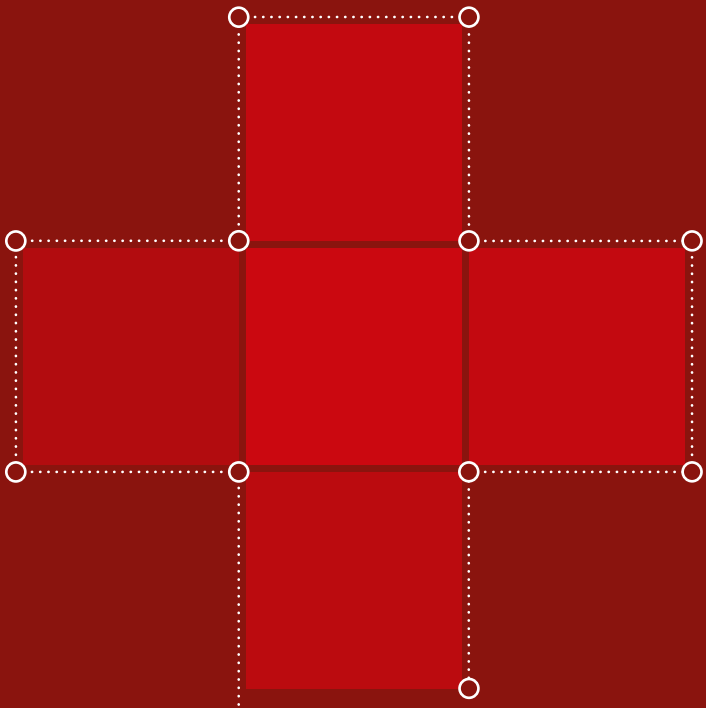
Dominique Mégret

DEEP TECH NATION SWITZERLAND



Prosperity or Dependency
Why Switzerland must invest in Deep Tech

Deep Tech Nation Switzerland Foundation

30

In the more than 100-year history of the Nobel Prizes, awards for individual people have underlined Switzerland's regular recognition.

50

Billions of Swiss francs in venture capital are laying the foundation for establishing Switzerland as a global deep tech hub in this decade and creating 100,000 new jobs in innovative start-ups and scale-ups.

This book sheds light on the vision and the path there.

‘Deep Tech Nation Switzerland’ takes you on a journey of discovery into the heart and soul of the Swiss deep tech scene.

But before we dive into the depths of this remarkable journey, it is important to recognise and appreciate those who worked behind the scenes to bring this narrative to life.

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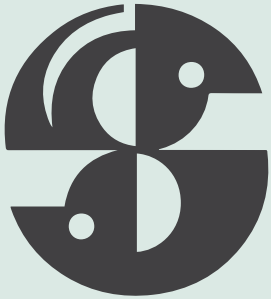
Switzerland is no longer a blind spot on the map of start-up nations. Numerous new technology companies have emerged in recent years.

Zurich and the Lake Geneva region, but also Basel and Zug, are hotspots for start-ups in the fields of ICT, biotech, medtech and fintech.

The seeds were planted a quarter of a century ago: the first competitions for young entrepreneurs and technoparks were launched at that time. The subject of technology transfer from academic research gradually gained importance. Universities – in particular the two Federal Institutes of Technology in Zurich and Lausanne – play a key role as focal points for the latest engineering knowledge and as breeding grounds for deep tech companies. For a growing number of our students, the leap into entrepreneurship has become an attractive alternative to their first job in the industry. In the ETH Domain alone, students, doctoral students and researchers have set up around 537 spin-offs over the past ten years, creating several thousand highly qualified jobs in Switzerland. These companies are also helping us to tackle challenges such as climate change or the energy transition, and to make progress in medicine and healthcare. What's more, many well-known international high-tech companies have now set up their own R&D activities close to our universities in Switzerland. This is a further indication of the appeal of the local education and innovation centre. Founding a company is one thing, being able to finance the growth phase with sufficient resources is quite another. And here, too, Switzerland has been busy. The venture capital that flows into new Swiss start-ups annually has increased significantly in the recent past, rising almost sixfold to CHF 2.6 billion between 2014 and 2023. Half of the money went to the cantons that the two Federal Institutes of Technology call home, Zurich and Vaud. There have been more financing rounds and more funds made available. The structural problem of realising larger financing rounds with venture capital from Switzerland has thus been addressed and the direction taken is promising. Companies such as Swisscom Ventures and other investor groups play a significant role in this development. Against this backdrop, a publication that sheds light on the genesis and background of the 'Deep Tech Nation' of Switzerland therefore comes at the right time. A lot is still possible, but resting on your laurels is not. International comparisons with European countries, but also with the US, China and Israel, show that there is sufficient room for manoeuvre for our country to make further progress in the future.

Joël Mesot
President ETH Zurich

Martin Vetterli
President EPFL



January 2021. My name is Dominique Mégret. I wrote the first edition of this book under the dual gaze of Janus, one side facing the past, the other the future.

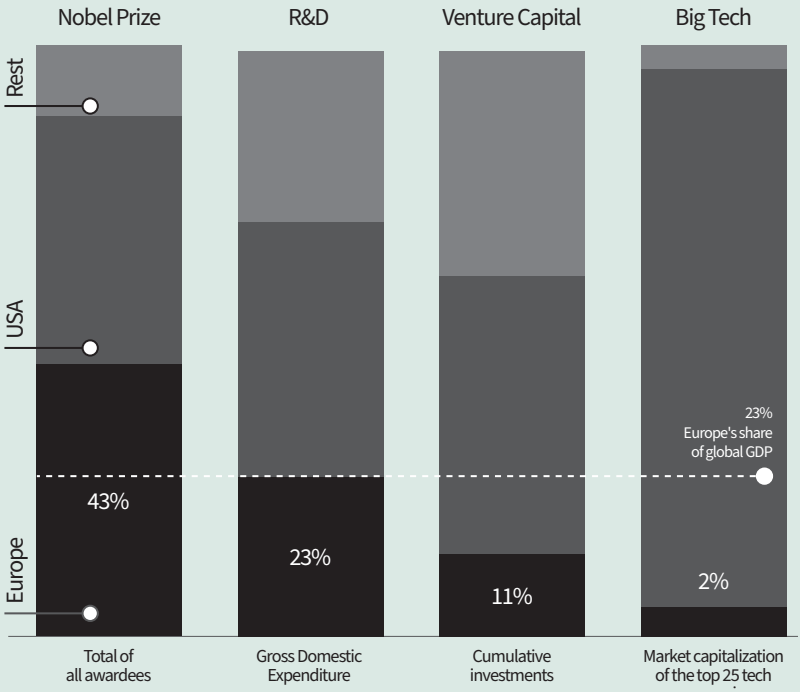
Janus is celebrated on 1 January and gave his name to the month of January (Januarius), which marks the beginning of the year. This mythological figure inspires me because it is a symbol of the passage of time and the questions that go hand in hand with change. Janus illustrates the challenge faced by Switzerland today: how can we draw inspiration from a brilliant past to tackle the tasks of the future?

Switzerland is indeed going through a sensitive transition from the industrial era, in which it excelled worldwide, to the digital age, which is unashamedly dominated by American and Asian giants. Europe is the big loser of the digital transformation, with only 5% of the market capitalisation of the 25 largest technology companies in the world, also known as Big Tech. It has become heavily dependent on American software and Asian devices. How did Europe, a continent at the forefront of scientific research and innovation, lose its technological sovereignty? What must Europeans, and in particular the Swiss, do to take back parts of the market and redress the balance of power? Which investments in future technologies need to be prioritised? We find ourselves in a time of decisions and change.

200 years of innovation

In order to give some answers to these questions, I have taken a look back in time for the first part of this book. The aim is to better understand the historical strengths and

weaknesses of the Swiss model in order to intelligently reposition it for the future. My research on Swiss entrepreneurs has exceeded my expectations. I was very surprised at the extent of their success and the modernity of their values, which are based on 200 years of innovation in high-precision technologies, consistent internationalisation and the ambition to conquer a niche on a global scale. These issues are still highly relevant for today's start-ups.



How has Switzerland become a world-leading hub for scientific research? With only nine million inhabitants, or 2–3% of the population of the United States or Europe, the Confederation seemed far too small to compete on a level playing field in the competition for deep tech – in other words, technologies derived from very expensive basic and applied research. Yet Switzerland has managed to build a unique network of public (CERN, ETHZ, EPFL, etc.) and private (Alphabet, IBM, Disney Research, etc.) laboratories, making it a world leader in patents and scientific Nobel Prizes per capita. It has even been named the most innovative country in the world for the last ten years in a row in the Global Innovation Index (WIPO, the UN's World Intellectual Property Organization, and INSEAD).

Source: International Monetary Fund (IMF), UNESCO, Eurostat, Pitchbook, and Google Search

This research and development (R&D) intensity is partly due to the success of Swiss multinationals, which are exceptional in relation to the size of the country. Nestlé, Roche and Novartis are the fourth, tenth and thirteenth largest European stocks across all sectors. The research infrastructure is also closely linked to a highly efficient industrial structure made up of small and medium-sized enterprises that are inconspicuous and little known to the public. These 'hidden champions' are entirely geared towards the export of high-precision technologies such as Straumann (medtech), Debiopharm (biotech) or Sensirion (microtechnology). They share historical values that form the basis of the Swiss model of entrepreneurship. Contrary to popular belief, Switzerland is not a country of privateers, but one of the most entrepreneurial high-tech nations in the world. Switzerland is a deep tech nation.

The Swiss model of entrepreneurship 2.0

The big question is whether the Swiss model will continue to be successful in a fully digitalised future. Fundamentally, I think so, because the values of Swiss entrepreneurship are timeless: the pursuit of excellence and excellence in research.

Switzerland can provide the basic conditions (freedom of research, infrastructure, living environment, taxation, political stability) as well as all the human, scientific and cultural assets for success in the high-tech sector, except for one thing: a world-class financing ecosystem for start-ups. There is no shortage of money for R&D and the seed phase. But in the final stages of the most advanced companies, where global leadership is at stake, Swiss investors have little presence.

For historical and cultural reasons, innovative companies in continental Europe are chronically underfunded in the venture capital (VC) sector compared to their Anglo-Saxon counterparts. The start-ups supported by VC funds, which I call 'VC kids', are the children of a specific culture that is still relatively rare in Switzerland. They enjoy a fundamental advantage: virtually unlimited access to capital, without restrictions on profitability (e.g. USD 28 billion for Uber), meaning they can concentrate solely on growing as fast as possible. The 'start-upper' commits their reputation on the basis of a business plan, unlike the traditional entrepreneur of an SME, who has to finance themselves or pledge their personal assets in order to access capital. The time factor is crucial in the race for the lead: while it takes hidden champions 20 to 25 years to reach a dominant position, VC kids can leave their competitors behind in less than ten years. It is therefore crucial that Swiss companies have access to the same venture capital resources in order to avoid distortions of competition.

Unfortunately, this is not the case on the European continent, which has not yet truly grasped the importance of venture capital, a capitalist revolution with decisive social, economic and scientific implications for the development of modern nations. This financial instrument, tailor-made for high-tech entrepreneurs, has become an important competitive advantage for those who know how to use it. Americans have been using venture capital for 50 years with phenomenal success. Let me demonstrate this with an example: with a total of USD 2.2 billion invested in its start-up ecosystem, partly financed by European investors, the US has taken control of almost 90% of the capital value of Big Techs worldwide.

The top ten American VC kids are valued at more than USD 13.3 billion.

This is almost equivalent to the value of all stock exchanges in continental Europe combined. The Chinese, too, have understood the strategic importance of venture capital in developing a powerful high-tech industry. In the last ten years, they have therefore launched a massive investment programme and have invested in American VC kids at the same time – to such an extent that the Trump administration effectively banned Chinese investment, knowing the importance of the high-tech industry in the economic war.

Europe and Switzerland have not yet seized this historic opportunity, and the lack of innovation capital is having a negative impact. With only 10% of cumulative global investment over the last 50 years, compared to 60% that went to the Americans, the European ecosystem had six times fewer resources than the US. As a direct result, it has produced few global technology leaders, particularly in the digital field. The crème de la crème of start-ups is often bought up by Chinese and American market leaders even before they reach critical mass. Nevertheless, Europe was an important big-tech player in the 1970s. However, it has failed to invest in a new generation of start-ups to consolidate its ecosystem and compensate for the natural erosion of historical industrial groups associated with the 'creative destruction' Schumpeter so cherishes.

Loss of tech sovereignty

This passivity has serious consequences.

The problem for Europe is more fundamental than just the weakness of its high-tech industry: it has lost control of its own digital transformation, which affects all economic and social spheres.

Digitalisation redistributes the cards across all value chains and shifts profits to global online platforms with an oligopolistic position. In this ruthless model of the platform economy, low-margin labour and costs remain in the countries of origin, while data and value are centralised. Without drastic changes, the current system will further increase our technological dependence, even in areas that are still protected today, such as health, transport and education.

Are we condemned to choose between digital protectionism (China-style) and resigned submission (like the rest of the world)? Of course not. It is entirely possible to restore a technological balance that corresponds to Europe's economic size (223% of global GDP), provided that we have an ambitious vision and provide sufficient resources. To catch up with the US, Europe needs to triple its investment in venture capital (USD 62 billion in Europe in 2023, compared to USD 170 billion in the US). In Switzerland, we need to aim for CHF 5 billion per year (compared to CHF 2.6 billion in 2023) in order to remain in the top ten innovation clusters worldwide. The goal should be to reach CHF 10 billion per year by 2030.

Note: these are not state subsidies, but generally profitable investments that are productive and have a strong impact on future jobs. They also make it possible to reduce technological dependencies without resorting to protectionist methods, while at the same time respecting the free-trade rules of a globalised world. With such geopolitical and economic advantages, why does venture capital account for less than 1% of Swiss households' net worth? Why do investors prefer passive and speculative investments (real estate, listed stocks, bonds, commodities) without direct impact on innovation and growth? It is high time to change our habits and allocate a proportion, albeit minimal, to venture capital (1–2% of private and corporate assets is sufficient) in order to revive the old Europe and take our destiny back into our own hands.

Action plan

The second part of this book is devoted to specific proposals for adapting the Swiss business model to today's circumstances.

The most important of these measures concerns the development of a complete financing ecosystem from the initial phase (start-up and growth) to exit through IPOs and acquisitions. This is entirely possible; the outstanding competitiveness of the Swiss biotech and medtech ecosystem proves it. The same methods must now be applied broadly in all sectors.

I am astonished by the lack of public and institutional interest in this subject. While there is always a consensus on financing public and private research with CHF 22 billion per year, there is much less when it comes to financing the commercialisation of innovations with ten times less venture capital. It's a strange kind of logic that reflects socio-cultural barriers. However, the studies mentioned in this book show that the success of innovation clusters is directly and principally correlated with the volume of investment.

In order to promote the use of venture capital in Switzerland, I propose a culture-specific adaptation, which I call 'innovation capital'.

The investment strategy needs to focus on the historical strengths of Switzerland, the deep techs. The book ends with eleven major technological challenges, called moonshots, that must be tackled in order to effectively address the environmental, health, social and economic issues of the 21st century. These sensible projects are exceptional investment opportunities in products with very high added value, especially in terms of Info-Nano-Bio-Cogno convergence and interdisciplinarity.

Entrepreneurs and investors share a great deal of responsibility for Switzerland's technological orientation. Together, we can make an active contribution to building the world of tomorrow that we dream of today, a choice we are privileged to have. We need to be ambitious, courageous and innovative; we can't just copy Silicon Valley.

Deep Tech Nation Switzerland Foundation

In an era in which technological disruption is continually shaping the social landscape, the Deep Tech Nation Switzerland Foundation is working as an architect of change in the innovation ecosystem.

Our vision is to create an environment that establishes and actively helps shape Switzerland at the forefront of the global innovation competition. As a catalyst for change, we aim to strengthen the structural framework conditions and make them fit for the future so that start-ups and scale-ups in the deep tech field can grow internationally.

We take a holistic approach that goes far beyond just supporting business start-ups:
we are redesigning framework conditions to create a fertile ground for a flywheel effect. This effect is intended to encompass the Swiss innovation ecosystem with all its stakeholders – from education, start-ups, investors and companies to politics – and set a national movement in motion.

