denmark	100	30	10	4	0.7	0.7
Israel	100	39	19	7	2	0
Germany	100	42	17	7	3	0,6
Sweden	100	32	14	7	2	0
Estonia	100	59	24	11.8	0	0
Finland	100	30	11	4	1	0
France	100	45	16	5	2	0.8
Switzerland	100	44	18	3	2	2
Netherlands	100	36	16	3	1	0
Median	100	38	16	5	2	0.6
Mean	100	39	16	6	2	0.6

Average time required for startups that received seed funding between 2010 and 2015 to obtain subsequent rounds of VC funding

121

(in years)

Speed	Seed to 2 nd	2 nd to 3 rd	3 rd to 4 th	4 th to 5 th	5 th to 6 th	Seed to 6 th
UK	2.5	2	1.7	1.9	1.3	9.5
Denmark	2.3	2.3	1.7	1	4	11.3
Israel	2.1	2.1	1.7	1.8	-	-
Germany	1.9	1.8	1.6	1.8	0.3	6.8
Sweden	2.7	1.7	1.8	1.4	-	-
Estonia	2.6	1.3	1.5	-	-	-
Finland	2.1	2.3	1.8	1.5	-	-
France	2.7	2.1	1.9	1.3	1.7	9.8
Switzerland	2.4	2.3	1.7	2	2	10.4
Netherlands	2.8	2.1	2.3	2	-	-
Median	2.5	2.1	1.7	1.5	1.7	9.8
Mean	2.4	2	1.8	1.6	1.7	9.6

Share of VC fundraising over US\$ 30 million



2000-2020 2010-2020

Average amounts raised in subsequent VC funding rounds by startups that received seed funding between 2010 and 2015

(in US\$M)

Financing	2 nd	3 rd	4 th	5 th	6 th	Total
UK	8	22.3	36.3	62.9	101.9	231.5
Denmark	6.6	25.4	39.1	73.5	55	199.5
Israel	7.4	16.2	42.8	60.5	-	126.9
Germany	10.6	21.6	35.8	120.2	52.3	240.5
Sweden	5	11.8	25.6	21.8	-	64.1
Estonia	21.5	5.8	11.6	-	-	38.8
Finland	6.4	19.3	45.6	60	-	131.4
France	7.4	19	44.8	57.5	143.5	272.2
Switzerland	8.4	15.7	32.6	30	187	273.6
Netherlands	5.7	14.8	30.2	-	-	50.6
Median	7.4	17.6	36.1	60.3	101.9	165.5
Mean	8.7	17.2	34.4	60.8	108	162.9

122

Number of companies receiving seed funding over a 5-year rolling period

(2010 to 2020)

	2010- 2015	2011- 2016	2012- 2017	2013- 2018	2014- 2019	2015- 2020	2010-2015 vs 2015-2020
UK	920	1,139	1,313	1,395	1,435	1,465	+59%
Denmark	143	168	188	192	176	174	+22%
Israel	243	288	347	403	409	419	+72%
Germany	522	622	727	791	891	932	+79%
Sweden	215	312	420	474	507	531	+147%
Estonia	17	17	24	30	35	41	+141%
Finland	142	174	213	222	215	209	+47%
France	384	520	686	800	898	940	+145%
Switzerland	138	183	224	241	275	285	+107%
Netherlands	56	72	84	126	161	190	+239%
Median	179	236	286	322	342	352	+97%
Mean	278	350	423	467	500	519	+87%

Background of founders of Next40 startups and top 40 French valuations



Higher education establishment / humanities university

- Researcher
- None



Distribution of R&D spending between the public and private sectors



Private/Public R&D spending as share of GPD (%)

Israel

Share of researchers in R&D activities

Share of Researchers in R&D in latest available year (2018)



124

125

3.8



Number of R&D Researchers in thousands in latest available year (2018)



Lack of correlation between R&D spending and VC fundraising of more than US\$30 million between countries in the sample



127



Lack of correlation between R&D spending and VC fundraising of more than US\$30 million between countries in the sample







Danemark

Source: Institut Montaigne analysis with the assistance of Accenture (Github data).

129

APPENDIX 2

Linear regression coefficient by country

(Coefficient = high value VC transaction (>30m) remating to a 1\$bn increase in R&D investment)



METHODOLOGY

Through extensive data collection by Accenture, a set of linear regression models were used to test the correlation between:

- the number of high-value transactions (with a transaction amount greater than \$30 million; over a 20-year period from 2000 to 2020, extracted from the CBinsights database) and,
- the following determinants:
- 1. R&D expenditure (2000-2018, OECD);
- 2. New users, projects and commits (a document modification) on the GitHub platform (2010-2019, *Github*);
- 3. Amounts invested in venture capital by companies (2006-2020, Pitchbook);
- 4. Financing of start-ups at different stages of development series A, B, C, D, E+ (2000-2020, CBInsights);
- **5.** Number of incubators (*Tracxn*).

The data collection covers the following ten countries:

Switzerland.

Israel:

- Germany; Denmark;
- Estonia; Finland;
- France;

Pays Bas;

- UK;
- Sweden;

The linear regression analysis showed a significantly positive correlation between the target variable, i.e., the number of deals above \$30 million, and two explanatory variables, both the venture capital investment of firms and the number of incubators.





- A Amount of venture capital investments by companies
- B Number of venture capital operations by companies
- C Number of incubators
- D New commits (a modification on a document) on Github
- E New projects on Github
- New users on Github
- G R&D expenditure in millions of dollar
- **H** Total amount of venture capital operations
- **1** Total number of venture capital operations
- UNumber of high-value venture capital transactions (>\$30 million)

This quantitative analysis was supported by a qualitative analysis using other more qualitative data sources: *Crunchbase* to analyze the careers of startup founders and VC partners and the Pisa and Shanghai rankings to assess school performance.

We also conducted a series of interviews with VC firms, founders, developers and other experts present locally in the ten countries mentioned above – i.e., 20 interviews conducted internationally and more than 30 in France, thus giving our analysis its comparative dimension. These interviews resulted in 6 country fact sheets describing the innovation ecosystems of our most successful neighbors (Germany, Estonia, Israel, United Kingdom, Sweden, Switzerland) with a particular focus on public policies implemented by their governments and which seemed to have positively impacted the emergence and growth of their innovation ecosystems.

APPENDIX 3

COUNTRY REPORTS

Germany innovation ecosystem

Institut Montaigne would like to thank the following people for their help writing this brief: Dr. Jan C. Breitinger, Project Manager of the Program Shaping Sustainable Economies of Bertelsmann Stiftung; Tyson Barker, Head of Technology and Foreign Policy program of German Council on Foreign Relations; Ann Cathrin Riedel, Manager Digital Transformation & Innovation, Friedrich-Naumann-Stiftung für die Freiheit; Shlomo Maital, professor at Technion and senior research fellow at the Neaman Institute.

54

Overview

• Favorable macroeconomic indicators

Germany is the most performing economy in Europe:

- with a GDP of over 3,4 trillion euros and a GDP per capita of 46,000 euros, Germany has the largest economy in Europe and is one of the wealthiest countries in the world;
- Germany's unemployment rate is at 4.2% in 2020 (when France's unemployment rate stands at 8% in 2020);
- prior to 2020, Germany's debt decreased continuously from 80% of GDP in 2010 to 59% in 2019.

• Rebound from the 2009 crisis

The country's economic growth rebounded quickly following the global financial and economic crisis in 2009, thanks to its exports capacity. Germany has a major export-led economy driven by a wide range of internationally competitive

firms, notably in the manufacturing of machinery and transport equipment. These firms make up nearly half of all German merchandise exports.⁷³ Right after the crisis of 2008, Germany increased its national investments in research and innovation. While it took years for neighboring countries to emerge from the crisis, Germany was experiencing a 'golden decade' of rapid economic growth.

• The German Mittelstand

Germany's *Mittelstand* is a unique economic dynamic. More than 99%⁷⁴ of all German firms belong to the **"German Mittelstand"**. *Mittelstand* firms are usually defined as enterprises with annual revenues of up to 50 million euros and a maximum of 500 employees. These companies account for more than half of Germany's economic output and almost 60% of jobs. The *Mittelstand*'s culture rests on planification, methods, and a strong emphasis on industrial design, precision and execution, not only of the product itself but of the production process. *Mittelstand* companies thrive on a very German brand of "family capitalism"⁷⁵ in which the manager is often the owner of the company and the employer-employee relationship is valued.

• Highly competitive scientific research applied to industries

In the World Competitiveness rankings, Germany ranks very high (3rd out of 59) in "innovative capacity" (the innovative capacity of firms to generate new products, processes and/or services), just behind Switzerland and Israel. Germany's innovation is mainly incremental, rather than radical. However, the result has been to underestimate the creative skill of German managers and businesspersons, especially since much of this innovation occurs in small and medium-sized businesses that attract little media attention, and involve no highly-publicized exits or financing deals.⁷⁶

⁷³ The innovation policy platform, Country profile, 2016.

⁷⁴ The German Mittelstand as a model for success, 2020.

⁷⁵ Beating Silicon Valley With the Mittelstand, 2017.

⁷⁶ A. Frenkel, S. Maital. Mapping National Innovation Ecosystems: Foundations for Policy Consensus. Edward Elgar Ltd: London, 2013.

The country's applied scientific research performs well. Germany is a top-performer when it comes to **patent applications**, not only in terms of absolute numbers of patent applications to the European Patent Office, but also in proportion to GDP and per million inhabitants. In 2017, a total of 128,921 patents were registered with the German Patent and Trade Mark Office (DPMA),⁷⁷ the largest in Europe and the fifth largest in the world, and one third patent applications in Europe came from Germany. Germany is also third in Al patent applications in the world.