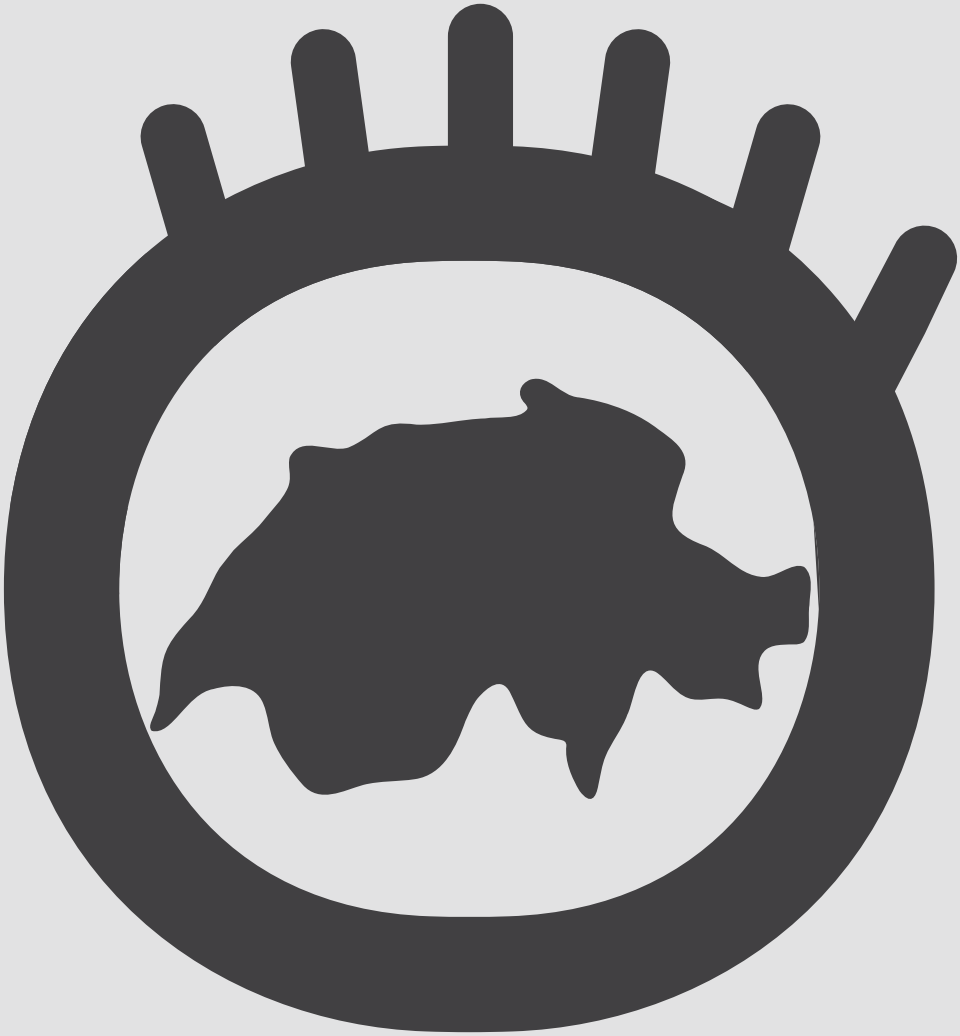
Our objective is to mobilise CHF 50 billion in venture capital and thus create 100,000 jobs through Swiss deep tech start-ups and scale-ups by 2030.

With measures such as the development and establishment of a venture industry, the creation of significantly more internationally scalable scale-ups, the provision of a comprehensive information platform and targeted international promotional activities, we are laying the groundwork for the establishment of Switzerland as a global deep tech nation – known and respected like the Matterhorn, chocolate and pocket knives.

We invite you to be part of this journey and help actively reshape the system, to ensure Switzerland's prosperity and to make the world a better place.

The Deep Tech Nation Switzerland Foundation, an independent, non-profit foundation, is the result of a private initiative of the foundation members Swisscom, UBS and Stadler Rail.

▸ deeptechnation.ch



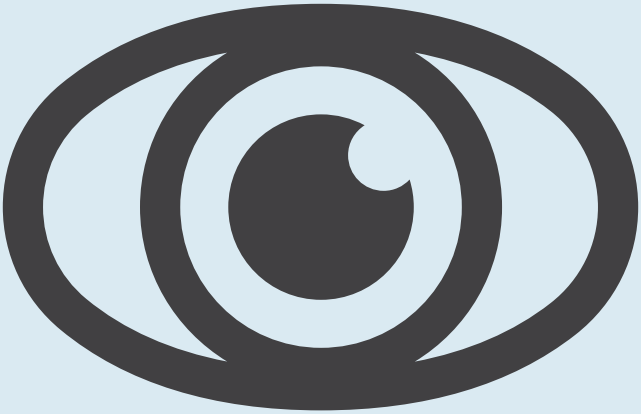
Switzerland at a glance

Official name	**Confoederatio Helvetica (CH)** Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra Swiss Confederation
Formation	Present-day Switzerland was formed in 1848, with the roots of the Confederation dating back to 1291.
Neutrality	Since 1515 – after the Battle of Marignano
Capital city	Bern
Area	41,285 square kilometres
Official religion	None
Currency unit	Swiss Franc (CHF)
Geographical structure	Alps 58%, Plateau 31%, Jura 11%
Large cities	Zurich, Geneva, Basel, Lausanne, Bern
Population	8.544 million, foreigners 2.296 million (25%)
Distribution	Females 50.4%, Males 49.6%
Languages	German 62%, French 23%, Italian 8%, Romansh 0.5%, other languages 5%
Life expectancy	Females 85 years, Males 81 years
GDP	CHF 781 billion (2022)
Unemployment rate	2.4% (January 2024)
Trade balance	CHF +42.9 billion (2022) Imports CHF 341 billion, exports CHF 382 billion
Trading partners	Imports: Germany, USA, Italy, France Exports: USA, Germany, China, Italy

Swiss entrepreneurship: milestones

1354	Anna Seiler founds the Inselspital hospital in Bern, the oldest surviving foundation in Switzerland.
1552	Louis Fonjallaz establishes the wine shop Fonjallaz SA (Lavaux), the oldest family business in Switzerland.
1735	Jehan-Jacques Blancpain establishes Blancpain, the oldest watchmaking brand in the world.
1741	Caspar Zyli founds Wegelin, the first Swiss bank.
1758	Johann Geigy-Gemuseus founds the dyes and chemicals trade, which leads to the formation of Novartis.
1852	Alfred Escher founded the Nord-Ost-Bahngesellschaft (now SBB). He is also the co-founder of ETH Zurich, CS and Swiss Life.
1859	Alexander Clavel takes over the fuchsin production plant, which originally belonged to Ciba (now Novartis).
1864	St. Moritz hotelier Johannes Badrutt invents winter tourism.
1867	Jacob Schmidheiny acquires the brickworks in Heerbrugg, the origins of the cement manufacturer Holcim.
1867	Henri Nestlé markets milk powder for infants, Nestlé SA's first major success story.
1869	Jakob Ammann founds the mechanical engineering company from which the Ammann Group stems.
1874	Robert Schindler and Eduard Villiger found the company Schindler & Villiger, which became the elevator manufacturer Schindler.
1879	Rudolph Lindt invents the conching machine. The company is number one in the premium segment and generates sales of CHF 5.2 billion.
1886	Alfred Kern and Edouard Sandoz establish a chemical company and merge with Ciba-Geigy (Novartis).

1891	Charles Brown and Walter Boveri found the company of the same name, which became ABB in 1988.
1894	Fritz Hoffmann-La Roche establishes his company for chemicals and pharmaceutical manufacturing, which later becomes Roche.
1897	Alphons Ehinger-Heusler becomes the first president of the Lonza power plant, which is the origin of the Lonza Group.
1898	César Ritz, 'the king of hoteliers, the hotelier of kings', opens the famous Hotel Ritz on Place Vendôme in Paris.
1910	Kaspar Winkler founds the chemical company Sika.
1954	Reinhard Straumann founds Straumann AG, the global market leader for dental implants.
1966	Andy Rihs, Beda Diethelm and Hansueli Rihs take over Phonak, now Sonova, the world leader in hearing aids.
1977	Hansjörg Wyss founds Synthes USA, the global market leader for implants used in the repair of bone fractures.
1979	Rolland-Yves Mauvernay founds the biotech company Debiopharm.
1982	Daniel Borel and P. Zappacosta launch Logitech.
1985	Nicolas Hayek acquires a majority stake in SMH (Swatch).
1990	Sir Tim Berners-Lee, inventor of the World Wide Web while working at CERN, publishes the first website in history.
1997	Jean-Paul and Martine Clozel, Thomas Widmann and Walter Fischli found Actelion, a spin-off of Roche.
1998	Felix Mayer and Moritz Lechner found Sensirion, an ETH Zurich spin-off and global leader in digital microsensors.
2013	E. Charpentier, C. Cowan, C. Mello, D. Anderson, M. Porteus and R. Novak found CRISPR Therapeutics.



Scientific Research

ETH Zurich

When young Albert Einstein (1879–1955) took the entrance examination for the Swiss Federal Institute of Technology in Zurich (ETH Zurich) in 1895 at the age of 16, he could not have guessed that, a century later, this university would become one of the most prestigious in the world.

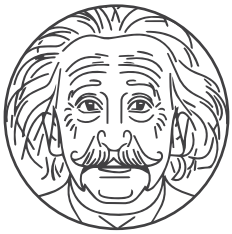
With 22 Nobel Prize winners and a ranking among the top European trio in direct competition with Oxford and Cambridge, ETH Zurich is today the highest-rated university of science in continental Europe. ETH Zurich was founded in 1854 by the Swiss government to meet the technical training needs of an emerging industry. It was known for the quality of its technical equipment, including the most state-of-the-art mechanical engineering laboratory in Europe. But at that time, it was relatively young and small compared to the venerable universities of Italy (Bologna, founded in 1088), England (Oxford in 1096, Cambridge in 1209), France (Paris in 1150, École Polytechnique X in 1794) or even America (Harvard in 1636).

Albert Einstein chose ETH Zurich because he came from a social background of polytechnic engineers and executives in the electrical industry who were working between Munich, Milan, Turin and Zurich. It is worth mentioning the extraordinary intellectual competition present in this transalpine region in the 19th century. Three of Einstein's 'neighbours', all of whom lived less than 350 km from Zurich, made significant contributions to the field of electrical engineering: Volta (an Italian from Lombardy who invented the electric battery), Ohm (a German from Bavaria) and Ampère (a Frenchman from Rhône-Alpes). All three are included in the famous Ohm's Law, fundamental to every student of electronics: $U = R \times I$, i.e. U (the voltage in volts V) = R (the resistance in ohms Ω) × I (the current in ampere A). Nikola Tesla, the ingenious inventor of the AC motor, was also not far away, studying in Graz and Prague and working in Budapest.

It was during this period that giants of the electrotechnical industry were formed, such as Brown Boveri (the origins of ABB) in Baden or SACM (precursors of Alstom and Alcatel) in Mulhouse in Alsace, 100 km from Zurich. In this environment of great scientific and entrepreneurial appeal, it is not surprising that young Einstein was fascinated by the magic of the 'fairy' known as electricity and wanted to learn more. He began researching the photoelectric effect, which earned him the Nobel Prize in Physics in 1921. Just as a teenager born on the West Coast of the US in the 1960s or 1970s had infinitely better chances of succeeding in computer science than if they had been born elsewhere, the favourable environment certainly played an important role in the development of the Einstein phenomenon.

$E = mc^2$

Born in Ulm in southern Germany, Albert Einstein began his schooling at the Luitpold-Gymnasium in Munich, where he left at the age of 15 for disciplinary reasons. He then moved to Italy, first to Pavia and then to Milan, where his father had just founded a company with about 80 employees that manufactured electrical appliances. Gifted but insufficiently prepared, he failed his first attempt at the



entrance examination for ETH Zurich and had to spend an extra year in Aarau in order to obtain the Swiss Matura and subsequently be accepted into the subject of mathematics at ETH Zurich. He was awarded his degree in 1900, but without a recommendation from his professors, Einstein had no chance of obtaining an academic position. After a period of unemployment, he applied for Swiss citizenship and took up a position as an expert at the Swiss Federal Institute of Intellectual Property in Bern in 1902. This position as a civil servant gave him free time to work on his doctoral thesis. In 1905, he published his *Special Theory of Relativity*, which became known to the general public thanks to the equation $E = mc^2$, which establishes an equivalence between mass and energy of a system.

1905 is known as Einstein's 'annus mirabilis', his most intellectually fruitful year; he was 26 years old at the time. In 1909, he became Associate Professor of Physics at the University of Zurich, in 1912 at ETH Zurich, in 1914 he moved to Berlin and in 1933, he finally made it to Princeton, where he died 22 years later. Einstein made an important contribution to the development of quantum mechanics and cosmology. The weekly magazine *Time* named him the person of the 20th century for his efforts as the leading scientist in a century dominated by science.

Switzerland provided fertile ground for the emergence of great scientists who often came from abroad, such as Einstein or his German contemporary Wilhelm Conrad Röntgen, also a graduate of ETH Zurich. Röntgen was awarded the first Nobel Prize in Physics in 1901 for his discovery of X-rays, which led to the development of medical radiography.

With 30 laureates, Switzerland is the country with the most Nobel Prize winners per capita.

ETH Zurich today

Today, ETH Zurich has 25,000 students and approximately 11,000 staff (technical, academic and administrative) with a budget of CHF 1.9 billion per year, 70% of which comes from the Swiss government and 30% from third parties. With more than 5,000 doctoral students, 500 professors and 1,500 other research staff, ETH Zurich is a world-class research centre. In the intense competition for the best talent, ETH Zurich has many advantages: it is among the ten best universities globally, it has state-of-the-art laboratories and it pays salaries that are among the highest in the world. For example, doctoral students at ETH Zurich earn an average of USD 65,000 per year, which is considerably more than at competing universities such as Stanford (USD 37,000), Harvard (USD 34,000), École Polytechnique de Paris (EUR 20,000) or Oxford (GBP 15,000). In addition to these exceptional material conditions, Zurich offers a very pleasant and cosmopolitan living environment, a particularly important argument when recruiting professors to stay long term. Zurich is regularly ranked among the top three most liveable cities in the world, due to the quality of its infrastructure and its proximity to nature.

Students also benefit from some of the lowest tuition fees in the world. At USD 1,600 per year, they amount to just 3% of the fees at comparable universities such as Harvard (USD 54,000), Stanford (USD 58,000) or MIT (USD 58,000). In addition, top students have access to generous scholarships, regardless of their parents' financial means. Moreover, thanks to bilateral exchange programmes, ETH Zurich students can study almost free of charge at the best universities in the world. It is therefore not surprising that in 2022, foreign students at ETH Zurich accounted for 42% of the student population (25% of bachelor's students, 46% of master's students and 74% of doctoral students), many of whom are among the best in their home countries. ETH Zurich is also beginning to expand outside Switzerland. For example, the Singapore-ETH Centre was founded in 2010 in collaboration with the National Research Foundation (NRF). It aims to produce practical solutions to societal challenges through three research programmes: Future Health (digital and mobile health), Future Resilience Systems (tools to increase the resilience of infrastructure systems) and Future Cities (smart cities).

Public-private partnerships

ETH Zurich has struck the right balance between research, teaching and partnerships with industry. The Wyss Zurich project partnership between ETH Zurich and the University of Zurich, for example, is a project accelerator that was launched in 2015 thanks to a donation of CHF 120 million from Swiss entrepreneur and philanthropist Dr Hansjörg Wyss. His mission is to 'transform outstanding scientific discoveries into new therapies for patients and to promote significant innovations in regenerative medicine and robotics'. The choice of these two fields of research is no accident: Switzerland enjoys global esteem in the fields of precision engineering, robotics, drones and, of course, biotech, both in academia and industry. ETH is headed by two professors with outstanding international and entrepreneurial experience. Roland Siegwart is Professor of Autonomous Systems at ETH Zurich, former Vice President of ETH Zurich and visiting professor at Stanford. He is also the co-founder of half a dozen start-ups. His colleague Simon P. Hoerstrup is Chair and Director of the Institute for Regenerative Medicine at the University of Zurich, a former faculty member of the Harvard Wyss Institute for Biologically Inspired Engineering and co-founder of several successful Swiss start-ups, including Symetis AG, Xeltis AG and InSphero AG.

Another example of successful collaboration between ETH Zurich and the private sector is Disney Research, led by Markus Gross, Professor of Computer Science at ETH Zurich and co-founder of several start-ups such as LiberoVision, which was bought by Vizrt. Professor Gross is also Vice President for Research at The Walt Disney Studios, which works closely with students and researchers at ETH Zurich. Their specialities are artificial intelligence, virtual reality and machine learning to bring technological innovations to cinema (Pixar Animation Studios, Marvel, Disney, George Lucas, etc.), television and theme parks.

Together with EPFL and the research institutes Paul Scherrer Institute (PSI), Eawag (Swiss Federal Institute of Aquatic Science and Technology), WSL (Swiss Federal Institute for Forest, Snow and Landscape Research) and Empa (Swiss Federal Laboratories for Materials Science and Technology), ETH Zurich forms the federal-run ETH Domain, a network that cooperates closely. With more than 2,000 scientists and an annual budget of CHF 400 million, mainly financed by the Swiss government, PSI is Switzerland's largest research institute in the field of natural sciences and engineering. PSI builds and operates large-scale research facilities, especially for materials science, condensed matter, particle physics and biological research. Every year, more than 2,500 scientists from all over the world come to PSI to carry out experiments that are often impossible anywhere else. PSI maintains close relations with ETH Zurich for teaching and with companies for the commercialisation of research innovations. The current President of ETH Zurich, Joël Mesot, who speaks French, is a good example of the close cooperation between the different institutions in the ecosystem of the Swiss Federal Institutes of Technology. Mesot received his doctorate from ETH Zurich and was Director of PSI from 2008 to 2018, while also holding a joint professorship in physics at ETH Zurich and EPFL. One of the most important developments under his leadership at PSI was the commissioning of the free-electron X-ray laser SwissFEL, a large-scale research facility that is unlike any other in the world. Thanks to his work in research laboratories in France and the US, Professor Mesot also brings with him a wealth of international experience.

Empa, which is also financed by the Swiss government to the tune of CHF 107 million per year, is the interdisciplinary research institute for materials science. The main research areas are nanomaterials, sustainable buildings, health, resources and pollutants, and energy. Its focus is on working closely with companies to develop useful applications such as recycling fluorine for lithium-ion batteries or green synthetic fuels.