Germany has one of the most active **ICT sectors** in the European Union, with a turnover of 160 billion euros in 2017, making it the fifth largest ICT market in the world. It is one of the markets that employs the most people in Germany (almost 1 million) after the manufacturing sector. Research and development in Germany is highly rated – with over 290 patents per million inhabitants.

1. General ecosystem dynamics

136

German universities have been vested with a third mission, in addition to researching and teaching: they now must also **promote entrepreneurship**. In 2015, three quarters⁷⁸ of Germans did not find it desirable to start a business. This is changing rapidly and there is still potential to develop an entrepreneur-friendly climate in Germany.

Germany is a country made up of **multiple Digital Hubs.** Germany's economy is essentially based on the *Mittelstand*, a large number of small and mediumsized enterprises (SMEs) which have established themselves near excellent universities that build specific skills. Germany created digital clusters based on the *Mittelstand's* strengths. The German Automotive Clusters are an excellent example of Germany's cluster structures. Only one or two large Original Equipment Manufacturers (OEMs) are usually present in these clusters. The OEMs hold a high degree of market power towards a larger number of supplier companies. This leads to a high level of competition between suppliers, which invest significantly in R&D to address cost and productivity pressure and stay competitive.

German startups have a global approach to **internationalisation:** 84.8% of German startups want to internationalise within the eurozone and 41.6% are looking to enter global markets. 25.6% of startups are planning to go to Asia, where revenues are already being created for 4.2% of the German startups (compared to an average of 2.6% in the EU).⁷⁹

2. Government choices

Before 1998, entrepreneurship was not a topic in the German higher education system. 15 years later, many universities and non-university research institutions throughout Germany established support structures and qualification measures (funding research institutions, supporting the creation of start-up companies, and licensing intellectual property to help researchers build careers outside of academia).

The German government has always played a very active role in the economy, as industry was often state-owned or closely guided by the state. The High-Tech Strategies (HTS), launched in 2006 and followed by a second edition in 2010, are the German government's national strategies that aim to intensify research and innovation. In 2014, the Federal Cabinet adopted the next German High-Tech Strategy and was followed by the "High-Tech Strategy 2025" adopted in 2018. This latter specifically promotes groundbreaking innovations. One of the key measures is the foundation, in 2019 in Leipzig, of the Springboard Innovation Promotion Agency (SprinD GmbH) for high-tech ideas "Made in Germany".

⁷⁷ How innovative is Germany?, 2018.

⁷⁸ The role of the state in the entrepreneurship ecosystem: insights from Germany, 2015.

• Enhancing public engagement in science and research

The EXIST programme launched in 2017 aims at improving the entrepreneurial environment in universities and research institutions and at increasing the number of technology and knowledge-based business start-ups. The EXIST programme comprises three schemes:

- the "Culture of entrepreneurship" scheme supports universities in formulating and implementing a comprehensive and sustained university-wide strategy for developing an entrepreneurial culture and spirit;
- the "Business Start-up Grant" scheme supports students, graduates and scientists in preparing innovative technology and knowledge-based start-up projects;
- the "Transfer of Research funds" scheme helps to gather the resource development required to prove the technical feasibility of start-up ideas based on research, as well as the preparation required to launch a business.

• Accelerating startups funding

A series of public programmes is already supporting the growth of the country's 5,000 start-ups (40% of the funding rounds in Germany go to Berlin-based companies).⁸⁰ At the federal level, these programmes take the form of equity investments ("HighTech Gründerfonds"), financial aid ("Invest" programmes) or even advantageous loans granted by the German public investment bank (Kreditanstalt für Wiederaufbau, KfW). KfW and the German Federal Government launched together in 2018 the Venture Tech Growth Financing programme, which provides a total of 50 million euros every year and is set to run until 2022. In the first five years, 95% of the resulting risks are hedged by the federal budget.⁸¹

This offer can be supplemented by the *Länder*, such as the Pro FIT programme for early-stage startups, created by the Berlin Land investment bank (IBB). Other financial aid includes the German Silicon Valley Accelerator, launched in 2011 by the Ministry of the Economy, which enables German start-ups to spend between three and six months in the United States in order to gather contacts, know-how and funding.

While venture capital is increasingly flowing into German technology start-ups, the volumes remain insufficient. Germany's startups lack domestic funding opportunities. So far, a majority of the late-stage investment has been covered by the US and Asian-based investors. The Federal Government wants to improve legislation and tax rules for venture capital and make Germany more attractive to investors. Various financing instruments are available. "My Microcredit program", launched by the Federal Ministry of Labor and Social Affairs, is an example of the government's attempts to improve access to capital for startups and small businesses.

Germany has the most active corporate venture investors in Europe. 91% of all non-IPO exits in 2019 were related to corporations. Nevertheless, corporations only spend $0.1\%^{82}$ of their revenue on external innovation.

• Prioritizing SMEs

SMEs are key in the German innovation system. The governmental promotion programs are usually designed to facilitate the innovation potential inherent in SMEs rather than providing direct support to startups.⁸³

⁸⁰ Why Berlin?, 2019.

⁸¹ Start-up campaign: KfW and German Federal Government launch debt financing for innovative companies in the growth phase, 2019.

⁸² Shortage of later stage venture capital in Germany: more acute due to Corona crisis, Dealroom, 2020.

⁸³ Auditions, Institut Montaigne, 2021.

The 2014 HTS⁸⁴ fosters innovation in German industries, and provides special support for SMEs and technology-oriented start-ups. It does so through:

- the extension of KMU-innovativ for the funding of cutting-edge research by SMEs to companies counting over 1,000 employees; Launched by the Ministry of Education and Research, KMU-innovativ aims to simplify the application and approval of funding for small and medium-sized enterprises. KMU-innovativ is integrated into technology areas that are particularly important for Germany's future. It addresses a specific need of small and mediumsized enterprises to conduct cutting-edge research. More than 1,266 million euros were funded to date, for more than 1,700 individuals involving almost 2,900 enterprises.
- The improvement of the Central Innovation Programme (ZIM) for SMEs, as well as its extension to companies with up to 499 employees. The Federal Ministry of Economics and Energy put in place the Central Innovation Program in order to promote R&D in German small and medium-sized enterprises. The aim of the program is to improve the innovative capacity of companies and strengthen their long-term competitiveness. With a budget of €559 million in 2019, the Central Innovation Program is the largest support program for innovative enterprises in Germany.

In 2016, the government issued a new SME strategy⁸⁵ which contains a number of new measures addressed to SMEs that are less involved with R&D and have less public support. It is intended to open discussion to a broader range of stakeholders (SMEs, public and private higher education institutions, research institutions and other organisations that are involved with research and development). Its measures aim to implement new networks (Innovationsforen Mittelstand) and to make use of existing ones to develop strategic cooperation between SMEs and strong partners.

This *Mittelstand* is scattered throughout the country (contrary to Silicon Valley, where all the resources are concentrated in the same geographical space. This is why the Federal Ministry for Economic Affairs and Energy (BMWi) launched the Digital Hub Initiative in 2017. Its aim is to connect 12 hubs with each other. The Digital Hub Initiative aims to bolster connections and partnerships between businesses and startups. It has helped make talent scouting even easier through a number of initiatives. Its 'Startup Finder', for example, is an online database that allows potential business partners to filter through the large number of startups by industry, location, funding size, and more.

• Focusing on deep tech

The government has set up a number of grants to encourage deep tech innovation. In December 2019, the German government formed a commission and funded the Agency for Breakthrough Innovations. This new agency is charged with launching innovations with radically new technologies.

The Foreign Trade and Payments Ordinance, which entered into force in May 2021, tightens Germany's FDI control regime. "Critical technologies" such as artificial intelligence, robotics, semiconductors, cybersecurity, aerospace, defense and many others will require Mandatory FDI notification for foreign investment. The new rules have a strong impact on future foreign investments and M&A activity in Germany.

3. State-actors cartography

The German government has created several organisations to support innovation. Some notable ones include:

⁸⁴ New High-Tech Strategy - Innovation for Germany.

⁸⁵ Give Way to SME – BMBF's Ten Points Programme for More Innovation in Small and Medium-Sized Enterprises.

[•] The Investment Bank of Berlin: a development bank and central promotional institute of the state of Berlin. The aim of the funding is the Berlin economy and developing small and medium-sized enterprises (SME).

- The Federal Agency for Disruptive Innovation (SPRIN-D): an agency which coaches and supports "high achievers" who have not yet found a playing field for realising their business idea. SPRIN-D enables innovative entrepreneurs to advance their initial ideas and are responsible for preparing the market launch. It promotes springboard innovations, with medical research, mobility and artificial intelligence given initial priority. For the current legislative period, the Federal Ministry of Education and Research (BMBF) as well as the BMWi jointly funded the agency with 151 million euros.
- Berlin Innovation Agency: an academy which executes end-to-end program journeys for startups and corporate clients.
- Ministry of Economics and Energy: the Ministry of Economy and Energy aims to respond to the real challenges of the German economy in the 21st century, with its main missions being the priority given to small and medium-sized enterprises, the reduction of bureaucracy and above all, the digitalization of industry.
- **Ministry of transports and digital infrastructures:** the Federal Ministry of Transport and Digital Infrastructure ensures that experts from industry, research, associations, administration and politics cooperate. One branch of the ministry, the Directorate General Digital Society, deals with issues related to the increasing digitalization of infrastructure.