World-class education

How has ETH Zurich managed to rise to the top of the European hierarchy, considering Zurich's average size (440,000 inhabitants in the inner city, 2 million including the wider metropolitan area) in a small country with limited human resources and no great cultural, historical or political influence? Not by accident. Switzerland has been able to establish other leading training institutions such as the IMD in Lausanne (the world's number one for executive MBAs), the EHL in Lausanne (the world's number one hospitality school) and, last but not least, the University of St. Gallen, the leading management school in the German-speaking world. The common characteristics of these schools are their international orientation, which helps them recruit the best students and professors, their large budgets for operational and infrastructure investments, and the quality of life. The liberal and pragmatic management culture of these schools and the quality of the dialogue with teachers are also important. Throughout its history, ETH Zurich has been able to continuously change and strike the right balance between its academic mandate, research activities and technology transfer to companies. Albert Einstein would hardly recognise the school of his youth today – and that's a good thing!

The challenger

The competition for ETH comes not only from abroad, but also from a young Swiss university in a city of only 140,000 inhabitants on the shores of Lake Geneva, the École Polytechnique Fédérale de Lausanne (EPFL).

Although it was founded in 1853, one year before ETH Zurich, it had no federal status. It was a private school called École Spéciale de Lausanne, which initially had only eleven pupils. In 1869, it became the technical department of the Académie de Lausanne, the forerunner of the University of Lausanne, and later the École Polytechnique de l'Université de Lausanne (EPUL). In 1969, EPUL was separated from the University of Lausanne, which was run by the canton of Vaud, and became EPFL, the second Swiss Federal Institute of Technology after ETH Zurich.

Since then, the development of EPFL has been spectacular: today, it has more than 13,000 students from 120 nations and more than 6,000 research staff, including more than 350 professors, with an annual budget of CHF 1.1 billion. This means that EPFL is only half the size of ETH Zurich. Nevertheless, it currently ranks among the top twenty in all categories worldwide and is improving from year to year. In 2015, EPFL was even listed as the best university in the world in the Young Universities Ranking of the magazine '*Times Higher Education* (universities younger than 50 years).

American-style campus

This extraordinary growth is the result of a visionary policy inspired by the great American universities, carried out in stages: in 1969, an integrated campus was built outside the city centre, bringing together teaching and research buildings on the same site, followed by the Innovation Park in 1991. Today, the Innovation Park employs 2,800 people in 150 start-ups, 35 R&D units at large companies (e.g. Logitech, Swisscom, Nestlé) and 20 service companies. Particular attention has been paid to the quality of the environment, which offers a magnificent view of Lake Geneva and the Alps, as well as to the quality of the buildings designed by world-renowned architects such as SAANA (library at the Rolex Learning Center), Kengo Kuma (ArtLab) and Dominique Perrault (administrative buildings and laboratories). In addition, the school has grown by adding new faculties such as the School of Life Sciences in 2003, with the aim of reaching critical mass and promoting interdisciplinarity.

The international nature of EPFL is particularly noteworthy: With foreign nationals making up two thirds of the student population and more than 120 nationalities represented on campus, EPFL is one of the most cosmopolitan technical universities in the world. This ability to attract excellent foreign students, researchers and professors is obviously a very important factor in being able to grow quickly without compromising quality.

EPFL has set up an accelerated tenure-track system to give young professors a chance. Junior positions that lead directly to permanent positions, as in North America, are still rare in some European countries. EPFL has attracted scientific talent and promised them financial resources for a research laboratory of the best quality, salaries that are among the highest in the world and attractive career prospects in academia.

Partnerships

EPFL has also grown through alliances with other universities in the region. In 2015, it launched four extended campuses specialising in biotechnology in Geneva (Campus Biotech under the patronage of entrepreneurs Wyss and Bertarelli), micro-technology in Neuchâtel (at the heart of the watch and precision engineering industry), environmental sciences in Sion (energy, green chemistry, health) and sustainable architecture in Fribourg (Smart Living Lab). EPFL cooperates with other research institutes, in particular with CSEM (Centre Suisse d'Electronique et de Microtechnique). Together, they run laboratories such as the PV-center (photovoltaic technologies) and the M2C (microfabrication and high-precision 3D material processing) in 2013.

How can this extraordinary dynamic be explained in an academic environment regarded as conservative and in a small country that already has another Swiss Federal Institute of Technology (ETH Zurich) that is outsized in relation to its population? We are dealing here with the fundamental values of Switzerland and its history, which is characterised by decentralism, social-liberal pragmatism and international openness.

Governance

Switzerland is in fact a confederation based on the principle of subsidiarity: Responsibility for public action rests with the competent authority closest to those directly affected by that action. In concrete terms, this means that the lower level decides which responsibilities it wishes to delegate to the higher level; i.e. the 2,250 municipalities delegate certain tasks to the 26 cantons. For their part, the cantons delegate certain coordination tasks to the federal level, such as monetary affairs, foreign relations and defence.

Education is mainly administered at local and cantonal level, with the exception of the two Federal Institutes of Technology, EPFL and ETH. The cantons therefore enjoy a high degree of decision-making and administrative autonomy with their own parliaments, governments and courts. They maintain a certain spirit of independence, but this is tempered by economic pragmatism in order to achieve economies of scale at national level.

On the one hand, the French-speaking cantons (Romandie) want to develop their own academic excellence so as not to be too dependent on that of the largest Swiss city of Zurich. On the other hand, these parts of Switzerland are also aware of the small size of their population (two million inhabitants), which accounts for only 23% of the Swiss population in a 65% German-speaking country. They have therefore taken the initiative of transforming their cantonal engineering school into a federal university, with the aim of providing it with more financial resources while preserving its French-speaking identity. The two schools have a joint governing body at federal level, which is headed by the Board of the Swiss Federal Institutes of Technology. Certain federal arbitration awards, in particular those concerning the determination of operating budgets, are the subject of delicate political discussions in order to prevent the German-speaking majority from favouring ‘their’ school.

Researchers, professors, entrepreneurs

EPFL's growth is the result of the entrepreneurial culture of its leaders. This spirit of initiative that characterises companies is still far from a given in most European universities. Each president gave a different impetus to meet the needs of each era: Maurice Cosandey (1969–1978) founded EPFL and developed an integrated campus, Bernard Vittoz (1978–1992) created the Science Park in collaboration with external companies, and Jean-Claude Badoux (1992–2000) added courses in microtechnology, communication systems and economics. The appointment of the pioneer Patrick Aebischer (2000–2017) aroused many reservations. He was not an engineer, but a medical researcher, who had founded two medical start-ups in the US. Moreover, he had no experience of running institutions at that time. It was a daring move that paid off. Professor Aebischer has enabled EPFL to expand its spectrum: with the establishment of the School of Life Sciences, he has promoted biomedical engineering in particular, as well as the College of Humanities and the College of Management of Technology. He has also accelerated the expansion of the campus in collaboration with companies that co-finance iconic buildings such as The Rolex Learning Center.

The appointment of Martin Vetterli in 2017 strengthens the strategic focus on new digital technologies, international openness and interdisciplinarity. Professor Vetterli's CV is exemplary, with an electrical engineering degree from ETH Zurich, a master's degree from Stanford and a doctorate from EPFL. He then taught at the University of California, Berkeley for ten years before returning to EPFL. He summarised the threefold mission (research, teaching, innovation) of his Audiovisual Communications Laboratory (LCAV) as follows: 'Basic and applied research in the field of signal processing for communication, training of students and doctoral candidates, and technology transfer to established companies and start-ups.' Vetterli is best known for his research on wavelet theory, image and video compression, and self-organised communication systems. Several start-ups have already emerged from his lab, including SensorScope, Quividi, Illusonique and Dartfish. Vetterli's experience coincides with his predecessor's vision. Both were inspired by their personal experiences on the best American campus.

Spin-offs

EPFL has become a reference for innovation and technology transfer in industry. Since 1996, 483 so-called academic spin-offs have emerged from EPFL. With a current rate of 20 to 25 new companies per year, EPFL's entrepreneurial ecosystem is efficient compared to universities with larger budgets such as ETH Zurich (25 to 30 spin-offs per year) or Oxford University (15 to 20). The EPFL brand also attracts start-ups, some of which are not academic spin-offs but set up close to the campus, such as AC Immune or VisioWave. Entrepreneurship is in the DNA of the EPFL campus and is explicitly encouraged by the management. Professor Aebischer wasn't afraid to make the provocative statement to his teaching staff that 'it is more important for EPFL to produce a Google than get a Nobel Prize'.

Some Nobel Prizes can nevertheless be found in Lausanne, just a few metres from EPFL: on the campus of the University of Lausanne (UNIL). Six scientists associated with UNIL have received it, three of them in medicine and three in chemistry.

This is remarkable for a city of 145,000 inhabitants. The University of Basel has also hosted nine Nobel laureates as students or professors, the University of Zurich 22, Geneva 11 and Bern 5. Scientific research at the highest level is well distributed across the country in ten universities, in addition to the two Federal Institutes of Technology. These institutions, including university hospitals, received more than CHF 650 million for their research projects, which corresponds to 54% of the amount of the Swiss National Science Foundation (SNSF) in 2023.

In addition, nine universities of applied sciences house research laboratories that complement the universities. These institutes, which focus on applied R&D innovation and design, often work directly with companies and are therefore particularly well positioned to meet the specific needs of specialists in their innovation projects.

Then there are the private research institutes that are of public interest. For example, the CSEM was founded in 1984 by the Swiss Confederation to revive the crisis-hit Swiss watch and mechanical engineering industry. It is a non-profit but private applied research and development institution owned by partner companies. The CSEM, based in Neuchâtel, initially concentrated on watchmaking, in particular on the development of the world's first electronic watch, the Beta 119. It then ventured into other areas such as the automotive and medical industries. Finally, there are the international public research organisations, of which CERN (the European Organization for Nuclear Research) is the best known example.

Elementary particles

‘End of the world on 10 September 2008!’ Alarming newspaper headlines reflect the concern of a section of the population that the launch of the world’s largest particle accelerator, LHC (Large Hadron Collider), would create huge black holes that ‘swallow up’ the entire planet.

That day, 340 journalists from all over the world were present at the premises of CERN, which was not used to this kind of media circus. There was no intergalactic disaster to report, but it was a unique opportunity to explain to the general public the purpose of the mysterious CERN’s work. Founded in 1954, the organisation is based in a suburb of Geneva on the French-Swiss border and has 23 member states, including Israel, which is the only non-European country to become a full member. CERN’s main task is to provide the particle accelerators and other infrastructure necessary for research in high-energy physics. More than 10,000 users from all over the world conduct scientific experiments there every year. CERN also employs 2,600 people (scientists, technicians and administrative staff) to build and manage these unique facilities.

Considered the largest machine in the world, the LHC is located in a tunnel with a circumference of 27 kilometres, 175 metres below the French-Swiss border. It uses superconductors and cryotechnology to transport the magnets that conduct the protons near absolute zero (approx. –271 °C). This requires sophisticated giant detectors, radiation-resistant electronics and server farms scattered around the world. The detectors record hundreds of millions of collisions per second and search for the signatures of new elementary particles predicted by the theories of physics.

The Higgs-Englert boson was confirmed in 2012, leading to the award of the Nobel Prize in Physics to François Englert and Peter Higgs in 2013. This discovery is very significant because the existence of the Higgs field was the last unverified part of the Standard Model of particle physics. This fundamental question led to research over a period of 40 years and to the construction of the LHC at a cost of CHF 4.3 billion.

The LHC is now helping to find explanations for many unanswered questions: where is the antimatter that was present at the time of the Big Bang? Where does the mass come from? What exactly are dark matter and dark energy, which make up 23% and 73% of the contents of our universe, respectively (while stars and planets comprise only 4%)? What did matter look like at the beginning of the universe?

Industrial and societal benefits

CERN is a great success story of international scientific and industrial cooperation, funded by Europe and based on Swiss soil. Michel Spiro, former President of the CERN Council, speaks of a 'collaborative, long-term and open strategic model of society, as opposed to the dominant model of globalisation based on competitiveness, short-termism, patents and individualism'. CERN prevailed against other competing projects, such as the American Superconducting Super Collider (SSC), also known as Desertron, which sought to compensate for its less daring technology with a circular tunnel that has a circumference of more than 80 km. Since it was much more expensive and not much more efficient, this project was stopped by the US Congress. CERN owes its leading position to its ability to bring together the most advanced resources and knowledge in the world. For example, the technology for cooling superfluid helium magnets was still conceptual before the LHC was built. Its application began in France at the Tore Supra thermonuclear fusion reactor in Cadarache, but had never been implemented on a large scale over a distance of 27 km.

Such major technical challenges stimulate innovation. In data processing, the concept of the distributed grid was the beginning of a revolution in mass data processing based on a distributed computer network rather than a large supercomputer concentrated in CERN. Researchers need remote access to these facilities, so the lab has always been an important centre for the wide-area network (WAN). The best-known and least-anticipated invention also emerged from the field of data processing: the World Wide Web (WWW) or, more simply, the internet.

The WWW

The story of the World Wide Web began in 1980 at CERN, when the young English computer scientist Tim Berners-Lee, 26 at the time, had an ingenious inspiration that would revolutionise the world a few years later. He developed a project based on the concept of hypertext called ENQUIRE to facilitate the exchange and updating of information between researchers. The prototype was not successful, but it laid the foundation for the world's first web browser, invented nine years later. Frustrated by the difficulties encountered in searching for information stored on different computers, Berners-Lee submitted a memorandum in 1989 entitled 'Information Management: A Proposal' to the CERN management. With the consent of his superiors, he developed all the tools necessary for a functioning web: the Hypertext Transfer Protocol (HTTP),

the Hypertext Markup Language (HTML), the first web browser, the first HTTP server software, the first web server and the first websites, which were published on 20 December 1990.

Berners-Lee explained his motivation as follows: 'Creating the web was really an act of desperation, because the situation without it was very difficult when I was working at CERN later. Most of the technology involved in the web, like the hypertext, like the Internet, multifont text objects, had all been designed already. I just had to put them together.' He later added: 'I just had to take the hypertext idea and connect it to the TCP and DNS ideas and – ta-da! – the World Wide Web!'

In fact, the internet as a protocol for connecting computer networks (TCP/IP) was invented long before that, based on packet-switching networks such as the US ARPANET in 1969 and the French CYCLADES in 1971. But it took the World Wide Web to really democratise internet use. Unlike its predecessors such as Apple's HyperCard, the World Wide Web was not copyrighted, allowing servers and clients to be developed independently and extensions to be added without license restrictions. On 30 April 1993, CERN announced that the World Wide Web would be freely accessible to all, free of patents and free of charge. This philosophy of sharing intellectual property then led to the extraordinary development of the web, the fastest growing medium of communication ever.

Sir Tim Berners-Lee later became a British icon when the world met him at the opening ceremony of the Olympic Games in London. He sat in front of his PC and wrote a Tweet on the stadium screen:

'THIS IS FOR EVERYONE!'

Google

'Ah, I'm really sorry! But I can't refuse an offer from Google. My employees would never forgive me for that.'

Stefan Muff, co-founder and president of Endoxon, called me just before Christmas 2006 to inform me that he was breaking off negotiations with us; he was on the verge of his company being taken over by the American giant. You have to admit, the development prospects for the 50 employees were very attractive. They were set to join the Google Research team in Zurich to accelerate the growth of a new product launched in the US a year earlier: Google Maps. The Californian company had implemented its buy-and-build strategy perfectly. It had bought four start-ups in two years and integrated them into an internal team responsible for product development. First was Two Technologies in 2004, an acqui-hire (i.e.a company is acquired to retain employees) with the aim of drawing on the mapping expertise of the two Rasmussen brothers. Then there was Keyhole, a specialist in satellite photography and aerial photography, ZipDash, a specialist in real-time traffic analysis, and Endoxon, a specialist in high-precision photographic cartography.

Founded in 1988 by brothers Bruno and Stefan Muff, the company with 80 employees had already generated a turnover of CHF 10 million at the time of the takeover, and enjoyed a good reputation for top Swiss quality among its customers such as local.ch, map.search and Homegate. 'No one in the world collates as much information on maps as we do. Switzerland has a strong tradition in this area – we have adapted it to the latest media,' said Samuel Widmann, then CEO of Endoxon and now Director of Strategic Partnerships Geo at Google. The American company was particularly interested in the technical team, including Bernhard Seefeld, a pioneer in the use of Ajax programming technology for cartography, co-founder of search.ch and Tech Lead Manager at Google at the time. Google took over the internet database, the foreign branches that digitise and present the maps, as well as a mobile communications division. The areas of classic cartography and geomarketing were not taken over – they continued their activities in a new company called mappuls.ch.

Perched on the rock above the picturesque city of Lucerne is Schönegg Castle, the headquarters of Endoxon, which is worth a visit. The extraordinary view of Lake Lucerne, Mount Pilatus and the surrounding peaks is a dream come true. This view certainly inspired Stefan Muff, a visionary and passionate entrepreneur. In 2004, before the launch of Google Earth, he presented me with the prototype of a fascinating project called 'Blue': 'Imagine a world map on the internet with the ability to freely navigate, search for information and zoom in on a local point of

interest (POI) of your choice. This would be ideal for creating virtual marketplaces and developing commercial applications, such as selecting a hotel or assessing the quality of a property's location.' Enthusiastic about this – at the time – futuristic product, we pushed the thinking to the point where we imagined a free platform, accessible to all, that would allow us to continuously measure the pulse of the planet. Like an observation satellite, Blue would allow anyone to follow the evolution of our natural ecosystem in real time (air or marine pollution, forest fires, etc.), as well as migration crises or geopolitical conflicts. The platform would be an exceptional tool of public interest for monitoring, educating, alerting and, in the best case, controlling the resolution of problems. It's a vision that has already been partly realised today, but will still need to be implemented in the future, especially with regard to societal applications. Following his exit from Alphabet, Stefan is focusing on the AXON Group, which now has 600 employees and provides IT services for digital transformation.

Alphabet celebrated its 15th anniversary in Zurich on 11 September 2019 in the presence of President Ueli Maurer. With more than 5,000 employees, Alphabet is a first-class employer and it continues to recruit at high speed. Some of the strategic global activities are concentrated on the banks of the Sihl, such as the machine learning centre of excellence, which was launched in 2016 and focuses on three research areas: AI, the understanding and automatic processing of natural language, especially for language applications, and artificial perception. The latter area deals with the difficulty of analysing and interpreting images, sounds, music and videos. Zurich had already been strategically involved in numerous products that use AI, such as Google Maps, the Google Search Knowledge Graph, the conversation function behind Google Assistant and Google Translate.

Global Zurich: the world's village

Urs Hölzle, Google's influential global head of technical infrastructure, explains that his choice was due to the desire to recruit the best talent from ETH as well as the city's very international orientation. Located in the heart of Europe in a city with a very high standard of living, Google Zurich is able to attract the best international researchers. Urs Hölzle, a native of Liestal, 100 km west of Zurich, can talk about it from a global perspective. The graduate of ETH Zurich and PhD student from Stanford was Associate Professor of Computer Science at the University of California. As Google's number eight employee and first VP of Engineering, he has become a discreet and influential billionaire. He was instrumental in the operational development of his company and in the choice of Zurich as a location. In the wake of Google, more California companies came here to set up research labs, such as Meta, Apple,

GoPro, and NVIDIA. But none of them have invested as much in Switzerland as the computer industry veteran Big Blue.

IBM at the forefront

As early as 1956, IBM chose Zurich as the location for its first European research centre. The small town of Rüschlikon on the shores of Lake Zurich is home to the premises of IBM Research. Of the 19 IBM research centres in the world, it is the laboratory with the most Nobel Prizes. Gerd Karl Binnig and Heinrich Rohrer were awarded the Nobel Prize in 1986 for their work with IBM on the scanning tunnelling microscope, which enables the generation of images down to the atomic level, as well as Georg Bednorz and Alexander Müller in 1987 for their high-temperature superconductors, which could lead to a more efficient use of energy, for example by transporting enormous amounts of electricity in much smaller cables.

'Switzerland is of particular interest to us because we can easily work with the headquarters of the world's leading players, not only in the biopharmaceutical industry, but also in banking, insurance, bonding and food. It is a playing field on which we can develop new technologies in close collaboration with our customers and with universities.'

– Axel Nemetz, IBM Life Sciences Switzerland

We're talking about a powerful ecosystem of top researchers and business leaders interacting and collaborating to develop innovative solutions for the world. The higher the concentration of highly qualified people, the more attractive the Swiss hub of excellence will be for new entrants. This intellectual stimulation is essential for research and the exchange of knowledge.

International competition

In the context of global competition, Switzerland will be able to rely less and less on its tax advantages. In the past, holding companies belonging to foreign groups were given tax advantages in order to encourage them to establish themselves in Switzerland. The abolition of this special tax status in the Swiss federal tax reform known as TRAF, which was passed in 2016 and adopted by the people on 19 May 2019, is the result of pressure from the G20, the group of major industrialised countries. The G20 has achieved two important reforms in recent years: the introduction of the automatic exchange of information on tax matters (which effectively puts an end to banking secrecy abroad) and the creation of new rules for the taxation of transnational companies. A particular focus is on tax breaks for multinational companies, which are seen as unfair. In order to avoid sanctions, Switzerland had to adapt to these new international standards. Following the vote on the tax reform, Switzerland was permanently removed from the list of EU tax havens in October 2019. Although the practice of so-called flat-rate taxation of wealthy foreigners resident in Switzerland is still current I(some of which is comparable to the status of Non-domiciled resident in the United Kingdom, which is well known to city bankers), it remains anecdotal and confined to a few, mainly French-speaking cantons. Overall, the tax rate for Swiss companies (14.6%) is close to the European Union average (21.3%). This average figure conceals strong regional differences such as a significantly higher tax burden on profits in Bern (21%), Basel-Landschaft (18%) or Zurich (19.6%) than in Zug (11.85%).

In order to remain competitive, the Switzerland of tomorrow must strengthen its historical advantages, which are based on a highly qualified technical and academic workforce, a stable and liberal political system and an attractive quality of life. The Swiss authorities also need to actively promote research and development (R&D) activities. It is no coincidence that parties across the political spectrum have insisted on introducing tax measures to promote R&D in the tax reform and AHV financing (TRAF). They were aware of the need to compensate for the loss of competitiveness caused by the abolition of the special status. On the one hand, part of the profits from innovation will benefit from reduced taxation in the cantons thanks to the Patent Box regime. On the other hand, the cantons may allow an additional deduction of up to 50% for R&D expenditure.

What characterises the identity of a people, the soul of a nation? Geography, religion, language, history and political and artistic personalities are essential elements.

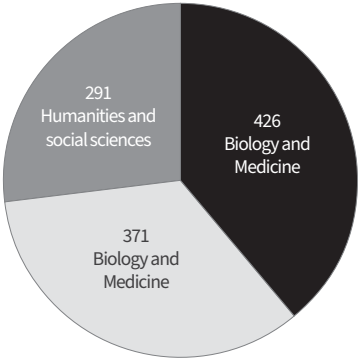
The identity of the Swiss people is closely connected with Alpine and maritime culture as well as with religious and political neutrality. Knowing that it is a small country surrounded by large nations, Switzerland therefore wants to be visibly independent, agile and pragmatic in order to ensure its survival. The myth of Wilhelm Tell opposing the Austrian oppressor is a perfect illustration of this national consciousness.

	Performance indicators (2023)					Percentages		
	Population in millions	GDP USD in billions	R&D USD in billions	VC USD in billions	R&D USD per capita	R&D GDP	VC GDP	VC R&D
China	1.426	30.200	620	38.3	435	2.1%	0.1%	6.2%
France	65	3.915	64	3.8	987	1.6%	0.1%	6.0%
Germany	83	83	5.582	129	3.6	1.551	2.3%	2.8%
Israel	9	498	21	15.7	2.337	4.2%	3.1%	74.6%
Italy	59	3.269	33	0.7	562	1.0%	0.0%	2.2%
Japan	124	5.896	172	6.2	1.388	2.9%	0.1%	3.6%
Netherlands	18	1.319	22	1.1	1.230	1.6%	0.1%	5.2%
Singapore	6	719	16	11.0	2.590	2.2%	1.5%	70.7%
South Korea	52	2.667	110	3.7	2.126	4.1%	0.1%	3.3%
Sweden	11	716	19	1.0	1.762	2.6%	0.1%	5.5%
Switzerland	**9**	**796**	**27**	**4.0**	**3.112**	**3.4%**	**0.5%**	**14.8%**
UK	68	3.848	84	3.5	1.240	2.2%	0.1%	4.2%
USA	338	25.744	710	190.5	2.098	2.8%	0.7%	26.8%

OECD Data, Swiss Venture Capital Report, The World Bank, Statista, IVC Online, TechCrunch, DealStreetAsia

So much so that the extremely powerful Habsburg dynasty, named after the Habsburg Castle in the Aargau since the 11th century, never really succeeded in conquering and taking over their homeland. At the time of Charles V, it ruled over a world empire that encompassed the vast majority of Europe, the Philippines, the North and South American West up to the Strait of Magellan. Switzerland also managed to maintain its territorial unity in the face of Hitler and Mussolini, despite being very clearly outnumbered. Napoleon returned to Switzerland to establish a French protectorate between 1803 and 1813, but did not annex the country. This episode of foreign intrusion also accelerated the unification of Switzerland under a new federal treaty, which was signed on 7 August 1815 and founded the Swiss Confederation. It consisted of independent cantons connected by a single common treaty and no longer by a network of heterogeneous alliances.

Distribution of the SNF



Nation of will

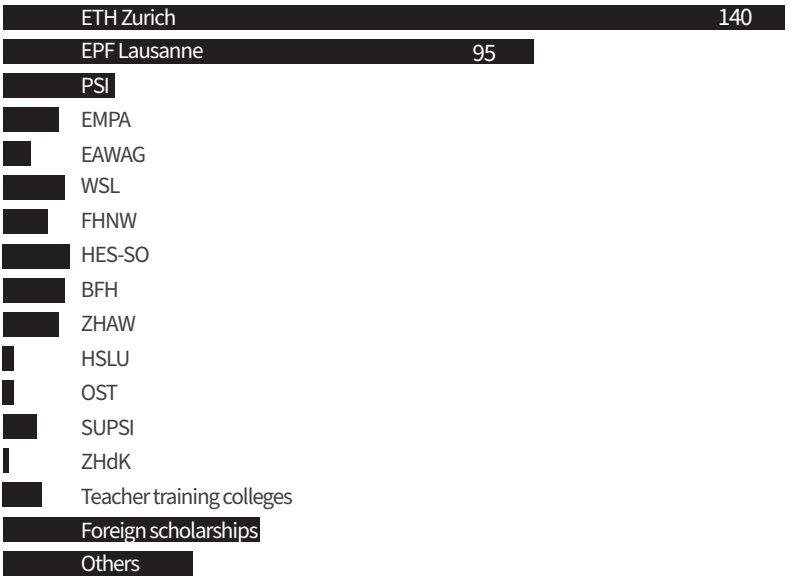
Switzerland is a typical example of a nation of will, a nation based on the will of its people to defend their common interests. Its existence is not due to a monarchy, a common religion or even a shared language; it owes its founding and survival to the pursuit of a common goal. And what is that common goal, you might ask? Firstly, freedom. Where other nations are built on the basis of a conquering, sometimes even belligerent will, Switzerland is more focused on defending its national sovereignty. The three German, French and Italian-speaking communities are well aware of this. They are making the necessary efforts to preserve this delicate balance in a culture of consensus and respect for differences, particularly those of minorities. This unlikely collection of very different cultural groups has held together since its founding in 1291.

	WIPO Global Innovation Index (2023)	IMD World Competitiveness Ranking (2023)	UNDP Human Development Index (2021)	World Happiness Report (2023)	Total Aggregates
Switzerland	**1**	**3**	**1**	**8**	**13**
Denmark	9	1	6	2	18
Sweden	2	8	7	6	23
Netherlands	7	5	10	5	27
Finland	6	11	11	1	29
Norway	19	14	2	7	42
Ireland	22	2	8	14	46
Singapore	5	4	12	25	46
USA	3	9	21	15	48
Germany	8	22	9	16	55
Canada	15	15	15	13	58
UK	4	29	18	19	70

A culture of high precision

In order to characterise contemporary Switzerland, an equally important identity-building dimension needs to be added: a passion for technology, typically of high precision, small size and the best possible quality. It is a high-tech culture in the noblest sense: high technology – much like how the French speak of haute couture or haute cuisine. This culture of excellence is rooted in the collective subconscious. It is not reserved for the elite, but permeates all levels of society. When I came to Switzerland, I felt the same emotional force in the world of haute horlogerie, the high art of fine watchmaking, as I did in the world of oenology in the South of France, where my in-laws live. In some regions, wine-growing is more than just food production. It reaches a higher level and becomes a powerful symbol of identity, a form of personal expression and even an art. The search for perfection and absolute refinement becomes an obsession, a reason for existence.

Distribution of the SNF



Take the example of mechanical Swiss watches, whose main function is not to display time. Rather, their main purpose is to evoke subtle emotions, such as a love of precision mechanics and materials, or reflection on the mastery of time and movement. A beautiful watch is an illustration of human engineering genius, and the ultimate goal of every watchmaker is to surpass the master who trained them. That's why they're constantly creating and innovating. They play around with the number of parts (more than a thousand for the most intricate watches) or the complications, i.e. additional functions, such as for sounds, calendars or clockwork. A prime example of this philosophy are some watches from legendary watchmakers such as Vacheron Constantin, which are sold as individual pieces with several patented and unique complications. The Patek Philippe Henry Graves Supercomplication, for example, which was resold in 2014 for the modest sum of USD 24 million, took no less than five years to complete. It has 24 complications including moon phases, sidereal time, and sunrise and sunset times in New York.

This culture of love for precision is not insignificant. It has been present in Switzerland for four centuries in watchmaking and goldsmithing and has gradually spread to other areas such as textiles, measuring instruments, precision engineering, microelectronics and many more. In fact, I think Steve Jobs had the mindset of a Swiss person. A passionate calligrapher and industrial designer, he was known for his tenacity when it came to the smallest details. For example, he insisted on making the internal parts of the Lisa computer beautiful, even if they couldn't be seen from the outside. This attention to detail runs through Apple's entire range of products and has given the company its own identity in a highly competitive IT market. For Swiss start-ups, the consequence of this perfectionism is a certain slowness in introducing new products because they refuse to forego the fine-tuning. Swiss culture is clearly not ideal for the hasty introduction of software in alpha or beta mode.

Dual system of vocational education and training

Switzerland has the peculiarity, even the genius, of having developed both a culture of scientific excellence, which by definition is very elitist, and mass technical education, which is symbolised by top-quality curricula. Two thirds of secondary school pupils choose vocational training instead of the more academic branch of the Baccalaureate (equivalent to the A-level in the UK or Abitur in Germany). Most companies offer places for two to four years of training for apprentices aged 15 to 19 years, whereby they alternate between time at school and work placement. Swisscom, for example, trains around 800 technical and commercial apprentices. The Swiss education system is characterised by a high degree of freedom to choose between vocational and academic education. Numerous pathways enable the best apprentices to continue their studies at the highest level up to a doctorate. The pathway through an apprenticeship is not seen as weakness, on the contrary: the practical experience gained will be seen as an asset later on. For example, people such as Sergio Ermotti, CEO of the UBS Group, or three out of seven members of the current Federal Council (Karin Keller-Sutter, Beat Jans and Guy Parmelin) have taken this path.

While the brilliant thinkers, theorists and speakers are highly regarded in some neighbouring countries, in Switzerland they are often viewed with a degree of suspicion. The archetype of the Swiss hero is more of a person of action who finds functional solutions to complex problems that come as close to perfection as possible. For example, the Swiss identity is directly associated with precision objects (the Swiss Army Knife™, watches), exclusive services or world-famous top brands made in Switzerland, sometimes even merged. In order to maintain its premium image and thus its own identity, Switzerland is ‘condemned’ to constantly innovate and therefore invest heavily in research. Its survival, its reason for existence, depends on it.

Innovo, ergo sum.
I innovate, therefore I am.

Strategic leveraging power

The total number of researchers residing in Switzerland is 74,000, which represents only 1.6% of the total number of jobs. However, this group of people is strategic for the country; it is the source of value creation, i.e. of technological advances that set Switzerland apart. Without them, Swiss exports would not be able to justify their high prices or compete internationally. Without innovation, existing large companies would not be able to transform and position themselves in new growth areas. Research is therefore a great defence mechanism, one that is largely underestimated by public opinion, which tends to take the current positioning for granted.

Research also plays an important offensive role in terms of growth. Researchers working with entrepreneurs have a very significant leverage effect, inventing new industries and thus the jobs of tomorrow. A fundamental distinction must be made between two types of job creation: one increases the country's added value, the other does not. This second category, which is also worth honouring, includes the jobs created by substitution (one competitor gains market share at the expense of another), so in this case the total number does not grow. A thousand new jobs created in a large company that merely replace those who have left to go into retirement also have no impact on employment growth. By contrast, the net balance of jobs created by start-ups is mostly positive because they are concentrated in growth sectors that are predominantly export-oriented.

Proof of this can be found, for example, in the impact of Actelion, which the Roche R&D spin-off has achieved in less than 25 years.

This biotech start-up has created more than 5,000 direct jobs and many more indirect jobs with subcontractors, service and infrastructure companies and local authorities. The ecosystem of today's young companies is of strategic importance, as it provides the fertile ground on which the Swiss high-tech champions of tomorrow will flourish.

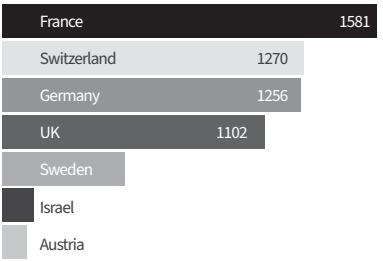
Legends in the History of High-Tech

Why is it that three of the ten highest rated continental European companies are from Switzerland? Nestlé is fourth (CHF 284 billion) and Roche ninth (CHF 212 billion), followed by Novartis (CHF 201 billion) in tenth place.

These are not multinational companies that moved to Switzerland for tax reasons, but companies that were founded there more than a century ago. The top twenty Swiss companies listed on the SMI have achieved a market capitalisation equivalent to that of the top twenty companies on the German DAX and is even almost as high as that of the English top twenty.
Even more striking is the comparison with countries of similar size, such as Sweden (2.5 times less than the Swiss top twenty), Israel (8 times less) and Austria (12.5 times less).

This is an extraordinary achievement for a small country that accounts for less than 5% of Europe's gross domestic product. Nothing favours this small country if it were to attempt a global economic conquest: no critical size on the domestic market, lack of commodities, limited agricultural resources and no direct access to sea lanes.