Estonian innovation ecosystem

Institut Montaigne would like to thank the following people for their help writing this brief: Olivier Väärtnou, CEO of Cybernetica CEO; Erkki Karo, Professor of TalTech.

Overview

142

Estonia is a country with the highest number of start-ups per capita in the world, with a number of 865⁸⁶ startups per 1 million population. It has 4,6 times as many start-ups per capita as the European average.

• Favorable macroeconomic indicators

Estonian's economy is thriving:

 4,5% annual economic growth on average since 2016, well above the rest of the European Union;

• a situation of full employment (employment to population ratio is 50% in 2010, the rate kept increasing until 2019, reaching 60%);

• a state with a stable deficit (in 2019, Estonia's budget surplus amounted to around 0.4 percent of GDP).

• An open & decentralized information ecosystem

Estonia gained its independence in 1991 and in very early stages in its development started to prioritize ICT as a sector that should be developed as a priority. The initial developments we all strongly supported by the early prime ministers of Estonia. It must also be noted that with a very sparsely populated territory and following the fall of the USSR, modernization policies made it possible to greatly develop infrastructure and create an open and decentralized information ecosystem. Specific e-government development plans appeared from the late 1990s (for example the Tiger Leap, a project undertaken by Estonia's government in collaboration with the business sector, and the citizenship in 1996 which heavily invest in development and expansion of computer and network infrastructure in Estonia, with a particular emphasis on education. This project was translated through rollout of Internet access to all Estonian schools) and strongly continued in the early and mid 2000nds (see for example the X-Road and electronic identity initiatives). There was in many ways a "no policy" area: the government focused only on setting-up basic institutions, knowledge and infrastructure, at the same time liberalizing the economy.

• A growing ICT sector

The official aim of the Estonian Entrepreneurship Growth Strategy 2014–2020 was to lift the share of employment in high and medium-high technology

⁸⁶ The State of European Tech 2020.
sectors in total employment from 3.6% in 2015 to 9% by 2020. The ICT sector accounted for 7.6% of value added of Estonian GDP (2019), and for the second quarter of 2020, this share increased to 9.4%. ICT is one of the few sectors in the country to have recorded positive growth since the onset of the Covid crisis, with 4000 active companies. Revenues from Estonian start-ups amounted to €562 million in Q3 2020 (+41% year-on-year).⁸⁷ Nevertheless, innovation performance has yet to reach OECD levels. This is why productivity growth and greater employment through an increase of the labor productivity thanks to technology and structural change to high-added-value activities are central objectives of the government's current economic policy.

1. General ecosystem dynamics

144

A **general culture supportive of innovation** and ICT was crucial for the emergence of ICT-enabled applications and services. This has fuelled Estonia's image internationally and, today, the country has become an international platform for tech events (Robotex, Latitude 59 and Refresh are renowned international technology events taking place in Estonia).

Scandinavian banks were central to the emergence of the Estonian ecosystem, and still are today. Estonia privatized a large part of its banking system to Scandinavians (Swedbank, Seb, Luminor etc), who built their ICT centres in Estonia. For years, banks were the largest ICT companies.

Unicorns, such as Skype, structure the ecosystem. The sale of Skype in 2011 created for the first time a bunch of **new start-uppers** (such as the unicorn Transferwise). These new unicorns, in turn, provide seeds to the new waves of start-ups. Thus, the Estonian innovation ecosystem benefits from the inputs of experienced startuppers who are able to finance and accompany new generations of enterprises.

2. Government choices

Estonia made very unique government choices. Estonia took the presidency of the Council of the European Union in 2017 and used this opportunity to forge a reputation as a pioneer in administration digitization, building a country where doing business is easy, thanks to a transparent, clear and simple administrative process driven by a user experience (UX). In parallel, the government took several actions to strengthen the country's ability to create successful, international startups.

• Attracting new talents

The country adopted a complement of the 2014 e-residency in June 2020 with the "digital nomad visa" which allows individuals to come to the country as tourists, while continuing to work for a foreign employer or as a freelancer. The goal is therefore to promote e-solutions, but also to diversify the IT community, while having positive impacts on local businesses. 1,800 people could already benefit from this new program.⁸⁹ Today, 31% of the founders of Estonian startups are of foreign origin.⁸⁹

145

Estonia launched, in 2014, a very ambitious plan to attract new talents. It rests on several pillars:

- Very low taxation: Estonia benefits from an attractive tax policy, based on a simple system, with no taxation of profits reinvested in the company (and a rate of 20% on dividends paid).
- E-residency: Estonia provided online access to Estonia's public services for both Estonians and foreigners alike. Estonian citizens could pay taxes, sign documents and access doctor's prescriptions online, while foreign entrepreneurs could establish a company and open a bank account in Estonia with a minimum of 18 minutes.

⁸⁸ Estonia to be one of the first countries in the world to create a digital nomad visa, June $10^{\rm m}, \ 2020.$

⁸⁷ Estonian start-up Database.

• Training high-level ICT workers

Estonia is the best performing country on computer-literacy.⁹⁰ Historically, during the time of the soviet curricula, the students had to study maths and physics as a priority, and the country's students continue to perform very well in these fields. Today, Estonia is the first European country in the PISA ranking carried out by the OECD.⁹¹

The share of ICT Specialists as a percentage of the workforce (5.3%) is well above the EU average and Estonia now ranks 3rd in the EU. Nevertheless, the number of graduates in science and technology (STEM), which includes not just ICT but also other technical disciplines, is below the EU average and is decreasing over time (now ranking 25th).⁹²

• Instilling entrepreneurship into education

In 2020, the government published the Lifelong Learning strategy to foster systematic **development of creativity and entrepreneurship at all levels and in all types of education.** This builds on a tradition of favouring entrepreneurship. Since 2016, ministries, universities, business unions, schools and different agencies such as the Foundation INNOVE and Enterprise Estonia Foundation (EAS) have been developing an entrepreneurship education methodology and teaching materials and providing in service education for teachers.

• Creating a strong public research system

In 2014, the government adopted an institutional package "Success Estonia 2014" to boost competitiveness through different spheres of life (environment, health, education, R&D, labour market, SME's). It notably increased the

efficiency of higher education and public R&D institutions.⁹³ Public research has improved significantly over more than a decade. Today, Estonia has a high level of public **R&D expenditures and strong performance in terms of international scientific publications.**

Fostering cooperation between government offices and the private sector

Since October 2015, **a strong partnership between private and public sectors** is encouraged: the Ratas I government launched a fund of funds, "the SmartCap", which also has a role in incubators (Garage88, Lift99, Startup WiseGuys). Moreover, Estonia encouraged a partnership between startups and companies with the 'Development of cooperation networks', through which startups become potential cooperation partners who run joint development and marketing activities through cooperation structures.⁹⁴

Building performant digital infrastructures

Estonia boasts one of the highest levels of cellular and internet coverage in the world: Estonia was 8th in 4G network coverage by operators in 2017 (94% of households were covered) and 4th in terms of mobile broadband subscription rate (there are 116 subscriptions per 100 people on average).⁹⁵ However, Estonia continues to lag behind on the fixed broadband market, with a coverage of 89%, mainly due to low rural availability.

Estonia has managed to circumvent sovereignty issues associated with the use of foreign cloud services. The **data embassy concept** replaced the traditional cloud model: data is stored on foreign servers, but Estonian actors retain the control.⁹⁶

⁹⁰ Digital Economy and Society Index (DESI)1 2018 Country Report Estonia, 2018.

⁹¹ Résultats du PISA 2018, OECD, 2018.

⁹² Digital Economy and Society Index (DESI)1 2018 Country Report Estonia, 2018.

^{93 (}p10) "After 15 years of market reforms in transition economies", 2005.

⁹⁴ Startup Estonia – Internationalisation policy measure, Eurofound, Praxis, 2018.

⁹⁵ Digital Economy and Society Index 2017 Estonia, European Commission, 2017.

⁹⁶ Embracing innovation in Government : Global trends 2018, OECD, 2018.

In 2020, the Estonian Ministry of Economic Affairs and Communications published the "Estonian digital strategy 2020", introducing the application of the "no legacy" principle: any ICT infrastructure in the public sector that is more than 13 years old must be renewed. Besides delivering pioneering measures to get the ICT sector effective, it also plays an important role in defining ICTs international standards.

3. State-actors cartography

148

The Estonian government has created several organisations to support innovation (organizations dedicated to repairing market failures). Some notable ones include:

- The Estonian Development Fund: a public funded hybrid (earlystage) venture capital organisation combining an investment team and an economic and technological foresight team.
- The StartUp Estonia: a governmental initiative aimed to supercharge the Estonian startup ecosystem for it to be the birthplace of many more startup success stories in the future.
- The Estonian Research Council: a governmental foundation that was established to concentrate the funding of R&D.
- The Estonian Science Foundation: an expert research-funding organisation which uses state budget appropriations to award research grants on a competitive basis to individuals and to research groups.

There are also other non-governmental organisations that play an active role in the innovation ecosystem:

- EngageEstonia: the hub that connects and engages big business with technology innovators - where data and technology collide.
- The Estonian Business Angels Network: an umbrella organization for business angels and business angel groups seeking investment opportunities with an aim to grow the quantity and quality of local seed stage investments.

Israeli innovation ecosystem

Institut Montaigne would like to thank the following people for their help writing this brief: Dr. Manuel Traitenberg, professor at Tel Aviv University; Benjamin Haddad, Director of Accenture Ventures and Yonit Serkin, Director of MassChallenge.