Top 20 Market Capitalisation



Moreover, geopolitically speaking, Switzerland does not have any historically determined sales markets (e.g. no colonial past). A degree of political isolation has weakened Switzerland in the past in the face of protectionist responses from major European, Chinese and American markets.

Nevertheless, Switzerland has long been characterised by an exceptional density of international companies. Economist Paul Bairoch estimates that at the beginning of the 20th century, Swiss companies accounted for 13 to 18% of industrial multinationals in the world – that is 14 to 19 times more multinationals per capita than in the nine most advanced countries of the time. In the first half of

the 19th century, Switzerland was indeed the second most industrialised country in the world and the richest in terms of GDP per capita after the United Kingdom. Thanks to its export-oriented economy, Switzerland, which accounted for only 0.2% of the world's population in 1840, supplied 6 to 7% of the world's industrial exports. At that time, these were mainly silk and cotton textiles (73% of Swiss exports), watches (8%) and agricultural products (6%). A century later, activities diversified to compensate for the loss in the textile industry (now only 20% of exports) due to international competition with machinery and electronics (16%), watches (18%), chemical and pharmaceutical products (15%) and agricultural products (6%). The industrial transformation continues to this day, with chemical and pharmaceutical products (37%) dominating sales far ahead of exports in precious metals and jewellery stones (20%), machinery and electronics (10%) and watches (7%).

The long existence of the current Swiss multinationals should also be highlighted, the largest of which (Nestlé, ABB, Roche, Novartis, Georg Fischer, Clariant-Sandoz, Sulzer, Schindler) began their activities abroad before 1915. They did this before the emergence of the large Swiss banks, which accompanied entrepreneurs rather than preceded them. The average age of the 20 largest Swiss companies listed on the SMI is 123 years, which makes them twice as old as American companies.

This is both good and bad. On the one hand, it is a testament to the tremendous resilience and ability to renew of the Swiss companies that emerged from the industrial revolution of the 19th century. On the other hand, it is a characteristic of the old Europe as we are perceived by our American, African and Asian friends. The economy lacks renewal; where are the young companies of the digital world? Switzerland's history of industrial strength is therefore both a weakness and an enormous opportunity for the future – we will return to this in the second part of the book. Overall, we can remain optimistic and confident. Switzerland's economic health remains exceptionally good, as it rests on a solid and diversified foundation. How did Switzerland achieve what many economists call a 'miracle' or at least a paradox, this early development despite the few factors that predisposed to such an adventure?

Attempt at an explanation

Paul Bairoch has looked at this question and found that the Industrial Revolution has led to two types of economic development in small European countries. The vast majority opted for a policy of complementarity with the dominant economy by supplying it with food, raw materials and human resources, whereby contracts were awarded. Switzerland, on the other hand, adopted a policy of direct competition with the dominant economy, based on the export of manufactured goods. A priori, this approach seems particularly risky in mass markets of strategic national importance, such as food, chemicals or pharmaceuticals, where size and political power usually play an important role. It is therefore all the more astonishing that the large Swiss corporations have managed to establish themselves in certain sectors.

We have seen in the previous chapters how important the quality of research and education & training was. However, Switzerland is competing in science with exceptionally powerful regions/nations, first and foremost with Europe, then with the US and now with Asia. Switzerland's R&D budget remains modest by global standards. Without playing down the importance of the contribution made by science and research, it is important to identify other development factors. The argument for greater flexibility with smaller size is not really convincing when you consider that the vast majority of countries of similar size are not undergoing particularly spectacular development. The sociologist Arnold Toynbee's theory of challenge and response provides some answers: for him, civilisations are born in response to an extremely difficult challenge. They develop thanks to a few intelligent and determined leaders ('creative minorities') and eventually disappear when creative inspiration erodes. 'Civilisations die from suicide, not by murder,' he concluded.

But this explanation has its limitations, as many countries are facing extreme challenges they are unable to overcome. Similarly, economist Max Weber, one of the founders of German sociology, emphasises in his book *The Protestant Ethic and the Spirit of Capitalism* the importance of puritanical (and, more broadly, Christian) religious ideas for the development of the Western economic system. This is the result of a change in values within the Protestant bourgeoisie, which ultimately valued human labour more highly, combined with the concept of salvation through earthly works. These factors cannot be the only reasons for the development, since economic success is not confined to Protestant communities. Moreover, Catholicism is the leading religion in Switzerland (30%), followed by the Evangelical Reformed Church (23%), other Christian denominations (6%) and Islam (5%). It should also be noted that only the cantons of Zurich, Bern, Basel,

Schaffhausen, Appenzell Ausserrhoden, Vaud, Neuchâtel and Geneva are fundamentally Protestant. The cantons of Lucerne, Schwyz, Valais, Uri, Zug, Fribourg, Unterwalden, Solothurn, Ticino and Appenzell Innerrhoden are historically Catholic. The remaining cantons are biconfessional.

Entrepreneurial immigration

The contribution of foreigners is another favourable factor that is often mentioned.

In fact, the roots of Swiss industry go back to the 16th and 17th centuries, when the Huguenots, who were expelled from France, brought watchmaking to French-speaking Switzerland and contributed to the development of the textile industry in German-speaking Switzerland. Tourism, for its part, is essentially an invention of English visitors who discovered the Alps in the 19th century and turned them into a holiday destination. Many entrepreneurs came to Switzerland to escape the political and social instability of their home countries, such as the German Heinrich Nestlé in 1839 (Nestlé), the Italian Fabio Bertarelli in 1977 (Serono) and the South African Johann Rupert in 1988 (Richemont). Others have fled to Switzerland to avoid prosecution in their home countries, such as the American Marc Rich, founder of Glencore, the global leader in commodities trading (CHF 191 billion in turnover with 140,000 employees). Robert Louis-Dreyfus, the owner of another commercial heavyweight, Louis Dreyfus Company, also moved to Zurich for personal reasons. As a result, Switzerland has become an important trading platform for oil, metals, cotton and cereals. With Givaudan, which was founded in 1895 by the two Frenchmen Léon and Xavier Givaudan, Switzerland is also the global market leader in perfumes and fragrances. After all, 318,000 cross-border commuters (173,000 French, 72,000 Italians and 62,000 Germans) enter Switzerland every day to work, making them a relatively skilled, relatively cheap and, in the event of an economic recession, flexible workforce.

The net inflow and outflow of entrepreneurs is clearly positive. However, public opinion tends to focus more on the talent drain.

Hotel owner César Ritz, car manufacturer Louis Chevrolet and architect Le Corbusier, for example, had to leave Switzerland in order to fully realise their talents.

More recently, the start-ups HolidayLettings and GetYourGuide have moved to London and Berlin respectively in order to find the necessary financing for their expansion. A large number of scientists and researchers also go abroad to pursue their careers. This is ultimately good thing, because they usually return home later. One such example is Geneva-based David Marcus, founder of the start-ups Echovox and Zong, who has become a key player in the digital industry in the US (former President of PayPal, Vice President of Meta). Today, he is the founder and CEO of Lightspark, a crypto start-up that deals with Bitcoin and the Lightning Network. The career of Edouard Bugnion from Neuchâtel is also remarkable. He studied at Stanford before co-founding the company VMware, which specialises in software virtualisation and the cloud, and was purchased by Broadcom in 2023 for USD 89 billion. He repeated the whole thing with another start-up, Nuova Systems, and became VP/CTO of Cisco's Server, Access and Virtualization department. After 18 years in the US, Edouard returned to Switzerland as Vice President of IT Systems at EPFL, allowing the Swiss ecosystem to benefit from his world-class experience.

Generally speaking, Switzerland attracts people who are very successful in fields as diverse as sport, business or the arts. These individuals usually have an entrepreneurial background, such as Jean-François Baril, former Senior Vice President of Sourcing and Procurement at Nokia, who moved to Geneva.

He is well on his way to making a success of his crazy entrepreneurial venture – reviving Nokia's mobile phone business. In 2019, he sold 60 million devices through his company HMD and in 2020, he raised around USD 230 million from Alphabet, Nokia and Qualcomm. Frédéric Gastaldo is another example of a French immigrant with a wealth of high-tech experience. He co-founded Louis Dreyfus Communications, renamed Neuf Telecom, which became France Télécom's first fixed-network competitor, before joining Swisscom's upper management in 2003 with his entrepreneurial spirit. In 2012, he co-founded Swisscom Energy Solutions (tiko Energy Solutions), which is now majority owned by the energy group Engie. Over the years, a considerable number of major European industrial empires have gained a foothold in Switzerland (e.g. Ikea, Tetra Pak or C&A). In most cases, these families have a strong entrepreneurial culture and often want to contribute to the entrepreneurial dynamism of their adopted home country.

Value creation

The leitmotif of Switzerland's entire economic history is value creation.

Switzerland therefore focuses on activities that generate the highest possible monetary (and reputational) value per person. The advantage of this positioning is that it can be adapted to any type of product, service or era. It enables profitable growth without the disadvantages of industrial mass production and bundles activities with high added value in Switzerland: R&D, resource management, and highly qualified and automated production. The high intellectual density in a protected environment creates a continuous cycle that makes it possible to attract the best talent.

This suggests that the reasons for Switzerland's development are multifactorial. In my research, however, one key dimension has crystallised: the quality of entrepreneurs, combined with the seriousness, responsibility and intensity of their employees' work. Having lived in six European countries as well as in the US, I can indeed testify to this particular quality. It is the human factors that make the difference and explain the emergence of certain economic activities in a particular place, even if many other regions of the world have similar contexts but haven't taken advantage of the opportunity. Although environmental factors play a role in the broadest sense (quality of research, infrastructure, political stability, etc.), great economic success is closely connected with the uniqueness of a few exceptional individuals who are able to work well with a skilled and motivated workforce.

That is why I have decided in this chapter to tell the great Swiss success stories from the perspective of the entrepreneurs of the past who are now the champions of the economy.

Nestlé

How was Switzerland able to become a leading global food producer despite its limited agricultural potential? At more than USD 104 billion in 2023, Nestlé's turnover is almost ten times higher than that of Swiss animal and plant production.

When Nestlé was founded in 1866, its immediate neighbours, France and Italy, were infinitely better positioned to dominate this market, thanks to their wide variety of products available in vast territories, a strong gastronomic culture and world-famous brands. Nestlé was later confronted with the emergence of national champions rooted in huge populations with specific tastes, particularly in the US and Asia. Nevertheless, the company eventually established itself as a global market leader thanks to an ambitious innovation strategy and the acquisition of major brands that were integrated into a global organisation with the aim of exploiting economies of scale while respecting country-specific differences. 'The United Nations of the food industry', so to speak.

Born in Frankfurt am Main in 1814, founder Heinrich Nestle came to Switzerland at the age of 29 to escape repression against the pro-democratic opposition parties. Trained as a pharmacist, he set up a pharmacy in Vevey, on the sunny and beautiful north shore of Lake Geneva, nicknamed the Riviera. He changed his name to Henri Nestlé in order to better integrate into the local French-speaking community. A few months later, still in 1843, he bought a mill with an attached distillery to produce various foodstuffs such as vinegar, liqueur and oil, but also fertilisers and, above all, liquefied fuel gas, to power the street lamps in the town of Vevey. About twenty years later, Henri Nestlé began the industrial production of a ready-made infant formula based on milk, sugar and wheat flour.

International growth

This milk powder, which was sold as a partial or complete substitute for breast milk for newborns whose mothers were unable to breastfeed, was first successfully marketed in Switzerland in 1867, then very quickly in Frankfurt, Paris, London and, within less than five years, all over the world. From the outset, the growth of Henri Nestlé was characterised by a very international orientation and numerous acquisitions. The management did not hesitate to merge with its Swiss competitors, who specialised in condensed milk (Anglo-Swiss Condensed Milk Co. in 1901), chocolate (Peter, Cailler, Kohler, Chocolats Suisses S.A. in 1929) and culinary products (Alimentana S.A. Maggi in 1947). Since Nestlé couldn't export everything from Switzerland, a decentralised policy was introduced to overcome the logistical, political and price constraints of the 20th century. The company acquired numerous food processing plants (e.g. no fewer than 11 plants in Australia and 11 in the US in 1920) with the aim of increasing efficiency and gaining access to commodities and local commercial markets.

Nestlé also began to expand its product range: chocolate (acquisition of Cailler in 1929, Rowntree Mackintosh Kit Kat, Smarties in 1988), coffee (Nescafé coffee powder in 1938), frozen foods (purchase of Findus in 1962), company catering (Eurest in 1970), cosmetics (minority stake of 30% in L'Oréal in 1974, reduced to 23% in 2014 and today valued at more than EUR 37 billion), coffee machines (Nespresso in 1986), pet food (acquisition of Ralston Purina for USD 10 billion in 2001), ice cream (acquisition of Mövenpick in 2003) and mineral water (acquisition of Vittel in 1969, Perrier in 1992 and San Pellegrino in 1998). Nestlé's new strategy in recent years has focused on personalised nutrition, wellness and health sciences, with numerous acquisitions such as Novartis Medical Nutrition in 2007 and Persona in 2019, a leader in vitamins.

Nestlé's turnover for 2023 is broken down as follows: 26% from beverages (Nespresso, Nescafé), 16% from nutrition and health sciences (illuma, Nestlé NAN), 20% from pet food (Purina, Felix), 12% from dairy products and ice cream (Nido, Nestlé), 12% from ready meals (Maggi, Lean Cuisine), 9% from chocolate (Kit Kat, Cailler) and 4% from mineral water (San Pellegrino, Perrier). In total, the corporation employs 270,000 people in 76 countries and 340 factories worldwide.

Innovation

Acquisitions are not the only growth drivers for the corporation; innovation is another key factor. With 55% of the total R&D budget, Switzerland is at the heart of the system, with its ten research centres working along the entire value chain, from basic research, nutrition and health to applied research for product development.

Founded in Lausanne in 1987, the Nestlé Research Center (NRC) employs almost 600 people, including more than 250 scientists from 50 nations.

They include nutritionists, biochemists, physicists, immunologists, pharmacists, computer scientists, mathematicians, sensory scientists, food technologists, packaging and design experts and many others. Founded in 2012 on the EPFL campus, the Nestlé Institute of Health Sciences is dedicated to the search for nutritional solutions to counteract the development of diabetes, obesity and Alzheimer's disease.

The development of new growth companies within large organisations (intrapreneurship) is extremely difficult due to internal resistance and cultural conflicts. There are very few successful examples of sufficient size that have a significant impact on the growth of the parent company. For this reason, I would like to highlight the extraordinary success of Nespresso, which was founded ex nihilo in Lausanne in 1986 and now employs more than 13,500 people in 76 countries.

Nespresso, what else?

Nespresso (an acronym for Nestlé Espresso) is a major innovation, in terms of both technology and its business model. A new product category, the coffee machine with disposable capsules, has revolutionised coffee consumption. The patent was filed in 1976 by Eric Favre, an engineer from the research and development department of Nescafé. Married to an Italian woman who kept reminding him that he knew nothing about 'good' coffee, he gave himself the mission of creating the best coffee in the world. He travelled through Italy for several months in search of the secrets of the best baristas. He observed that the barman at the 'Sant'Eustachio' in Rome, famous for his exceptionally flavoursome short black, pulled the lever of his partially defective professional machine ten times instead of once continuously. Eric Favre says that it was only a few hours later at home, sitting in his bathtub and listening to Mozart, that he suddenly realised that the addition of air to water had to give coffee such an intense flavour: 'I realised that espresso is to filter coffee what sparkling water is to still water. The small air bubbles, which are first dissolved in the water before the coffee is extracted and then throughout the cup, finally explode in the mouth. I invented the coffee formula of compressed air, water and coffee oil.'

It is thanks to this 'coincidence', which only pleases well-prepared minds, that the principle of the Nespresso machine was invented according to the famous formula of Louis Pasteur. It took about twenty years to finally commercialise this invention and make it profitable after several failures and strong internal resistance. The idea of selling a coffee machine that would allow the end-user to make an espresso like a barista was in contrast to the prevailing culture at the time, which focused on freeze-dried soluble coffee powder, better known as instant coffee. How did Nestlé manage to produce this young offspring that challenged the business model of the very powerful Nescafé, the corporation's leading global brand?

The invention of the coffee capsule is, in fact, a groundbreaking innovation that differs from existing practices in the coffee machine industry due to its radically different approach. Nespresso has succeeded in building a global system that combines the machine and the coffee, in a leading position, with high margins and a direct relationship with the consumer. Selling the coffee machines is necessary to provide a high-quality experience, but the bulk of the revenue comes from selling the capsules – a concept similar to that of razor blades or printer cartridges. What is now a well-known model, copied by a number of competitors, was not welcomed with open arms at the time

of its creation. The inventor of Nespresso, Eric Favre, admits that his superiors had regarded him as a 'loose canon' and that they had done everything they could to 'get rid of' him. He was forced to abandon the development of this product and was transferred to Japan to work on other packaging projects. It took the intervention of a visionary Japanese manager to convince CEO Helmut Maucher to give him a chance to bring his product to market. In 1986, Nespresso set up in Lausanne, 20 km from the parent company, with five employees. Eric Favre tells the anecdote that he had been advised by the CEO to build Nespresso's headquarters 'as far away from Nestlé's headquarters as possible' in order to preserve independence and entrepreneurial culture.

The first launch was a bitter failure, but the company was given a second chance and gained momentum thanks to many successive changes and improvements. On its website, Nestlé describes the pioneering years up to 1994 as trial and error, followed by five years of financial equilibrium (1994–1999), with the growth of online retail and the Nespresso Club playing a major role. This was followed by the development of a global brand with the launch of prestige boutiques and the iconic 'What else?' promotional campaign with George Clooney (2000–2005). In recent years, the focus has been on a range of product and environmental innovations (including sustainable quality control and recycling) to bolster its position as a global market leader.

To summarise, it took a decade for the technological development to be recognised (1986), a second to achieve financial equilibrium (1995), and a third to create a global brand (2006) that realises its full potential on a global scale. Nestlé has mastered these different phases of development with pragmatic conflict management and a culture of continuous technical and commercial innovation. It will have to continue to reinvent itself in order to adapt to the new demands of consumers, in particular regarding the environment. The merging of nutrition, health, wellness and digitalisation represents a great challenge for Nestlé, but also a great opportunity that must be seized. Good food, good life.

Fritz Hoffmann-La Roche was only 26 years old when he co-founded the company Hoffmann, Traub & Co. in 1894, which was renamed F. Hoffmann-La Roche two years later, to produce thyroid preparations and wound antiseptics.

Financed by his father, a wealthy silk merchant from Basel, the young company soon expanded internationally. In its third year of existence, a factory was built in Grenzach, Germany. The company quickly developed a network of representatives and sales offices, including one in the United States in 1905. The cough and heart medications were a worldwide success, but the company faced a severe crisis during the First World War. It was boycotted by the Germans, who suspected it of supplying France – and by the French, who accused it of being pro-German. In the Russian Revolution of 1917, the company lost all of its investments in Russia. The Hoffmann family had to refinance the company and put it on the stock exchange in 1919 to enable a fresh start.

Roche succeeded with great dynamism, mass-producing the world's first artificially synthesised ascorbic acid (vitamin C), marketing it under the brand name Redoxon and becoming the global market leader. In order to avoid dependence on vitamins, the company invested more in research and diversified its pharmaceutical portfolio. It achieved great success, especially in the fields of antidepressants (discovered in 1960, Valium became the most widely prescribed drug in the history of pharmacy) and oncology. Roche was then reorganised around two main activities. Firstly, pharmaceuticals, which generates 80% of turnover, half

of which in oncology. Roche also offers treatments for infectious, cardiovascular, inflammatory and autoimmune diseases, bronchopulmonary and metabolic diseases, and is active in virology, haematology, dermatology and neurology. Secondly, the Diagnostics division generates 20% of turnover from genomics and proteomics research tools, testing methods for viruses such as HIV and HCV, integrated laboratory workstations and patient devices. The Fragrance and Flavour Division went public in 2000 and became Givaudan, today a leading global company with a value of CHF 37 billion. In 2002, Roche also sold its Vitamins and Fine Chemicals division, once its core business, to the Dutch company DSM for EUR 1.7 billion – less than 1% of the parent company's value. This figure illustrates how the diversification strategy implemented in the 1950s was fundamental to Roche's development, far beyond the original business.

The growth of the group was initially driven by the dynamism of its founder, until his death in 1920. Endowed with 'restless energy, infectious spontaneity and indomitable optimism' (as his successor Emil Barell described him in his funeral speech), the young Hoffmann was also a visionary. He was among the first to recognise the importance of the industrial production of standardised, high-quality medicines based on major investments in scientific research. He funded laboratories all over the world to give scientists the freedom to experiment that was otherwise only known in university laboratories. He was also a pioneer in the field of marketing and was interested in all aspects of sales promotion, especially advertising, an innovative idea in his time.

The DNA of Roche

The entrepreneurial culture shaped by the founder continues to this day. Every year, more than 24% of turnover is invested in research and development, which corresponds to expenditure of CHF 16 billion, of which about 25% is in Switzerland. Another important feature of Roche's DNA is its ability to enter new markets through mergers and acquisitions (M&A). At the same time, the measures for external growth were numerous (more than 20 since 2015), highly ambitious and well controlled.

With the acquisition of Genentech from California, the global leader in biotechnology at the time, Roche was able to solidify its position in this promising segment. In 1990, Roche acquired 60% of Genentech for USD 2.1 billion at a valuation of USD 4.5 billion. Roche acquired the remaining shares in 2009 for USD 47 billion at a valuation of USD 100 billion. This was a conservative two-step approach that was used in 2015 to acquire 50% of Foundation Medicine at a valu-

ation of USD 1 billion, followed by the full takeover three years later at a valuation of USD 5 billion. Roche was able to achieve significant cost and growth synergies by integrating the acquisitions well into existing research infrastructures and distribution channels.

Today, Roche is the second largest pharmaceutical company in the world behind Johnson & Johnson from the United States. Roche employs 100,000 people in 105 countries. The head office has remained in Basel, even though the Swiss market accounts for only about 2.5% of global sales (CHF 1.671 million in 2022). With 10% of the shares and 50.1% of the voting rights, the Oeri-Hoffmann family continues to control the company. André Hoffmann, Vice-Chairman of the Board of Directors, represents the interests of the richest Swiss family with an estimated fortune of CHF 26.6 billion. In his fourth generation, he has preserved his entrepreneurial spirit and is co-founder of an organic food start-up and a renowned business angel. André Hoffmann also took over as Vice President of the International Board of Directors at WWF, the world's largest conservation organisation, known for the logo with the panda and its fight to protect endangered species. His father Luc Hoffmann was a founding member of the WWF and also Vice President. The appointment of Dr Jörg Duschmalé to the Roche Board of Directors in 2019 marks the fifth generation of the family who will ensure that the company continues to develop how the founder intended it to.

Tailor-made digital medicine

Roche places personalised medicine at the heart of its strategy. This targeted approach is particularly important for cancer medicines, an area in which Roche is a global leader. Precision medicine makes it possible to administer the right drugs (or combinations of treatments) at the right time and with minimum side effects. The aim is to develop preventive and even predictive medicine and targeted therapies based on the genetic and biological profile of the patient. The development of personalised medicine is directly connected with advances in molecular biology (genetics) and bioinformatics. Roche has therefore invested heavily in these two complementary areas. Over the past 25 years, Roche has made a number of acquisitions totalling more than CHF 100 billion, ranging from biotech companies that produce medicines (Genentech), to companies that specialise in collecting and analysing personalised data (Flatiron, Foundation Medicine), to digital medical applications (e.g. mySugr to help people with diabetes). Roche invests more than CHF 3 billion annually in digital IT infrastructure and over 30 digital solutions on the market.

The digital transformation is underway in all areas of Roche's business, from increasing the productivity of R&D activities to clinical trials and the commercialisation of medicines.

The future of the corporation depends on its ability to exploit the potential of digital technology while defending its position against new competitors (Apple Watch, Google Fit/Fitbit), all seeking to conquer personalised data in the areas of health and wellness.

Following Ciba-Geigy's marriage to Sandoz in 1996, as the mother of two now independent daughters (Syngenta and Clariant) and as the holder of 33% of Roche's voting rights, Novartis is now at the centre of Basel's powerful chemical and pharmaceutical family.

The empire was founded more than 260 years ago in 1758 by Johann Rudolf Geigy-Gemuseus, who at the age of 25 years began trading in dyes and chemicals, mainly for the textile industry. He later built a dye extraction plant and developed synthetic dyes (such as magenta-coloured fuchsin) that enjoyed global success.

Ciba's origins, however, can be traced back to Alexander Clavel, who took over the production of fuchsin in a silk dyeing factory in 1859, before selling the factory to Bindschedler & Busch in 1884, renamed Chemische Industrie Basel, or Ciba for short. Ciba's first pharmaceutical substances were the antiseptic Vioform and the anti-inflammatory Salen in 1900.

The roots of Sandoz go back to 1886, when the chemical company Kern & Sandoz was founded by Dr Alfred Kern and Edouard Sandoz in Basel. In 1895, the company produced its first pharmaceutical substance, antipyrine, a remedy for fever. The lab brought many drugs to the market that have shaped the history of medicine, but none is as well known to the general public as LSD, also known as acid. The Swiss chemist Albert Hofmann first produced it in 1938 from lysergic acid, a chemical from the ergot fungus, and discovered its hallucinogenic properties by chance in 1943. The main purpose of the synthesis was to obtain a respiratory and circulatory stimulant (analeptic). LSD was introduced as a commercial drug in 1947 and became increasingly used in psychiatry over the subsequent ten years. The medication became a drug that, as a central element of the counterculture of the 1960s, was widely used in artistic circles, especially in psychedelic rock bands. These musicians attempted to recreate or reflect the experience of taking LSD in their music. Possession of LSD was banned in the United States in 1968. By contrast, the legally authorised and regulated psychiatric use of LSD continued in Switzerland until 1993.

In 1970, Ciba and Geigy merged to form Ciba-Geigy AG and in December 1996, it merged with Sandoz to form Novartis. This was the largest company merger in history and certainly one of the most successful in the pharmaceutical industry. Will this logic of concentration continue until a merger with Roche is achieved? Although such a merger is not on the agenda, it remains a possible option for the future of the two corporations, whose headquarters are less than two kilometres apart.

Novartis currently employs more than 76,000 people, two thirds of whom work in the Pharmaceuticals Division (Cardiovascular, Dermatology, Autoimmunity, Infectious Diseases, Metabolism, Neuroscience, Oncology, Ophthalmology, Respiratory Diseases, Rheumatology and Transplantation) and the rest in the other Divisions Alcon (Ophthalmology), Sandoz (Generics), Vaccines and Diagnostics and Consumer Health.

As with Roche, the digital transformation of healthcare is emerging as the major challenge of the near future. It is therefore no coincidence that the new CEO of Novartis since 2018 is Dr Vas Narasimhan, an American of Indian descent.

The Indian diaspora has become very influential in the high-tech digital world and now occupies important CEO positions such as at Alphabet, Microsoft, Adobe and IBM. As stated on the official Novartis website, the role of the CEO is to:

'lead a strategic and cultural shift at Novartis to build a world-leading pharmaceutical company based on advanced therapeutic platforms and data science.'

The great battle of data-driven medicine has begun.

ABB

Even though ‘made in Switzerland’ is one of the strongest national brands in the world, many foreigners confuse Switzerland with Sweden (or even Swaziland).

On 3 April 2018, the Swiss flag had the honour of flying from the facade of the stock exchange building on Wall Street to celebrate the launch of Spotify, the Swedish music streaming service. A fleeting moment of glory for the Swiss start-up ecosystem, for which our Swedish friends have kindly forgiven us, especially after they were able to take revenge in the semi-finals of the Ice Hockey World Cup six months later. In addition to the similarity in the sound of the name and population size, the two countries share many values, such as political neutrality, environmental protection and an affinity for high technology. The large technology group ABB, formed in 1988 by the merger of the Swedish ASEA and the Swiss company Brown Boveri, is certainly one of the symbols of this connivance.

With more than 105,000 employees in 100 countries (not including the 36,000 employees of the Power Grid division, which joined Hitachi in 2018), ABB is a global leader in many areas of industrial technology for power supply, transportation and infrastructure. Its activities are divided into four business areas: Electrification (hardware, digital solutions and services for low and medium voltage), Process Automation (industry-specific integrated automation, electrification and digital solutions), Mobility (electric motors, generators, drives and services) and Robotics & Discrete Automation.

How did we get there? It all started in Baden, a spa town 15 kilometres from Zurich, where the Englishman Charles Brown and the German Walter Boveri, two former employees of the Maschinenfabrik Oerlikon engineering factory, founded the company Brown, Boveri & Cie (BBC) in 1891. The company specialised in electricity and produced AC and DC motors, generators, steam turbines and transformers. It soon became a multinational corporation with subsidiaries in several European countries, transforming the city of Baden into a thriving centre for mechanical and electrical engineering, from which it set out to conquer world markets.

Switzerland as home, the world as a market

The export-oriented BBC quickly established itself abroad to secure its local position. It set up its own production facilities, first in Europe and, after the Second World War, on other continents. Germany started with a factory in Frankfurt (1895) and the founding of BBC Mannheim (1900). BBC was also present in France, Italy, Norway, Austria and many other countries before the First World War. In the interwar period, the company failed in North America, but after the Second World War, BBC/ABB conquered all the other continents.

Nevertheless, ABB did not abandon Switzerland. It built, modernised and expanded in Baden, took over the Maschinenfabrik Oerlikon engineering factory in Zurich in 1967 and Ateliers du Sécheron in Geneva in 1970. Switzerland has maintained its leading position in research and development, with the Corporate Research Center in Dättwil being one of seven such laboratories. It is regarded as the leader among the seven ABB research centres worldwide. ABB's global culture is deeply rooted in Switzerland and intends to remain so.

The founders

The two founders of BBC complemented each other very well. Charles Brown was the brilliant and creative engineer, and Walter Boveri (1865–1924) the businessman. Walter's son describes him as follows:

'While Charles Brown envisioned the design of each of his machines, my father foresaw their various uses in the service of human society.'

They also complemented each other in their origins: German for Walter (born in Bamberg) and English for Charles (born in Winterthur, but with an English father). This cultural openness was obviously very useful to them for the international development of BBC.

Walter was instrumental in gaining access to capital. He didn't have the half a million Swiss francs he needed to start his young business at the age of 26 . He had tried to write to banks all over Europe, but had received only negative replies. Fortunately, in 1890, he met the Zurich silk manufacturer Conrad Baumann, who took a liking to the young entrepreneur and allowed him to marry his single daughter. Walter Boveri received the money for his company from his father-in-law and founded BBC directly.

Without venture capital investors or a wealthy family, marriage was certainly the most effective way to secure seed funding for the start-ups of the time. Incidentally, this was an excellent financial operation for the Baumann family, which came out of the declining textile sector and was thus able to reposition itself in a new technological sector with a promising future. Note the identical approach of the Hoffmann family, wealthy silk merchants who financed their son Fritz four years later (see chapter on Roche).

As a visionary, Walter Boveri also strongly advocated the creation of new companies in the energy sector, complementing the engineering activities of BBC, which became the backbone of the Swiss electricity grid. In 1894, he was behind the founding of the Olten-Aarburg electricity plant, which later became Atel. A year later, Boveri acquired a second minority stake in a company he had started, Motor AG für angewandte Elektrizität. It specialised in the design and financing of hydropower plants worldwide, often in partnership with BBC. Motor AG built the Breznau and Löntsch power stations, which it sold to the power station in northeastern Switzerland, today Axpo. Motor AG later became Motor-Columbus AG, then Atel and, after the merger with French EOS, finally Alpiq. Today, Alpiq is active in electricity generation, service and energy trading in Switzerland and throughout Europe. The serial entrepreneur and captain of industry for transport and energy, Walter Boveri, bears many similarities to Elon Musk. They also share the same vision that the future will be electric.

With Skype and internet telephony, Swisscom will be dead in five years. When it was put to me by Pierre Chappaz on a podium in front of a full EPFL amphitheatre, I was somewhat taken aback and preferred not to answer.

I must say, I have great respect for this successful entrepreneur, pioneer of the internet in Europe, co-founder of Kelkoo, sold to Yahoo in 2004 for EUR 475 million, and of Wikio/Teads, sold to Altice in 2017 for EUR 285 million. I have to admit, I fear that he's right! It was the year 2005, shortly after the sale of Skype to eBay for USD 2.6 billion. One of Skype's main investors, Neil Rimer, co-founder of Index Ventures and European venture capital superstar, was also in attendance. The young, technology-loving public, who made extensive use of internet applications to make free calls, were convinced from the start. The reason for this was obvious: telecom operators would not survive in the face of new competition from peer-to-peer (P2P) networks.

Made popular by data sharing, such as the Napster application for music sharing, the P2P architecture allowed participants (or peers) to share some of their resources, such ascomputing power, storage space, or network bandwidth, directly with other network participants without the need for central coordination. In contrast to the traditional client-server model, peers were both providers and users of resources. The P2P culture was collaborative, based on free services, and fostered breakthrough innovations that would revolutionise many industries such as communications (Skype, WhatsApp), music (Spotify) and finance (blockchain). More than 80% of Swisscom's turnover in 2005, which was essentially based on minute- or volume-based pricing of communications, were at risk. How could you compete against free competitors?

Open internet

Taxing, restricting or even banning P2P applications was not an option. Switzerland has a liberal economic philosophy and promotes competition and freedom of choice in most markets. This has been the case for telecommunications since the liberalisation of the market in 1998 with the arrival of 250 active partners and competitors of Swisscom, the former Federal Post and Telecommunications Authority (PTT). Since 1998, Swisscom has been an independent listed company in which the Swiss state holds 51% of the shares. Swisscom plays along with its competitors and supports the principle of an open and free internet. It therefore supports the principle of net neutrality (without discrimination between data networks), unlike some US telecoms providers such as Comcast or AT&T. The

latter request the possibility of charging their customers for access to third-party services (e.g. YouTube, Skype or Netflix) in order to promote their own content. The Swisscom Code of Conduct, which was developed in cooperation with other operators in 2014, stipulates that all users in Switzerland should be able to use the content, services, applications, hardware and software of their choice. Subject to regulatory requirements, no services or applications may therefore be blocked or hindered.

Swisscom has responded to the emergence of free internet services by reducing tariffs to the point of abolishing volume-based or per-minute prices, which it has replaced with a package offering unlimited internet access and a wide range of digital offerings. For example, Swisscom has managed to compensate for the sharp decline in traditional turnover (about CHF 300 million less per year) by introducing new, very popular services: first mobile telephony, then high-speed broadband internet in the 2000s and finally, in the last decade, digital television.