Overview

Israel has a dense ecosystem which includes 5 world-renowned universities, around 9,000 start-ups⁹⁷ (the second-largest number of startup companies in the world) and more than 200 incubators. Israel has a favorable environment for innovation, with many investments opportunities for pioneering technologies, and the Israeli Defense Forces' history and culture on the training of local talent.

Favorable macroeconomic indicators

Israel's economy is dual : it has a very dynamic and attractive high tech sector while having an underproductive and over-regulated "traditional" sector. Overall, it has favorable macroeconomic indicators:98

- 3.3% annual economic growth on average since 2000, well above the rest of the OECD;
- a situation of **full employment** (unemployment rate at 4.1% in February 2019) with controlled inflation (+0.9% in 2018):
- a state with **solid financial capacities** which, although it is in regular deficit (3% of GDP in 2018 and 2019), now has a stable debt at around 62% of GDP since 2016, after it fell steadily since the 1990s;
- Israel attracts inflows of direct investment of \$12 billion each year (almost twice as much as France in proportion to GDP), with a peak of \$18 billion in 2017.

98 La politique d'attractivité israélienne, Direction générale du Trésor, 2019.

⁹⁷ Israel Tech. Dealroom, 2020.

• A highly invested startups ecosystem, especially for pioneering technologies

Israel is the country with the highest amount of VC investment per capita:⁹⁹ 810 dollars per person are being invested in startups, compared to 300 dollars in the US and 40 dollars in Europe. It has the third-largest number of NASDAQ-listed companies after the U.S. and China.¹⁰⁰

Technology is a key economic growth driver, comprising nearly 10% of Israel's workforce. Israel has become a renown innovation ecosystem by exporting its know-how and its technologies (Israeli innovations include a long list of market firsts such as disk-on-key technology, IP telephony, ZIP compression) in partnership with international companies. One of Israel's key advantages is its ability to tie strong links to the world's highest-performing innovation ecosystems. There are 350 multinational R&D centres in Israel, many of which were established following the acquisition of Israeli hi-tech companies. These R&D centers create significant technological value by representing 50% of investments in R&D.¹⁰¹

• Israel's military contributes to the innovation ecosystem

The military service is very important in Israel. It is mandatory from 18 to 21 years old (nearly 45% of the population is under 24) and contributes to the training of citizens in elite high-performance technological units which play a role in the creation of startups. More than 1,000 companies have been founded by 8,200 alumni, from Waze to Check Point, and 90% of the intelligence material in Israel comes from the alumni of this military service. The Innovation Authority together with the Ministry of Finance put in place a dual-purpose technology incentives programme, called MEIMAD, which supports the development of innovative solutions for the defense and commercial markets.

99 An entrepreneurial ethos, The Economist, 2019

100 How Israel Became The Startup Nation Having The 3rd Most Companies On The Nasdaq, Seeking Alpha, 2018. The military service's key contribution is that it encourages the systematic scanning of schools for the country's best talent. The training enables the population to develop an entrepreneurial culture as well as hard and soft skills that are key to start a business.

1. General ecosystem dynamics¹⁰²

The Israeli ecosystem benefits from dynamic interactions between academia and industry. There are **strong incentives for professors and academics to work with large companies.** Research institutions are part of the detection of go-to-market technologies and help showcasing innovation to large companies that are increasingly buying Israeli startups. Professors who build large companies often become public figures.

The "chutzpah" culture is also one of the main drivers of Innovation, as it encourages **risk-taking and can-do attitudes**. Moreover, there is **a strong sense of community in Israel**, which manifests in a "pay it forward" culture (the idea that one can settle one's debt by paying back society at large, and not the creditor only).

2. Government choices

For several decades after the country's founding in 1947, Israel's economy has been heavily dominated by the public sector and trade was greatly restricted. Since the late 1980s, the government has actively created policies to foster the private sector's potential.

• Building financial and international support

The Israeli government founded the Technology Incubator programme in the early 1990s. Today, this incubator has given birth to 25 incubators across the country, all of which have been privatized. The incubators fund up to 85%

¹⁰¹ Innovation Report, Israel innovation authority, 2019.

of early stage projects for two years. They nurture companies from seed to early stage, thus minimizing investors' risks. More than 1,100 projects have graduated from the incubators so far, with over 45% successfully attracting additional investments from different investors. From 2021, the programme provides support through grants of up to NIS 5.2 million per project from the initial concept, and promotes commercialization of groundbreaking technological knowhow originating in academia. Technological incubator operators, who are selected following a competitive process, receive a grant of up to NIS 2 million for the establishment of a central laboratory and assist entrepreneurs in developing and testing products, assessing technological feasibility, marketing development, etc., during a concession period of up to 5 years with an option for a 3-year extension.

In 1969, the Israeli government established within the ministry of economy and industry, the Office of the Chief Scientist (OCS), tasked with implementing government policy to support and encourage industrial R&D projects undertaken by private firms. In early 2016, the Israeli government replaced the OCS with an independent public entity, the Israel Innovation Authority (IIA) with a broader objective than the OCS and an expanded scope of its incentive programmes. With an annual budget of around 400 million dollars, the IIA has been essential in providing the nation's entrepreneurs with the funding they need and with a variety of support programmes, some notable ones include:

- the R&D Fund which offers Israeli corporations and startups, R&D grants of up to 50% of the approved R&D programme cost in established companies, and up to 66% for startups.¹⁰³
- the Early Stage Incentive programme which helps firms that are up to 4 years old to raise private investment by supporting them with early funding and by signalling business potential. Recently, the IIA completed this programme with the Hybrid Seed Incentive programme which reduces the risk for potential investors in high-risk seed-stage startups that have raised less than NIS 3.5 million.

The Investment Law, enacted in 2010, enables foreign companies to benefit from a reduced company tax rate and investment grants. The government also provides employment grants for R&D centers and large enterprises, offering a 4-year grant scheme covering on average 25% of the employer's employment cost for each new employee. The same law states that companies, whether big corporations or small startups, which meet certain eligibility criteria, are entitled to receive **matching grants** for the development of innovative, export-targeted products. Every project is judged by a panel of experts with two main considerations : the tech feasibility and the commercial viability.

• Fostering cooperation between government offices, universities and the private sector

Major incentive programmes were implemented by the IIA to promote academia-industry collaboration. Some notables ones are:

- the Magnet programme which has managed partnerships between academic and commercial R&D programmes and has supported knowledge transfers since 1994. With a budget of more than 50 million euros a year, it supports the development of generic technologies in fields in which Israeli industry has a competitive advantage. The grant provided is up to 66% of the approved budget for an industrial company and 100% of the approved budget for a research institution.
- the Nofar programme which aims to bridge the development gap between academic knowledge and industry needs in the fields of biotechnology and nanotechnology by providing support and guidance to the academic institutions. This programme assists academic research groups that carry out applied research, and the results of which are not mature enough to be supported by the industry. The grant provided is up to 90% of the approved budget for a period of 12 months.
- the historical R&D Collaboration with Multinational Corporations programme (MNC) which offers a framework for technological cooperation between multinationals and innovative Israeli companies. Around 60 companies, such as Stellantis recently, have already established an agreement with Israel through this programme in order to equally invest in pre-selected R&D projects, conducted jointly by the MNC and the company.

¹⁰³ Government Support for Commercial R&D: Lessons from the Israeli Experience, Manuel Trajtenberg, 2002.

The Yozma programme, a government-targeted policy to support R&D activities, has enabled effective interactions between government (the IIA under the Ministry of Economy in particular), universities and industries. Established in 1993, Yozma invested around \$80 million for 40% stake in 10 new venture capital funds. To further attract foreign investors, the programme offered them insurance covering 80% of the downside risk and gave them the option to buy out the government's share at a discount within five years. Yozma funds had induced private VC investments by stimulating co-investments. For the first time, industries and governments worked together for innovation. Israel's Yozma programme has triggered the emergence of a domestic VC industry with a pool of human capital and VC support from the OCS in sharing the risks of R&D projects. This led to the development of Silicon Wadi.¹⁰⁴

• High-level of conversion from researchers to entrepreneurs

Researchers are encouraged to launch a "spin off" of their patents in the industry. The Encouragement of Industrial Research and Development Law of 1984 states that a faculty member working in the industry on an R&D project during his or her sabbatical year will pay taxes up to 35%, when the marginal tax is 55%.

The IIA implemented many programmes to encourage the researcher to become an entrepreneur:

- the KAMIN programme finances proof of concept of academic inventions and serves as a bridge between basic and applied research transforming basic research achievements into technologies with commercial application. The aim of the programme is to assist researchers from Israeli universities, colleges and other research institutions that seek to conduct applied research, and the results of which must be applicable to industries in Israel and potentially have high added value for the economy.
- the Tnufa programme is supporting entrepreneurs in formulating and validating an innovative technological concept and reaching the R&D stage.

155

3. State-actors cartography

The Israeli government has created several organisations to support innovation. Some notable ones include:

- Israel Innovation Authority: a support arm of the Israeli government, charged with fostering the development of industrial R&D within the State of Israel.
- Startup Nation Central (SNC): a Israeli non-profit organization that tracks the local innovation ecosystem.
- Israel Advanced Technology Industries (IATI): an umbrella organization of the high-tech and life sciences industry in Israel is connecting more than 700 members, which include venture capital funds, R&D centers of multinational corporations, local small and large companies, technological and business incubators, acceleration programmes for startup companies, commercialization companies of universities, hospitals, academia and service providers.

UK innovation ecosystem

Institut Montaigne would like to thank the following people for their help writing this brief: Martin Carkett, Policy Lead, Science & Innovation Unit at Tony Blair Institute; Mark Lazar, director of programmes at Govtech accelerator; Eleonora Harwich, Director of Research at Reform; Daniel Sleat, Head of Research Unit at Tony Blair Institute; Georgina Wright, Head of the Europe program at Institut Montaigne.

Overview

The United Kingdom is home to 406 new startups each year per 1 million inhabitants.¹⁰⁵ Although it is not the country with the highest number of new startups, the country has produced more than twice the number of 1 billion dollars

104 Government policies towards Israel's high-tech powerhouse, Wonglimpiyarat, 2016.

valuation tech companies than any other country in Europe: the UK created 77 unicorns between 2010 until 2019 (compared to 32 in Germany, 22 in Israel, 14 in France, and 12 in Sweden and Switzerland respectively).¹⁰⁶ The British tech startup and scaleup ecosystem is valued at 585 billion dollars -120% more than in 2017, and more than double that of Germany, which is the next most valuable tech ecosystem with a cumulative value of 291 billion dollars.¹⁰⁷

The United Kingdom is an open economy with favorable macroeconomic indicators, and its Science, Technology and Innovation sector enjoys a good level of foreign direct investment, is open to foreign firms and benefits from world class tech knowledge:

• Favorable macroeconomic indicators

156

The UK is a high-performing economy in Europe:

- with a GDP per capita of 40,406 dollars in 2020, the UK is in the OECD average, right before France's GDP (39,907 dollars).¹⁰⁸ However, the combination of Brexit and COVID-19 made the UK one of the slowest growing economies in Europe in 2020;¹⁰⁹
- the UK's unemployment rate stood at just 4.12% in 2020, a rate that has been steadily decreasing since 2011 (in comparison, the unemployment rate in the European Union in 2020 was around 7.3%).¹¹⁰ However, it is expected to take a hit following Covid-19;
- the UK sovereign debt has remained broadly stable over the past decade (notwithstanding the fiscal consequences of COVID-19);
- the UK's price stability over the past decade is to be highlighted. The Bank of England has kept inflation to broadly between 2-3%¹¹¹ over this time, which is an important factor for business or investment decisions.

- 109 UK economy suffers worst slump in Europe in second quarter, 2020.
- 110 Office National for Statistics: Employment in the UK, 2021.
- 111 Bank of England's Monetary Policy Report, 2021.

• An advanced Science, Technology and Innovation sector

The UK has long held a strong position in global innovation. The tech industry is expanding more than two and half times faster than the rest of the British economy with a reported 2.1 million jobs¹¹² created in the digital economy in 2018. The UK digital sector is said to have added £149bn or £400m a day¹¹³ into the country's economy in 2018, an increase of 7.9% on the year before. The UK is a European leader in deep tech: cutting-edge, disruptive technologies based on scientific discoveries. UK VC funding into deep tech companies reached 3.1 billion euros in 2019, up from 0.9 billion euros in 2015.¹¹⁴ Their nearest European competitors, France and Germany, attracted a combined figure of 2.7 billion euros. Moreover, the UK is very attractive to international investors, as 63% of investment into UK tech came from overseas in 2020, up from 50% in 2016.¹¹⁵

World class tech knowledge and research

Five of the world's top 20 universities are in the United Kingdom.¹¹⁶ UK universities punch above their weight on article downloads, citations and world's most highly-cited articles. The UK is ranked 4th on the 2020 Global Innovation Index. Looking at University spin out companies -companies set up to exploit intellectual property that has originated from within a university-, the UK holds five of the top 10 positions if we rank universities according to the amount of capital raised by their spin outs. The University of Cambridge ranks first globally.¹¹⁷

- 116 The World's Top 100 Universities Top universities, 2021.
- 117 UK Tech Competitiveness Study, Gov.uk, 2021.

¹⁰⁷ The future UK tech built, Infintech, 2021.

¹⁰⁸ OECD Gross domestic product (GDP), 2021.

¹¹² A bright Tech Future, 2019.

¹¹³ Digital sector worth more than £400 million a day to UK economy, 2020.

¹¹⁴ UK Tech Competitiveness Study, 2021.

¹¹⁵ The future UK tech built Tech Nation Report 2021.

• A good amount of capital invested in UK startups

The UK also has the largest level of capital invested in startups in Europe over the past five years. On a cumulative basis, about 50 billion dollars has been invested into UK tech companies since 2016, more than twice the capital invested in Germany (23 billion dollars) and France (19 billion dollars).¹¹⁸ London is currently the fourth most attractive destination for global tech venture capital (VC) investment behind San Francisco, Beijing and New York, but that share is increasing quickly: in 2019, UK VC investment increased by 44%, outpacing the US and China, down 20% and 65% respectively.¹¹⁹

1. General ecosystem dynamics

There is a clear signal¹²⁰ from the UK Government to prioritize the tech sector. There is also an active role of the NHS in building a digital health ecosystem.¹²¹

Startups are looking at how they can have greater impact: the UK is third in the world for investment in "impact tech" (the proactive use of responsible technology to create or multiply positive impact), which has increased 160% since 2018 while in the US it rose by 15% over the same period.¹²²

The UK has the UK Government as a market: since the UK left the EU, regulations underpinning procurement have changed, resulting in more flexibility for public contracts. The example of the "oyster card" is quite revealing. Public authorities become buyers.

UK universities, especially Cambridge, have always had a culture of encouraging businesses to partner with them, or develop some of the research

they produce. They develop partnerships with businesses to build clusters. Encouraged by their financial structure, universities can easily plug their alumni with investors and tech startups.

2. UK Government choices

The UK's Industrial Strategy in 2017, transitioning towards the Plan for Growth of 2021 in line with the 2015 Productivity Plan, sets out a policy agenda to boost the UK's productivity growth, incentivising firms to invest in technology and to innovate. Maintaining research excellence, promoting innovation and strengthening the interface between universities and industry are major focus areas of new national strategies for productivity and competitiveness. These cross-UK Governmental strategies have been complemented by a number of important reviews and plans focused on specific aspects of the UK innovation system, including the public research funding, human capital robustness and university-business collaborations.

• Funding facilities

The UK Government has traditionally been a big supporter of many R&D intensive and innovative businesses from their inception through tax incentives, grants, loans and equity. The main 3 schemes are the following.

- The Enterprise Investment Scheme (EIS), launched in 1994, is designed to encourage investments in small unquoted companies carrying on a qualifying trade in the United Kingdom. Through the EIS, eligible investors can claim up to 30% income tax relief on investments up to £1 million per tax year.
- The Venture Capital Trusts (VCTs), first introduced in 1995, is a publicly-listed, closed-end fund in the UK that allows individual investors to gain access to venture capital investments via capital markets. VCTs encourage small business growth, provide potential high returns through high-growth private companies, and have multiple tax advantages as well.
- The Seed Enterprise Investment Scheme (SEIS) was launched in 2012 to encourage investors to finance startups by providing tax breaks for projects they might otherwise deem too risky. Through the SEIS, investors, including

¹¹⁸ The State of European Tech 2020.

¹¹⁹ UK tech investment grew faster than the US and China in 2019, 2020.

¹²⁰ Global Britain in a Competitive Age, 2021, Cabinet Office.

¹²¹ The NHS Long Term Plan – Research and innovation to drive future outcomes improvement, 2019.

¹²² The State of European Tech 2020.

directors, can receive initial tax relief of 50% on investments up to £100,000 and Capital Gains Tax, exemption for any gains on the SEIS shares.

• The £375 million Future Fund founded in 2021: to address the scale up gap for their most innovative businesses.

Established by the UK Government in 2014, the British Business Bank is a main actor for the UK innovation ecosystem which increases the supply and diversity of finance available for UK SMEs. Its lending and equity programmes are supporting nearly £8 billion of financing to almost 100,000 small businesses. British Patient Capital, established in 2018 within the British Business Bank with £2.5 billion¹²³ of investment, crowds in an additional £5 billion of private investment over 10 years and increases the overall supply of funding for companies at later stages of their growth, where capital needs are higher.

Moreover, grants are often an important factor in a spinout's growth trajectory. Innovate UK is the most significant grant body for the UK's young companies.

160

• The UK public research system relies on links between businesses and universities

To cope with the difficulty of translating the pioneering intellectual property developed in universities' labs into commercially viable products and to support academics to become entrepreneurs, the UK Government created the Knowledge Transfer Partnerships (KTP) scheme in 2003. This program enables a business to bring in new skills and the latest academic thinking to deliver a specific, strategic innovation project through a knowledge-based partnership. The UK Government has gone further on commercialising public sector knowledge assets recently in May 2021. Through the 'Getting Smarter' report, it sets out an implementation strategy that focuses on three pillars: good practice, incentives and support which will help provide clarity to organisations about how to manage their knowledge assets and unlock their potential. The key deliverables of the implementation strategy are to set up a new strategic capability unit (The UK Government Office for Technology Transfer) and fund to improve how we manage, develop and invest in public sector knowledge assets. At the Spending Review 2020, funding of up to £17 million¹²⁴ in 2021 and 2022 was announced to help establish these key deliverables which will, in turn, help public sector knowledge assets translate into new high-tech jobs, businesses and economic growth.