Overall, Swisscom's stock market value remained almost at the same level as in the year of the IPO in 1998, almost the same EBITDA (CHF 4.5 billion in 1998, CHF 4.6 billion in 2023), while in the meantime more than CHF 30 billion in dividends have been paid out. This is a remarkable achievement in an international context in which most telecommunications companies that emerged from former state monopolies are in sharp decline:

BT Group, France Télécom/Orange, KPN and Deutsche Telekom have lost 80%, 80%, 62% and 20% of their value since Swisscom's IPO. The stock market value of Swisscom is currently 2.4 times and 1.9 times that of BT Group and KPN respectively, whereas in 1998 it accounted for around one third of these companies. Furthermore, Swisscom's value is now 94% of Orange's value, compared to 11% in 2018.

Open innovation

Before the arrival of the internet, most innovations came from public operators with huge labs such as AT&T's Bell Labs in the United States, which are credited with countless fundamental inventions such as radio astronomy, the transistor, the laser, the photovoltaic cell, the Unix operating system or the C++ programming language, as well as nine Nobel Prize winners. The European operators were also very powerful, with 5,000 employees at Orange Labs (France Télécom R&D). Swisscom was also heavily involved in research, with more than 400 researchers in the 1990s. Its achievements include the invention of the first prepaid payment option for mobile phones. In autumn 1995, the Telecom-PTT General Directorate presented the new NATEL® easy product as a 'revolutionary Swiss innovation', for which the pioneer Walter Heutschi was responsible. What was new at the time was that the card could be recharged as often as desired without having to take out a subscription. This was indeed a significant innovation, as prepaid cards now account for the bulk of global mobile revenue.

Swisscom is also a pioneer in cloud-based television with carrier grade classification. Swisscom launched its own platform, Swisscom TV, in 2012 with the aim of moving away from the standard solution used by most operators that is, however, expensive and inflexible. This enabled it to create new, differentiated functionalities at its own discretion (e.g. the replay feature) and to immediately gain a leading position in digital television in Switzerland. Ironically, Swisscom has overtaken Switzerland's historical market leader, the cable network operator UPC – called Cablecom until 2026 – in which it held around one third of the shares in the 1990s, but had to sell its stake for regulatory reasons. NTL bought Cablecom in 1998 for CHF 5.8 billion, which brought in almost CHF 2 billion for Swisscom. Other innovations in very different areas are also worth mentioning, such as a robot for laying fibre-optic cables in sewers or the environmentally friendly Mistral project, which enables significant electricity savings in Swisscom's telephone exchanges.

In the last twenty years, however, a fundamental change has taken place in the telecommunications R&D sector: Almost all major innovations have come from small, independent companies, i.e. start-ups, that were financed by venture capital and have become large telecommunications companies such as Cisco, Juniper Networks, Palo Alto Networks, etc. As a result, the operators' research centres have practically disappeared or are in the process of restructuring. They are now limited to applied product development with much shorter profitability targets. Swisscom therefore works with most of the key players in the IT, telecommunications and cloud worlds. In line with the principle of open innovation, Swisscom

integrates numerous technologies from external research to create easy-to-use solutions for Swiss consumers, both private individuals and companies.

In order to develop open innovation in collaboration with start-ups, Swisscom has been present in California in the immediate vicinity of the Stanford campus since 1999 (Swisscom Outpost). In addition, in 2007 it set up a venture capital investment unit, a so-called corporate venturing unit or corporate VC unit (Swisscom Ventures), which is described in detail in the following chapters. An important reason for the takeover of Fastweb, a young, innovative company founded in Milan in 1999, was the acquisition of start-up skills in line with this idea of openness, in a position to attack the established provider Telecom Italia. Swisscom maintained the independence of Fastweb in order to preserve its growth-oriented identity. The turnover of the Milanese company reached EUR 2.5 billion in 2022, 103% more than at the time of the takeover in 2007.

This dual culture enables Swisscom to better anticipate competitive dynamics and thus remain more agile and vigilant. 15 March 2024 was another important date for Swisscom:

Swisscom CEO Christoph Aeschlimann announced the acquisition of Vodafone Italy, which is to be merged with Fastweb.

With this transaction, Swisscom is showing itself to be an ambitious and dynamic pillar of the Swiss IT industry.

Digital transformation

Swisscom has focused on providing a telecommunications infrastructure of the highest possible quality. Over the past twenty years, Swisscom has invested more than CHF 35 billion in its Swiss networks. The telco is regarded as a pioneer in the telecommunications sector in terms of testing and the commercial introduction of new technologies. It was the first European telco to launch 4G in 2012 and 5G on 17 April 2019, just two weeks after the world leaders in the US and South Korea.

However, the challenges ahead are daunting. The higher the quality of digital networks, the more expensive they are and the easier it is to introduce the often free internet services that are in direct competition with network operators. The increase in bandwidth has thus enabled the mass entry of new players outside of internet providers, the so-called OTT (over the top) media services, such as Netflix (streaming) or WhatsApp and Zoom (messaging, voice, video). In the business world, network virtualisation in the cloud enables the replacement of old

infrastructures managed by telecommunications companies. Knowing that this trend is inevitable, Swisscom decided to develop its own virtual solutions, even if traditional services had to be cannibalised.

With 7,000 IT technicians and engineers, i.e. almost half of Swisscom's employees (excluding subsidiaries), the IT culture is becoming more and more pronounced.

The aim is to develop customised solutions tailored to the specific needs of the Swiss market, such as Swisscom TV (now known as blue TV) or cloud offerings, and to support the digital transformation of private and business customers. It is a dual mission: to build the digital infrastructure and to develop intelligent solutions for the Switzerland of tomorrow.

The most famous Swiss watchmaker is neither Swiss nor a watchmaker.

And yet Switzerland has no shortage of entrepreneurs who have given their names to famous watch brands. They enabled their country to maintain a quasi-monopoly on production in the past, with global export market shares exceeding 80% in the first half of the last century. The watch industry is mainly located in the Jura Arc, which stretches from Schaffhausen (IWC) via Biel (Tissot, Omega, Swatch) to Geneva (Rolex, Patek, Vacheron Constantin) and is closely connected with the immigration of the Huguenots. After the Edict of Nantes was revoked by Louis XIV, expelled from France in 1685, these French-speaking Protestants settled in Geneva and brought with them their skills in goldsmithing, finance and commerce.

And yet I have chosen to highlight another immigrant, Nicolas Hayek, the creator of the Swatch Group. Born in 1928 in Beirut, Lebanon, he studied mathematics and physics at the University of Lyon before completing an internship as an actuary in Zurich, where he met his wife in 1949. His long professional career can be divided into three periods spanning 60 years, first spending a dozen years in his father-in-law's small foundry, where he became a specialist in steel. At the age of 35, he founded and headed the consulting firm Hayek Engineering Inc., which grew to 250 consultants over the subsequent twenty years. The iconoclastic boss, who did not mince his words, didn't hesitate to question his clients: 'The rarest resources are entrepreneurial profiles in top management.'

In 1983, he carried out an assignment from Swiss bankers to oversee the liquidation of two large watch companies in serious trouble: SSIH (Omega and Tissot brands) and ASUAG (Longines, Rado and ETA). Competition from Japanese brands such as Seiko and their electromechanical quartz watches (with battery and integrated circuit) was so great that the Swiss industry was on the verge of collapse in the 1970s. At the time, few people believed in the future of the Swiss market. But Nicolas Hayek's assessment was that Switzerland could survive if it restructured its activities and repositioned its brands: 'ASUAG, for example, owned more than 100 separate companies. Most of these companies had their own marketing, research and development, and assembly. It was crazy.' He advised merging the two groups and investing heavily in the automation and standardisation of parts and tools in order to achieve economies of scale and better quality.

He was so heavily involved in the reorganisation of ASUAG and SSIH, which led to a merger, that in 1985, he took over the majority of the new company with a group of Swiss investors. At the age of 58 years, he became Chairman of the Board of Directors and CEO of what would become the Swatch Group, his third career.

The Swatch revolution

Parallel to this restructuring, the ETA group, led by Ernst Thomke, developed a very innovative concept with watchmaking engineers Elmar Mock and Jacques Müller: the Swatch. Above all, it was a technological innovation, using the smallest possible number of parts (51), i.e. only one third of a traditional watch, thus reducing production costs without compromising quality. But this colourful plastic watch was also a commercial revolution with extravagant marketing and a unique brand identity. Launched in 1983, it was a worldwide success that enabled Switzerland to recapture much of the lower price segment in the watch market that it had lost to Japanese manufacturers.

Ten years later, the dashing 60-year-old Nicolas Hayek set his sights on a new 'career' and tried to apply to the car the same principles that made his watches so successful. His revolutionary concept, which he first called Swatchmobile, envisaged the development of a mini-city car with electric motors built into the wheels and a body whose colours could be changed at will according to the Swatch philosophy. As a visionary, he even envisioned a self-service rental system for his cars. In 1994, Hayek signed an industrial partnership with Mercedes-

Benz under the name Smart. The two-seater car was introduced in 1998 but was less successful than expected. Swatch withdrew from the project and the joint venture was taken over 100% by Mercedes-Benz in 2006. In 2019, Daimler decided to refocus on fully electric versions and sold 50% of Smart to the Chinese manufacturer Geely in order to accelerate penetration of the Chinese market.

Future challenges

Only death from cardiac arrest at his workplace at the Swatch Group headquarters was able to stop Nicolas Hayek's creative momentum. He was 82 years old. The Hayek family still owns 40% of the company, which is led by their children Nayla (Chair) and Nick Junior (CEO).

Currently valued at CHF 11 billion, Swatch faces a major challenge: the increasing competition from smartwatches.

Apple alone sold 53 million Apple Watches in 2022 (+15% on 2021), i.e. half more than the total of 15 million watches sold by all Swiss manufacturers. What is even more worrying is that this trend is accelerating as more and more young consumers, the customers of the future, are choosing smartwatches and digitalised wristbands over their parents' analogue watches. Will the watch industry succeed in reinventing itself for the digital challenge, as Swatch did 40 years ago?

Bringing the world of tomorrow to a higher level. What a sensible company mission!

For the global market leader in escalators and number two in lifts, 'a higher level' can be understood both literally and figuratively.

This is about more than just marketing: more than 1.5 billion people use the urban mobility systems developed by the Swiss company 24 hours a day, 7 days a week. With 6,000 employees in more than 100 countries, the multinational corporation is heavily involved in our urban life without us even really being aware of it. Schindler manufactures and maintains vertical urban mobility systems and offers a range of services to make cities smarter. Coming from the world of mechanical engineering and electrical engineering, the company has changed over time and is becoming increasingly digital.

Schindler was a pioneer in public traffic management with its destination control system. It interacts with users, limits access and optimises traffic flow at peak times. It also provides digital services for remote monitoring of facilities or turns elevators into media platforms to inform, entertain or display advertising.

It all began in Lucerne in 1874 when the 24-year-old apprentice mechanic Robert Schindler founded the collective society Schindler & Villiger together with Eduard Villiger, who left the company after 18 years. Robert Schindler was strongly committed to improving the conditions of workers, building houses (e.g. in Littau) and introducing the 59-hour week(!) in 1894. Originally specialised in agricultural machinery, Schindler turned to the manufacture of elevators with the boom in hotel construction at the end of the 19th century. The company quickly expanded abroad and opened its first branch in Berlin in 1906. It was even the first Western company to establish an industrial joint venture with the Republic of China, the China Schindler Elevator Co., founded in Beijing in 1980.

Schindler employs more than 30,000 specialist engineers and invests heavily in innovation.

The company also finances new external activities. For example, it provided EUR 150 million for the start-up BuildingMinds, which was launched in Berlin in 2019. Schindler is the sole shareholder, but allows the start-up to operate independently. It has developed a cloud solution that enables building owners to manage all their properties and service providers centrally.

'The need for data-based intelligence in management is great and growing. This will close a long-standing gap in the development of smart buildings.'

– Silvio Napoli, Chairman/CEO

With turnover of more than CHF 11.5 billion in 2023, Schindler has generated a comfortable return on sales (EBIT margin) of 10.3%. Its valuation has risen to CHF 25 billion, i.e. ten times the value in 2000 and a hundred times the value in 1980! With its evolution from a simple mechanical workshop to a global market leader in its industry, Schindler is a good example of a hidden champion, a discreet high-tech SME that has, over time, become one of the mainstays of Swiss industry.

Grounding – a word that still reverberates in Switzerland's collective unconscious as a national trauma, a disgraceful economic debacle. At 4.15 p.m. on 2 October 2001, the loudspeakers at Zurich Airport announced the suspension of all Swissair flights.

All the planes on the ground, 40,000 stranded passengers worldwide and the announcement of the bankruptcy of Swissair, which could no longer afford to buy kerosene. This scenario, which was terrible for a brand's image, was seen by the Swiss population as an embarrassing failure. As the flag bearer of Switzerland, the airline conveyed values such as reliability and quality all over the world, and travelling with Swissair was a hallmark of success. This sudden end seemed incomprehensible. In fact, the national airline was known for its financial strength, which earned it the nickname 'the flying bank'. How could it come to this?

Like Icarus, it crashed and burned in the 1990s with an aggressive external growth strategy known as Hunter. It acquired shares in Sabena of Belgium, Volare of Italy, Air Littoral of France, Air Europa, AOM, LTU of Germany, South African Airways and LOT of Poland for a total of USD 17 billion. With 72,000 employees worldwide, proportionally more than its competitors, and lax management of operating costs, Swissair was weakened. The aviation crisis following the attacks of 11 September 2001 dealt Swissair the final fatal blow. The Swiss Parliament approved financial support of CHF 2.1 billion for the continuation of Swissair flights until a new company was established under the umbrella of Crossair, a subsidiary of Swissair that was still profitable. Despite numerous waves of redundancies, the company was still oversized and loss-making.

It was finally sold in 2005 for EUR 310 million to German rival Lufthansa, which restructured it into one of the group's most profitable subsidiaries. With turnover of CHF 5.3 billion in 2023, it generated a profit of CHF 718 million with 8,600 employees. While retaining the name 'Swiss' and the white cross in the logo, it still embodies traditional Swiss values in terms of product quality and service, and Switzerland's honour remains intact.

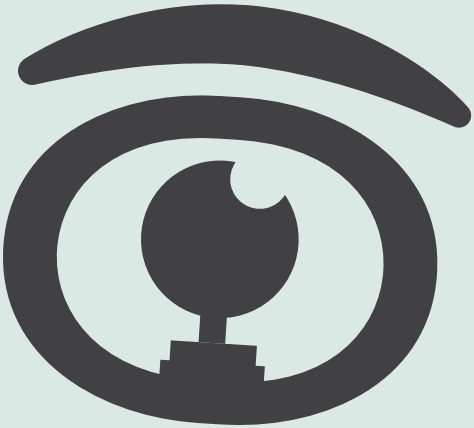
Nevertheless, this success after the demise of Swissair has left a bitter aftertaste, since it highlights an avoidable industrial failure. The Swiss government took a critical look at this in order to learn from its mistakes, which in turn made it possible to better manage subsequent crises, in particular the rescue of the banking sector in 2008, which benefited UBS in particular.

The megalomania that brought down Swissair is atypical of Swiss business culture.

Of course, the past is peppered with sensational bankruptcies, such as that of the Erb Group in 2003, the second largest bankruptcy in Swiss history after the Swissair Group. At that time, the Erb conglomerate comprised 82 companies (including sales of the Suzuki, Mitsubishi and Hyundai car brands) with 4,900 employees and a turnover of CHF 4.5 billion.

Industrial crises

Switzerland is characterised by its ability to overcome deep structural crises and to reposition itself in promising sectors. Switzerland's share of international trade in watches fell by 85 to 90% between the two world wars, by 79% in 1946 and from 40% in 1970 to 13% in 1982 due to competition from Asian quartz watches, before a positive dynamic developed again in the 1990s thanks to Swatch and luxury brands. International competition has also led to a sharp decline in the textile industry over the last century. The technical expertise in the mechanisation of weaving and dyeing of fabrics enabled the emergence of new industries such as machine tools and chemicals. These also came under pressure at the end of the 20th century, but are now shifting their focus to robotics, biomechanics or personalised medicine. Overall, Switzerland is one of the few industrialised countries that has managed to maintain full employment and high price stability despite oil price crises, structural industrial crises and currency crises.



Hidden Champions

The term 'hidden champion', first mentioned in 1990 by German Professor Hermann Simon, refers to the extraordinary network of small and medium-sized export companies in Germany, the famous SME class. Of course, these hidden champions also exist in Switzerland;

they are highly successful companies, but they are very discreet and relatively unknown to the public. According to Professor Simon, they are defined by three criteria:

A The company must be in the global top three or number one in its continent, in its industry

B The company must have a turnover of less than USD 5 billion

C The company mustn't be widely known about.

The Swiss hidden champions specialise in niche markets in which they aspire to become global leaders. According to Credit Suisse's 2014 SME study, this is particularly the case in the following areas: precision instruments (58% of SMEs in this sector see themselves as world leaders for at least one product), watches (27%), mechanical engineering (22%), electrical engineering (19%), plastics (17%) and pharmaceuticals (14%). Hidden champions are active on the global market right from the start of their business development in order to achieve economies of scale and compensate for the limitations of their market. They work very close to customers, which allows them to better serve specific market needs. They establish themselves as market leaders through performance, not through low prices. They focus on quality, total cost of ownership (TCO), high performance and customer proximity.