• The UK has established a number of networks, clusters, campuses or centres to bring academic research excellence closer to industry

Through the work of Innovate UK, the UK Government has expanded this part of the innovation ecosystem, establishing a network of 'Catapult centres' to commercialise new and emerging technologies. An independent review of the Catapult network has been conducted in 2017. It sets out that Catapults are an important and successful part of the UK's innovation ecosystem, and that they can drive innovation and economic benefit in the UK. The High-Value Manufacturing Catapult has been particularly successful. Since its inception in 2012 it has tripled the impact of UK Government spending – generating £655 million of additional income from industry by working with over 3,000 businesses every year to bring new technology to market.

• The UK struggles to promote R&D in domestic firms nd manufacturing industries

To this end, the UK Government has implemented a variety of novel direct and indirect support measures to increase innovation in companies and support Small and Medium sized Enterprises (SMEs). Compared to most OECD countries, public support for R&D and innovation tax incentives have seen an increase in the UK.

¹²³ Build Back Better: our plan for growth, 2021.

¹²⁴ Getting smarter: government publishes strategy to support public sector better manage its knowledge assets, 2021

- The UK Government announced in 2015 its intention to broaden the range of finance options for innovative businesses, so that they can access more consistent and appropriate support at all stages of innovation.
- In 2017 and 2018, R&D tax reliefs of £5.1 billion supported £36.5 billion of R&D expenditure. $^{\rm 125}$
- In 2022 alone, the UK Government is investing £14.6 billion in research and innovation grants and facilities. This investment will back the priorities set out in the UK Government's Research and Development Roadmap and drive progress towards the target for total UK investment in R&D (public and private) to reach 2.4%¹²⁶ of GDP by 2027.

• The UK ranks high on all human capital indicators, reflecting the robustness of its skills foundations

While targeting programmes to encourage students to study physics and mathematics at advanced school level, the UK Government has also committed to give more generous bursaries and scholarships to increase the number and quality of science and mathematics teachers in schools.

The UK Government is investing in the creation of five new National Colleges: Digital Skills, High-Speed Rail, Onshore Oil and Gas, Creative and Cultural Industries, and Nuclear, in an effort to address skills gaps for school-leavers and work directly with employers.

The UK Government has committed in 2021 to a £2.5 billion¹²⁷ National Skills Fund over the course of this Parliament to improve the technical skills of adults in England. The UK Government will also introduce the UK Shared Prosperity Fund (UKSPF) to help to level up and create opportunities across the UK for people and places. A portion of the UKSPF will be targeted at bespoke employment and skills support tailored to local needs. Since september

2020, employers are encouraged to create new jobs for 16 to 24 year olds on Universal Credit who are at risk of long term unemployment through the governmental Kickstart Scheme which provides them with funding.

• The UK has policies that aims to attract international talent

Around 42%¹²⁸ of UK fintech workers are from overseas, 49% of the UK's fastest growing businesses and nine of the UK's 14 unicorns have at least one foreign-born co-founder. To ensure the continued competitiveness of their high-growth in innovative sectors, the UK needs to outpace global competition with a visa offering that can attract and retain the best and brightest from around the world – Brexit means that EU citizens must also have a visa to work in the UKAt the beginning of this year, in 2021, the UK Government launched the new points-based system to create a single, global immigration system. This skills-led system delivers a new route for skilled workers and specialist work routes for business founders and those with recognised or high-potential talent in their field.

3. State-actors cartography

The UK has several organisations to support innovation. Some notable ones include:

- The UK Research & Innovation (UKRI): a non-departmental public body of the UK Government of the United Kingdom that directs research and innovation funding, funded through the science budget of the Department for Business, Energy and Industrial Strategy.
- **The Innovate UK:** a non-departmental public body, part of UK Research and Innovation, founded in 2007, funded by a grant-in-aid from the UK Government.
- The Advanced Research & Invention Agency (ARIA): a research funding body launched in 2021, based on the principles of the US Advanced Research Projects Agency (DARPA).

¹²⁵ Research and Development Tax Credits Statistics, 2020.

¹²⁶ BEIS research and development (R&D) budget allocations 2021 to 2022, 2021. 127 National Skills Fund, 2020.

¹²⁸ The UK as a science and technology superpower, 2021.

- The Digital Economy Council: a non-statutory advisory committee of independent members set up to provide advice to the UK Government. Its purpose is to harness the expertise of industry and the wider tech community.
- **The Catapults:** a not-for-profit network of innovation centres founded by Innovate UK in 2012, connecting businesses with the UK's research and academic communities.
- The Council for Science and Technology: an advisory council which is supported by the secretariat in the UK Government Office for Science. Its role is to give advice on issues related to research, science, technology and disruptive innovation across UK Government departments.
- The UK Government Tech Fund: a venture capital fund dedicated to UK Government technology startups.
- **The EIS:** a range of UK Government departments with a strong focus on tech, which is backing a winner approach.
- The Department for International Trade (DIT, formerly UK Trade & Investment, UKTI): a UK Government department established in 2015 to promote the internationalisation of SMEs.
- The Department for Business, Energy & Industrial Strategy: a UK Government department which is in charge of developing and delivering a comprehensive industrial strategy and leading the UK Government's relationships with businesses, along with securing affordable and clean energy supplies to the country.
- The Ministry of Defence: a ministry which spends more than £20 billion each year within UK industries, supporting a total of over 200,000 jobs across the UK, and serving as one of the largest providers of apprenticeships. The MOD's Defence and Security Accelerator has supported more than 750 innovations by funding ideas. In the forthcoming Defence and Security Industrial Strategy, we will set out further actions we are taking to foster vibrant and innovative UK businesses.
- The British Business Bank: a national fund of funds which supports the scale up of innovative and R&D-intensive businesses.
- **The Newton Fund:** a Fund managed by the UK Department for Business, Energy and Industrial Strategy (BEIS), builds scientific and innovation partnerships with 16 partner countries to support their economic

development and social welfare and to develop their research and innovation capacity for long-term sustainable growth. It has a total UK Government investment of USD 1.1 billion PPP (GBP 735 million) up until 2021, with matched resources from the partner countries.

- The Alan Turing Institute: a national institute for data science and Al created in 2014, bringing together 13 leading UK universities, five strategic partners with key user sectors, international researchers, UK Government departments, as well as UK and international corporates and SMEs. The Institute forms partnerships between industries and research to promote innovation around data.
- **The Office for Investment:** an office which has been established to support the landing of high value investment opportunities into the UK which align with key UK Government priorities, including our focus on key sectors, reaching net zero, investment in infrastructure and advancing research and development.
- The Tech Nation: a national network for ambitious tech entrepreneurs

 offering growth programmes, visas for exceptional talent from overseas
- The Tech London: a comprehensive online platform connecting and supporting London's expanding entrepreneurship ecosystem.
- The London Co-Investment Fund: a venture firm that invests in high growth tech, science, and digital startups in London.
- The Francis Crick Institute: a leading institute in biomedical research and innovation, which is similar to the Turing Institute with a unique partnership between government, universities and charities.

Swedish innovation ecosystem

Institut Montaigne would like to thank the following people for their help writing this brief: Peter Svensson, Analyst at Growth Analysis; Johan Eklund Research, CEO of Swedish Entrepreneurship Forum (Entreprenörskapsforum); Enrico Deiaco, Innovation expert of Swedish Entrepreneurship Forum; Sten Tärnbro, Analyst at Swedish Private Equity & Venture Capital Association (SVCA); Isabella de Feudis, CEO of Swedish Private Equity & Venture Capital Association (SVCA); Jan Sandred, Program Manager Sweden of Vinnova; Joakim Appelquist, Deputy Director General of Vinnova; Emma Bäcke, Programme Manager, Vinnova.

Overview

• Favorable macroeconomic indicators

Sweden's economy has slightly deteriorated since 2015:

- the annual economic growth of Sweden decreased from 4,4% to 1,2% within 4 years;
- Employment to population ratio kept increasing from 2010 to 2018, it slightly decreased ever since, reaching 59%;
- a state with a comfortable budget, from 2015 to 2019, Sweden's average budget surplus amounted to around 0.9 percent of GDP.

• From crisis to growth, a deliberate promotion strategy based on intangible assets

The Swedish economy was deeply affected by a crisis that lasted from 1991 to 1993, characterized by the collapse of a housing bubble, a sharp rise in the unemployment rate and large fiscal deficits. Sweden, then, adopted a series of important structural reforms (pension reform, liberalization of public services, rigorous management of public finances and entry into the European Union in 1995) allowing it to adapt to globalization and to improve results since 2012 (budget surpluses and reduction in public debt falling from 84.4% of GDP in 1995 to 32% of GDP in 2012, a GDP / capita – 58,012€ / capita – approximately 30% higher than that of France – 40,493€ / capita – in 2019). Sweden enjoys a positive image worldwide, which is based on clearly identified values and on which Swedish companies can capitalize for their international economic development. This positive image is partly the result of a deliberate promotion strategy driven by the State at the end of the 1990 crisis. Sweden is now producing 429 startups per year per 1 million inhabitants.¹²⁹

167

• The Swedish R&D and innovation ecosystem is one of the densest and most diverse in the world

A large proportion of national R&D expenditure comes from the private sector: more than 2/3 come from companies. On the public side, research issues in Sweden are the responsibility of the Ministry of Education, which alone captures 63.3% of the public R&D budget, and allocates almost half (47.8%) of the R&D budget to nearly 40 universities. Five of these, considered centers of excellence (the Karolinska Institute, Lund, Uppsala, Stockholm and Gothenburg universities) capture around 60% of these funds. All the major universities have innovation departments, often set up as independent entities (subsidiaries) thanks to the relative autonomy of the institutions. According to the International Intellectual Property Organization, Sweden ranks 10th in the world for the number of patents filed.

• A reinvestment in start-ups from experienced Swedish entrepreneurs

The Swedish innovation ecosystem is efficient and robust because it has reached a level of maturity accompanied by a reinvestment in start-ups and support schemes for start-ups from experienced Swedish entrepreneurs or other individuals who have built up personal wealth in the last 20 years. These individuals open a network in Sweden and abroad. Notable individuals engaged in this kind of activity include Rune Andersson, Dan Olofsson, Jane Walerud and Michael Blomqvist. Corporate venture capital does not present itself as having a particularly important influence in the financing or support of start-ups in Sweden. However, successful Swedish entrepreneurs often come from the corporate world – often, they see an opportunity in the market and decide to create their own project.

1. General ecosystem dynamics

The Swedish entrepreneurial **culture is fostered in school:** since 1980, the country trained more than 330,000 students in business creation through a

166

COUNTRY REPORTS

program called "Young Entrepreneurship" and funded by large companies and employers (via the Confederation of Swedish Enterprise "Svenskt Näringsliv"). Sweden is a country of engineers: Sweden had 300,000 engineers in 2015 (6,000 graduate engineers / year). Nevertheless, by 2030, there is expected to be only 30,000 engineers in Sweden.¹³⁰ In addition, the average salary of developers according to the CodinGame global ranking¹³¹ is \$53,896 in Sweden, the 7th country, especially ahead of France.

There is a culture of **admiration and pride in entrepreneurs** in Sweden, thanks to the international successes of brands like IKEA and Spotify.¹³² Overall, Failure in Sweden is valued in individual careers and not stigmatized. In addition, Swedish entrepreneurs spontaneously and immediately think of "global market" when they set up their business, in a country where exports represent 46% of GDP.

Sweden also has a large population of **"early adopters" of technologies:** it is the European country with the highest share of loyal Tech first-time adopters, according to a recent Yougov study, ¹³³ a prime target for companies launching their project in Europe.

A unique trait in Sweden is the open working environment. Founders are giving their employees a high degree of freedom (68.0%, compared to 54.4%) and 90.0% confirm to share critical information with their staff, 68.0% even seek advice for strategic decisions from their employees.¹³⁴

Sweden is also one of the most **cashless** societies in the world.¹³⁵

- 131 Les 11 pays dans le monde où les développeurs sont les mieux payés, Business Insider, february 6 2019.
- 132 Interview with Vinnova.

168

- 133 First in Line: Technologies : qui sont les "Early adopters " et comment se comportent-ils?, YouGov, 22 novembre 2020.
- 134 EU Startup Monitor European Startup Ecosystem Country Overviews, 2020.
- 135 Sweden: How to Live in the World's First Cashless Society, 2020.

2. Government choices

Sweden's startups are known for having a high survival rate with relatively fast growth. It is also known to be a country with high government spending per capita. The country excels in promoting new businesses and is one of the few countries in Europe who cut corporate tax rates to stimulate entrepreneurship. Since 1993, the government has created policies to develop the ecosystem. They are listed below.

• Building performant infrastructure

From the end of the 1990s, the government and businesses have deployed programs enabling households to equip themselves with a free computer, in particular to facilitate remote work. All buildings in all towns and villages are now connected to Very High Speed fiber (which corresponds to 30MB / second). Sweden now aims to connect all of Sweden to high-speed Internet (which corresponds to 100MB / second) by 2025 - while France plans to have all of its businesses and households connected to Very High Speed by 2022 (30MB / second).¹³⁶ With 95% of the population connected to the Internet, Sweden is now probably one of the most digitized countries in the world.¹³⁷

Fostering R&D

Sweden introduced a modest R&D tax relief scheme, which provides a 10% reduction in employers' social security contributions for employees engaged in R&D. The tax relief primarily benefits smaller firms. Public expenditure on R&D is high. Much of this goes to research at Swedish universities, which are well placed in global rankings of world-class universities and publications. Around 45%¹³⁸ of funding for research in Swedish universities comes through institutional block grant funding, with the remainder earned through project funding.

138 Collaboration Between Universities in Sweden, 2019.

¹³⁰ Sweden needs 30,000 software engineers, 2019.

¹³⁶ Présentation de l'écosystème numérique Suédois, MEDEF, 2016.

¹³⁷ Confiance numérique et cybersécurité en Sweden, 2020.

Accelerating startups fundings

The government has also sought to reform public venture capital so that it becomes less risk averse and focuses more on early-stage investments, where there are often shortfalls in private venture capital provision.

The number of start-ups in Sweden exploded since the 2000s (overweighting in relation to the total population). However, like almost all countries in Europe, Sweden faces a dire shortage of players in the Series B and C fundraising segment in light of the number of start-ups in stock looking for funds to grow.

• Repairing the unequal quality of supportive structures

Sweden has around forty clusters / poles of competitiveness, generally led by associations, companies or foundations, but rarely by the state. However, the quality of all accelerators is not the same. Some are managed by highly skilled individuals and have sufficient capital to support entrepreneurs; others do not. The governance structure and the nature of accelerators' partnerships vary widely in Sweden. Some are oriented towards large corporate players such as ABB, while others have close links to universities, and others to local and regional governments.

3. State-actors cartography

170

The Swedish government has launched several schemes to support innovation (organizations dedicated to repairing market failures). Some notable devices include:

- Vinnova (1,000 applications of startups every two years): a Swedish government agency that administers state funding for research and development. The agency's mission as defined by the government is to promote development of efficient and innovative Swedish systems within the areas of technology, transportation, communication and labour.
- The Swedish Agency for Economic and Regional Growth: a vehicle that manages European grants, supports universities to develop entrepreneurship education and networks with VCs. Arrangements by the Swedish Agency for

Economic and Regional Growth to introduce elements of entrepreneurship into university curricula has been a sensitive topic with university Presidents, who are the ones deciding to add these entrepreneurship courses.

- The National Innovation Council: The Swedish National Innovation Council (NIC) was created by the Prime Minister (Stefan Löfven) in 2015. It is personally chaired by the Prime Minister, which is unusual for such councils in other countries. Another atypical characteristic of the Swedish NIC is its dominant and wide focus on innovation rather than on research (see the Swedish Research Council, below)).
- **The Swedish Research Council:** Sweden's largest governmental research funding body, which supports research of the highest quality within all scientific fields. Every year, the Swedish Research Council pays out almost 7 billion SEK to support Swedish research.
- Saminvest AB: a venture capital company, founded by the Government in 2016. Saminvest works actively for the establishment of new venture capital funds with sufficient qualities and long-term ability to develop the Swedish venture capital market, giving innovative and fast-growing companies access to both capital and ownership skills.

The Swiss Innovation Ecosystem

Institut Montaigne would like to thank the following people for their help writing this brief: Patrick Aebischer, former President of the École polytechnique fédérale de Lausanne (EPFL); Roman Bruegger, Managing Director of the Swiss Edtech Collider; André Catana, Head of the Startup Unit at EPFL; Jean-Philippe Lallement, Managing Director of the Innovation Park at EPFL; Jordi Montserrat, Director of Romandie Venturelab and Venture Kick; Philippe Renaud, Professor at EPFL, and; Jean-François Ricci, Project Director at EPFL. We would like to express our sincere gratitude to all interviewees.

Overview

172

While the number of startups created per year in Switzerland is relatively low compared to other OECD countries – 420 startups per 1 million inhabitants per year – startups seem to fail less in Switzerland than elsewhere. Switzerland has a favorable environment for innovation: high levels of R&D spending, high-quality education and research systems which attract foreign researchers, and very dynamic universities which help create start-ups.

Outstanding macroeconomic indicators

Switzerland's economic performance is remarkable:

- Long term stable growth, with an average GDP growth rate of +1.9% between 2000 and 2018 Switzerland was above the Euro area average of +1.4%. Swiss GDP per capita stands at USD 83,000, the second highest ratio worldwide after Luxembourg;
- Very low unemployment rate, with an 80% employment rate for 15-64 year olds. In addition, more than 40% of young people follow apprenticeship courses after compulsory schooling, contributing to the low youth unemployment rate;
- **Competitive exports,** with trade in goods and services representing 120% of GDP, a current account surplus of 10% of GDP, and specialization in R&D intensive industrial sectors.

High R&D spending

Switzerland is one of the countries with the highest rates of R&D expenditure compared to GDP. The private sector accounts for more than two-thirds of Swiss R&D spending, which currently represents about 3.4% of GDP, or about CHF 16 billion. Private R&D spending is concentrated in high value-added sectors, strongly contributing to exports. This is particularly true for the pharmaceutical sector, which accounts for one-third of spending. Public R&D spending is mainly aimed at promoting basic research. Switzerland is one of the few countries in Europe where salaries in this field afford comfortable living standards.

Switzerland's (public and private) R&D spending contributes to its excellent human capital, as more than 40% of the working population is employed in the creation, dissemination and implementation of scientific and technological knowledge, according to the State Secretariat for Education, Research and Innovation.

• Excellent internationally recognized academic institutions

Switzerland's 10 cantonal universities and two federal institutes of technology – the Swiss Federal Institute of Technology Zurich (ETH Zurich) and the Swiss Federal Institute of Technology Lausanne (EPFL) – are very high in international rankings. The Shanghai Ranking lists five Swiss universities in its top 100 (out of 1,000): the ETH Zurich (20th), the University of Zurich (56th), the University of Geneva (59th), the EPFL (83rd) and the University of Basel (88th). Of all countries worldwide, Switzerland is second only to Luxembourg in highest spending per student in its public education institutions, and its total education expenditure represents 5.1% of its GDP.

With 25% international students and 40% of its researchers coming from abroad, Swiss universities are highly internationalized. Several internationally renowned institutions contribute to its attractiveness: CERN, the Paul Scherrer Institute (PSI) and the Swiss Centre for Electronics and Microtechnology (CSEM). Furthermore, Switzerland is unrivaled (1st out of 63 countries) in the IMD World Talent ranking, which assesses the availability of skills in a country and the economic and administrative capacity to call on foreign labour.

The Swiss Federal Institutes of Technology (ETH Zurich and EPFL) are part of the ETH Domain. The Domain comprises six autonomous public institutions and hosts around 30,000 students and doctoral candidates. The ETH Domain holds around 910 patents in the field of advanced technologies, more than a third of which are internationally protected. This places the ETH Domain in the top three strategic patenting organizations, alongside Harvard and MIT. It also ranks first worldwide in terms of scientific publications and patents per million inhabitants.

• A crossover between the worlds of research and startups

Since 2011, Switzerland is number one on the Global Innovation Index, which ranks innovative economies based on various measures such as patent applications, R&D investments, innovation capacity and the proximity between universities and industry.

Switzerland strongly supports the creation of start-ups founded by students and university researchers, especially through the Swiss Innovation Promotion Agency (InnoSwitzerland), which mainly supports projects carried out jointly by companies and research institutions. InnoSwitzerland finances the direct project costs and contributes 15% of indirect research costs – the company contributes at least the same amount.

1. General ecosystem dynamics

174

The Swiss innovation ecosystem is defined by five principles: subsidiarity, actor autonomy, cooperation, competition culture, and quality. This is reflected in its structures and processes: the structures of democratic institutions, federalism, the liberal economy, and bottom-up institutions. Three other characteristics stand out: diversity, stability and adaptability. This structure, underpinned by broad principles, gives participants a high degree of autonomy, which is reflected in the abundance of activities at each political level.

Swiss companies have a high level of interconnection with foreign companies and research sites in the field of innovation. From an internal point of view, Swiss research institutions, such as EPFL, actively campaign to attract foreign professors, especially from the United States, which has a strong entrepreneurial culture, to help influence its own university culture.

2. Government choices

Switzerland is a federal state with three levels of political decision-making: the Confederation, the cantons and the municipalities. All of them ensure that

the private and public players in the field of research and innovation operate within a favorable framework. However, the cantons have a high degree of autonomy. As a result, the coordination of innovation efforts at the federal level is less important than it is in other countries in our sample. While there is a very strong subsidiarity principle, there is still significant political ties between the cantonal and federal levels.

However, the Confederation's slower reaction time has a stabilizing and smoothing effect, ensuring that major structural changes have time to prove their effectiveness before further measures are taken. One of the most important Confederation initiatives was the creation of the Commission for Technology and Innovation (CTI) in 1996, which, before being replaced, supported applied research and R&D, start-ups as well as knowledge and technology transfer. It promoted the development, implementation and dissemination of technological knowledge. It became the Swiss Innovation Promotion Agency (InnoSwitzerland) in 2018 in order to gain independence from the federal government and to have financial and organizational flexibility. InnoSwitzerland, unlike the CTI, can build up financial reserves of up to 10% of its annual budget and attract third-party funds. This increased flexibility allows the agency to be more efficient.

• Major investments in basic research

Switzerland also devotes 30% of its public budget to basic research. The Federal Law on the Promotion of Research and Innovation (LERI), which was enacted in 2013, requires that institutions responsible for promoting research give special weight to the promotion of basic research. The Swiss National Science Foundation (SNSF), which was founded in 1952 to promote research, has CHF 1.3 billion available for funding basic scientific research (which represents 49% of available funds).

The division of labour between the public and private sectors is clear. The fact that almost two-thirds of Swiss R&D is financed by industry not only ensures efficient technology transfer – internal pipelines are the shortest route between

scientific discoveries and competitive products – but also allows the public sector to concentrate on general basic research.

In 2016, the SNSF and InnosSwitzerland jointly developed the "Bridge" program, adding to the support already provided to Swiss science and innovation respectively. The program harnesses the economic and social potential of research by promoting the transfer of scientific knowledge for the benefit of innovation.

• Strong ties between companies and universities

In the 1990s, the CTI often defined and implemented action programs jointly with cantons and industry partners. The aim of these interventions was to develop scientific and technical expertise in strategically important areas at universities and Federal Institutes of Technology, and to strengthen private sector capabilities in the application of new technologies.

Numerous research framework agreements, established by InnoSwitzerland to promote cooperation between the ETH and companies, have been signed between ETH Zurich and several large companies such as Alstom, Oracle and Google. The Swiss Federal Institute of Technology in Lausanne has created the Innovation Park on its campus as a place for research and business to interact. Thanks to a scientific community made up of more than 300 laboratories and 9,300 students, companies can surround themselves with the best talent to innovate. More than 160 companies (large groups such as Nestlé or Intel, but also numerous start-ups) are currently located in this innovation hub.

Since 2008, from a regional stand point, the federal government's New Regional Policy (NRP) has been supporting rural regions to strengthen their competitiveness. Thanks to this policy, regional innovation systems were established, improving the coordination of existing support measures (business-school clusters, inter-company cooperation projects).

177

• An appealing tax policy

In a referendum on May 19, 2019, the Swiss people voted in favor of the Federal Law on Tax Reform and the Financing of the AHV (RFFA). The RFFA introduces major changes to the Swiss tax system by abolishing certain current tax regimes and replacing them with new measures in line with international standards:

- The introduction of a "patent box" regime at the cantonal level which allows for a reduced taxation of income generated in particular by patents and comparable rights developed in Switzerland. The patent box regime allows for a reduction of the taxable base of such income by up to 90%. Cantons may decide to apply more restrictive rules.
- The possibility for cantons to introduce an "increased deduction for R&D expenses" generated in Switzerland of up to 150%. These Swiss R&D expenses include personnel expenses that can be directly allocated to the R&D activity plus 35% of other R&D expenses. This deduction is limited to the company's actual amount of expenses. In addition, 80% of the fees paid for (Swiss) research mandates can also benefit from this increased deduction.

• In addition, a continuous availability of training programs to develop technical skills

According to the European Innovation Scoreboard 2020, Switzerland is first on the European ranking of innovative countries, thanks in particular to its attractive research and education systems. The applied and professional nature of education makes Swiss higher education a system that enables the building of a highly qualified workforce capable of transforming a patent into an industrializable product. The Federal Law on Vocational Education and Training (LFPr), which began in 2004, established a continuous process of updating the curricula with the aim of keeping the training courses up to date. To this end, the State Secretariat for Education, Research and Innovation (SEFRI) has set up the Leading Houses to define priority topics in vocational training research. As competence networks, the Leading Houses carry out several research projects on their priority topics. They benefit from a dense network and are coordinated by a University Chair.

The Digital Switzerland Strategy, launched in 2016, establishes a suitable framework for reaping the benefits of digitization in the field of education in order to promote cooperation via institutional and professional networks, and to strengthen the dialogue between various stakeholders. In the same year, the Swiss Parliament set aside CHF 26 billion for the implementation of measures to promote the development and funding of higher vocational education and training, the training of highly qualified young scientists and the maintenance of the innovation capacity of the Swiss economy.

3. State-actors cartography

Key federal players in the innovation ecosystem include:

- State Secretariat for Education, Research and Innovation (SEFRI).
- Swiss National Science Foundation: Switzerland's most important institution for the promotion of scientific research.
- InnoSwitzerland (formerly CTI, Commission for Technology and Innovation): the federal agency promoting innovation in Switzerland by encouraging high-potential projects from start-ups and SMEs.
- Swissnex: Switzerland's scientific consulates, an instrument for promoting international collaboration that supports the international networking of universities, scientists and research-related companies.
- swiTT (Swiss Technology Transfer Association): the professional association of Technology Transfer Offices (equivalent to SATT), created in the 1990s, dedicated to the transfer of research to industry. This service helps companies find academic partners and promotes the research results of their students and researchers.
- ETH Domain: domain of the Federal Institutes of Technology.

ACKNOWLEDGEMENTS

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Institut Montaigne would like to thank **Diana Mangalagiu**, PhD, Professor at the Neoma Business School and Oxford University, **Tristan-Pierre Maury**, PhD, Economy Professor at the Edhec Business School, as well as the **Accenture Research team** for their help with the quantitative study:

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180

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184

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187

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188

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189

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Imprimé en France Dépôt légal: october 2021 ISSN: 1771-6764

190

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THERE IS NO DESIRE MORE NATURAL THAN THE DESIRE FOR KNOWLEDGE

Innovation: France's Got Talent

This report examines the quality of the French innovation ecosystem compared to its neighbors. It is based on a quantitative analysis to determine the factors that contribute to the emergence of successful innovation ecosystems in 10 countries. The figures were reviewed by a task force co-chaired by Gilles Babinet, Advisor to the Institut Montaigne on Digital Issues, and Francis Hintermann, Global Executive Director of Accenture Research.

This quantitative method was accompanied by more than 50 interviews and analyses of public policies favoring the development of innovation ecosystems in six countries (Germany, Estonia, Israel, the United Kingdom, Sweden and Switzerland).

The conclusion: after a 2010 decade devoted to mobilizing capital for start-ups, the 2020 decade must be one of unprecedented investment in human capital, by increasing the resources devoted to French research, supporting its autonomy and welcoming more foreign talent.

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> ISSN 1771-6764 OCTOBER 2021