Professor Simon also noted that these companies have a high level of vertical integration. They work with their own processes, which prevent imitation by competitors. Their corporate culture is based on hard work, intolerance of underperformance, low sickness rates and high employee loyalty. Most of the hidden champions are based in small and medium-sized cities.

Very often, management lies in the hands of a family whose style is authoritarian in strategic matters, but participatory at the operational level. Managers identify with the company and stay in the company much longer than in large corporations. Hidden champions like the principle of not spending more than they earn and prefer to finance themselves for as long as possible, therefore making little or no use of venture capital. They take the time to develop their business at their

own pace, usually over several generations. They remain very discreet in terms of their market shares, which in very specific niches sometimes account for 70 or 80% of the global market. Their managers avoid risky diversifications, but do not hesitate to make targeted acquisitions. Having a long-term strategy allows them to pursue global leadership without the pressure of having to sell to their competitors.

Are the historical values of the hidden champions still relevant in the New Economy? Yes, of course they are! Swiss entrepreneurs can only benefit from the long tradition of coming from a culture of perfectionists, a high-quality dual education system and a pragmatic elite. The Swiss entrepreneurial culture is a curious blend of local technical expertise and the efficient management of global and multicultural organisations.

The consistency of these entrepreneurial characteristics over the last 150 years is striking. Today's start-ups can look to the international expansion strategies of successful companies, such as Schindler in China (1980) or Logitech in the US (1982). The global market leaders Straumann and Sonova are also excellent examples from which typical single-product start-ups in the deep tech environment can learn.

I wrote this chapter primarily in response to the many pessimistic comments about the lack of entrepreneurship in Switzerland, particularly in relation to young people. These comments are objectively wrong. Switzerland has one of the most successful entrepreneurial cultures in the world. I hope that the encouraging examples of the hidden champions in this chapter will inspire aspiring entrepreneurs.

I have been living in Switzerland for almost twenty years and it was only while writing this book that I discovered that the medical technology company Straumann is no ordinary SME, as its origins led me to believe.

Judging by the dwarf size of the Bernese village of Waldenburg (1,135 inhabitants), where Reinhard Straumann founded the humble research centre Straumann AG in 1954 and was based until 2003, in my opinion it could only be an SME. This impression was reinforced by the choice of location for the new Straumann production plant in 2000 in the Jura village of Villeret (800 inhabitants). How wrong I was! I made the classic mistake of underestimating the economic power of SMEs in the Jura Arc, which is known for its discreet factories for watches, micromechanics and precision medical devices. Straumann has now moved its headquarters to Basel, but remains discreet – and extremely efficient.

Let me demonstrate this with an example: the company is valued at almost CHF 23 billion on the stock exchange, meaning Straumann would be in the top thirty of the German DAX, on a par with BioNTech and even ahead of the Société Générale on the French CAC 40. This figure is directly related to the exceptionally profitable growth of this flagship Swiss medical technology company: between 2014 and 2023, turnover more than tripled from CHF 800 million to CHF 2.7 billion. As a global leader in the field of dental implants, the Straumann Group, which has 10,500 employees, also supplies instruments, biomaterials, CAD/CAM-made total prostheses, digital devices and software for dental applications.

Its impressive success is based on a culture of very high quality and considerable investment in research to achieve the highest possible precision.

This innovation policy enabled Straumann to become the global market leader in osteosynthesis implants between 1970 and 1990, based on a licence from the AO Foundation. This activity was spun off into a spin-off called Stratec Medical, which later merged with Synthes. CEO Thomas Straumann succeeded in an impressive strategic repositioning with a focus on implantology. He subsequently expanded the group through targeted acquisitions in the areas of biomaterials (Kuros Biosciences) and digital dentistry solutions (Dental Wings), enabling him to offer a complete solution for dentists, clinics and laboratories worldwide.

Like Straumann, we must recognise the exceptional innovative power of companies specialising in high-precision industries that have faced numerous crises in the watch industry, precision engineering and microelectronics. Straumann itself has been able to transform its business model several times over the course of its history. Between 1954 and 1970, the company specialised in alloys for timekeeping devices and in materials testing, which are still used in the watch industry today. A breakthrough in the use of non-corroding alloys for the treatment of bone fractures prompted Dr Fritz Straumann to enter orthopaedics and thus open the second chapter of the organisation's history. This is a company that has never ceased to amaze us.

If the strong ties between the US and Switzerland in the high-tech sector had to be symbolised by one person, it would be by Hansjörg Wyss,

the absolute epitome of the American dream of the generations of the second half of the 20th century. After completing his civil engineering studies at ETH Zurich, the young man from Bern visited the United States in 1958 and took a summer job as a surveyor at the Colorado Highway Department. His passion for the American West was so great that he later earned his MBA at Harvard and founded Synthes USA, which he sold to the American pharmaceutical company J&J in 2012 for USD 21 billion. His 40% stake in the shares was valued at USD 8.7 billion. Today, Hansjörg Wyss lives in the state of Wyoming and is regarded as one of the biggest patrons in the world. The Wyss Foundation, for example, intends to invest USD 1 billion to help indigenous peoples preserve 30% of the Earth's surface in its natural state by 2030. The record donation of USD 400 million to Harvard made it possible to finance the Wyss Institute to develop technologies inspired by nature (bio-inspired engineering). In Switzerland, the Wyss Institute, which belongs to ETH Zurich and the University of Zurich, and the Campus Biotech in Geneva were established – thanks to a generous donation from the American-Swiss philanthropist.

Hansjörg Wyss, however, is not the inventor of Synthes; this is a trademark registered in 1960, belonging to the Association of Osteosynthesis (AO/ASIF), which was founded in 1958 in Biel by thirteen Swiss doctors. Synthes' main innovation involves osteosynthesis, a surgical procedure in which the fragments of a broken bone are held together with body-tolerant screws and metal plates. At that time, there were practically no surgical treatments for fractures, which, back then, were simply treated for weeks with pushing/pulling or plaster casts. This often led to misalignments, limited mobility and muscle wasting, meaning that subsequent rehabilitation often took months. The idea of Synthes was to achieve early and functional rehabilitation by firmly fixing the bone fracture. The work of AO also led to the development of the AO classification for fractures, which has become an internationally recognised standard. Today, the non-profit AO Foundation is the world's leading organisation for education, innovation and research in the field of surgical trauma treatment with an international network of 20,000 surgeons and research centres in Dübendorf and Davos.

The Synthes technology was initially licensed to the Swiss industrial partners Straumann and Mathys. Synthes USA, founded in 1977 by Hansjörg Wyss, is the third company to enter into an alliance with AO. As an executive from the aerospace industry, the 40-year-old Wyss was a newcomer to the world of medical technology. His interest in Synthes was aroused after meeting a surgeon working

in the field. Wyss spent two years learning about the orthopaedic industry and set out to market Synthes in the US. Over time, he managed to buy out his Swiss competitors and became the global market leader in the implant segment. He merged with Stratec in 1999, a spin-off of Straumann, and bought Mathys for USD 1 billion in 2003.

From scratch, with no medical training or experience in the world of medical technology and venture capital financing, Hansjörg Wyss has accomplished the feat of creating a value of more than USD 20 billion in less than 27 years.

He has identified a technology with high potential from Swiss research, developed it internationally and then consolidated his field of activity without losing control of his company. A prime example of capital efficiency.

‘Discover, discover, discover,’ Rolland-Yves Mauvernay, the founder of Debiopharm, often enthused when talking to his employees.

Overflowing with energy, he never stopped working until his death in 2017. He died at the age of 95 and left behind a company based on his model: discreet but very dynamic and winner of the Swiss Biotech Success Stories award in 2020.

‘Rolland-Yves Mauvernay was a person of incredible curiosity and always enthusiastic. He managed to develop a unique business that was later copied by other players,’ says Benoît Dubuis, director of the Biotech Campus in Geneva and co-founder of Eclosion, the seed fund of the life-science incubator. In fact, Debiopharm’s model focuses on the middle stage of the biotechnology value chain: drug development. The company acquires licences for biological products and molecules with interesting development potential. The company develops the products with a view to global registration and licenses pharmaceutical partners to market and sell them. ‘Three characteristics distinguish Debiopharm: developing molecules to become drugs, outsourcing as much as possible and remaining private,’ says Thierry Mauvernay, president of the group. ‘Like an architectural firm that doesn’t build itself, but designs a house and supervises the work, Debiopharm employs the most competent experts possible for every job.’ This targeted approach enables the 420 staff to manage a large development pipeline of 17 trials, 10 of which are in phase I, II or III clinical trials. This is a considerable number. For example, the four products developed by Debiopharm in 2008 have already generated turnover of USD 2.6 billion.

Born in Limoges, France, in 1922, Rolland-Yves Mauvernay came to Switzerland at the age of 55 after meeting an American Nobel laureate who was working on a molecule to fight prostate cancer. ‘The board of the laboratory I had put him in contact with did not understand the significance of this discovery and rejected the product. So I came here,’ Rolland-Yves Mauvernay told a Swiss journalist from La Gruyère in 2013. The founder was inspired by Antoine de Saint-Exupéry, author of the famous *The Little Prince*. On every floor of Debiopharm’s Lausanne headquarters, there is a quote from him. I’ll never forget this one:

‘You shouldn’t try to predict the future, you should make it possible.’

A mouse in Swiss cheese

Even though the computer mouse was developed and commercialised in California, an important step in its development is directly linked to EPFL.

The mouse was invented in 1963 by Douglas Engelbart at the Stanford Research Institute and introduced to the public in 1968. The first modern computer with a mouse was the Xerox Alto in 1973. It was based on a trackball, which, due to the friction of the ball on the table, allowed the pointer to move on the screen. In 1979, Jean-Daniel Nicoud, a professor at EPFL, invented the sensor-based Depraz mouse, which was marketed by Logitech. Logitech subsequently developed several generations of optical mice, which eventually displaced the mechanical ball system from the market because the latter was prone to dust formation. Contrary to popular legend, Apple did not invent the mouse, but made good commercial use of the operating license acquired by Xerox and equipped the computers Lisa in 1983 and later Macintosh.

Smaky in front of the Mac

Professor Nicoud was also a computer pioneer with his microcomputer Smaky, which was produced in 1974 in EPFL's Digital Computing Department (which would become the LAMI Laboratory of Microinformatics), two years before Apple Computers was founded. Smaky was marketed in 1978 by EPSITEC AG and equipped with various software such as editors, simulation programs and drawing tools. There was a portable version with a motherboard in the keyboard, but it was above all the operating system that made Smaky a powerful computer for its time. From the Smaky version (1980) onwards, the microcomputer became a pre-emptive multitasker and had a graphical interface with windows. Professor Nicoud, also the designer of the CALM standard, a universal assembly language for microprocessors, was at the forefront of research, but did not meet Steve Jobs to commercialise Smaky, whose development was discontinued in 1995.

Logitech

Professor Nicoud found an exceptional entrepreneur, Daniel Borel, who marketed the mouse with great success from 1983. However, Nicoud had to wait around ten years before this innovation, which had already existed in his EPFL laboratories in 1972, could become a spin-off company capable of producing it on a large

scale. Born in Switzerland in 1950, Daniel Borel earned an engineering degree in physics from EPFL and a master's degree in computer science from Stanford in 1977. He met Pierluigi Zappacosta on the California campus, and together they set about developing a word processing system, a prototype of which was delivered to the Swiss company Bobst. The team was later joined by Giacomo Marini, a former Olivetti engineer, who founded Logitech in 1981. Daniel Borel led the company until 2008. He currently sits on the Board of Directors of Logitech (Honorary Chairman) and Nestlé.

The company, which has been listed on the NASDAQ since 1997, now has a value of about USD 10 billion and 6,000 employees, started out modestly. From its first offices in an old family farmhouse in the municipality of Apples overlooking Lake Geneva, a rural Swiss version of the legendary Californian garage, Logitech initially focused on graphic software. The company conducted an initial feasibility study for an image editor project for Ricoh. The development work was then moved to Palo Alto, California, at Ricoh's request, to bring the teams closer together. Daniel Borel, who remained in Switzerland, was responsible for acquiring the first distribution licence for the so-called Depraz mouse, which was developed by the watch manufacturer Dubois Dépraz AG in collaboration with Professor Nicoud. He marketed it under the name P4 from 1982 to 1984. The first mice were made by Dubois Dépraz in the nearby Vallée de Joux, known for its watch factories such as Breguet, Audemars Piguet and Jaeger-LeCoultre.

The next generation was produced in the farmhouse in Apples, after which the production moved to Taiwan in 1986 and China in 1994.

Initially positioned as original equipment manufacturer (OEM) for the large American corporations (HP, Apple, AT&T), the company also successfully launched direct sales with its own brands at the end of 1985. Known for product quality, cutting-edge design and intuitive user interfaces – a strategy reinforced by the appointment of a former Apple executive, Guerrino De Luca, as CEO in 1998 – Logitech quickly became a leader in its field, thanks in part to global innovations such as the wireless infrared mouse, the thumb-operated trackball and the laser mouse. Logitech has diversified into a variety of peripheral devices such as keyboards, microphones, joysticks, universal remote controls, headsets, online information sharing tools (webcam, video conferencing) and, more recently, in particular, streaming through the acquisition of Streamlabs in 2019.

How was this Swiss start-up able to establish itself in an extremely competitive industry dominated by Americans and Asians without venture capital financing? Admittedly, the timing of the company launch was particularly good for riding

the wave of PC development. But above all, it was the quality of the team that made the difference, combining world-class technical training with an opportunistic and ambitious commercial approach. Studying at Stanford, in the heart of then-emerging Silicon Valley, entrepreneurs Borel and Zappacosta saw the innovations of the future and set up shop in California in Logitech's second year of business to meet the needs of a client (Ricoh). This move made Logitech a global company, with a holding company and research centres in Switzerland near the EPFL campus, operational headquarters in Fremont, California, and large factories in Asia. In addition, the entrepreneurs were able to implement an aggressive policy of organic and inorganic growth, financed by an initial public offering in Zurich in 1988 and on the NASDAQ, where they raised USD 66 million in 1997.

Pivoting

The name Logitech is derived from the French word logiciel (in English: software), which shows that the initial project was far removed from the company's core business, which would later focus on hardware. This pivoting is typical of agile and opportunistic technology companies. For this reason, venture capital investors often choose to 'bet on the jockey, not the horse' in the seed phase, when the risks and uncertainties are greatest. This means relying on a highly qualified team and trusting them to develop a product that meets the needs of the market. You have to be patient, because this process is often iterative, following a trial-and-error principle.

Miniaturisation of high-tech, high quality, global leadership in a growing niche: what Logitech has achieved in informatics has been achieved by another Swiss company in the world of healthcare, namely Sonova.

It was spring in the year 2000. The number five player in the global hearing aid market had just passed the billion-dollar mark. Andy Rihs, Chairman of the Board of Directors, had reason to be satisfied, as this value was five times higher than that of the IPO in 1994.

At the age of 58, he had just handed over the operational management of the company to Peter Pfluger when he was contacted by Canadian competitor Unitron Industries to explore opportunities for a partnership. The question was: is it better to take this opportunity to sell, or take the risk of trying to move further upwards?

Andy had held the reins of the family business for 34 years. His father Ernst had taken over marode AG, an electroacoustics company, in 1965 and renamed it Phonak. In 1966, the sons Andy and Hans-Ueli and Beda Diethelm joined the company and took over the management and the majority of the shares. In the early years, Phonak marketed hearing aids with high amplification for children with severe deafness. As early as the 1970s, the company successfully exported its products to the United States. With the establishment of subsidiaries in Germany, France and Denmark in the 1980s, Phonak continued its international expansion. Major investments were made in the development of new technologies, such as the PiCS HörComputer hearing device introduced in 1992, the multi-microphone AudioZoom technology and receivers for wireless audio transmission.

In November 1994, Phonak went public with a turnover of CHF 100 million. With acquisitions in Belgium, Italy, the Netherlands and Spain, but above all with the introduction of the first all-digital hearing system Claro, Phonak tripled its turnover in five years by the year 2000. Andy Rihs saw the sense in merging with Unitron. Together, the two companies would become number three in the market, behind Siemens and William Demant. Unitron looks back on a very similar story to Phonak: it was led by three founders who entered the hearing-aid market in 1964, invested early in digital technology and then expanded internationally through acquisitions. Unitron's Nexus chip platform was the first in the world to improve the performance of hearing systems through software-only upgrades.

Andy Rihs didn't want to sell his life's work; his goal was to make Phonak a global leader with quality technology, a strong brand and global distribution. He succeeded in persuading the management of Unitron to sell their company to Phonak, and the acquisition for CHF 160 million was completed in November 2000. Unitron's management team was integrated into the group, whose total turnover in 2001 reached more than CHF 500 million.

Andy remained very attached to the company as Chairman of the Board of Directors, remaining true to his vision until his death in 2018 – and with great success! The company, which was renamed Sonova in 2007, has become the global market leader with turnover of CHF 3 billion, 14,000 employees and a market capitalisation of CHF 14 billion in 2020. Based in Stäfa on Lake Zurich, Sonova has overtaken the previous market leaders Siemens (now WS Audiology) and William Demant.

Sonova shows how important it is to have an ambitious, very long-term objective, without giving in to the temptations of an early sale.

For a life without limitations (Sonova's advertising slogan), you have to take your destiny into your own hands.

Sensirion

The charming town of Stäfa on the shores of Lake Zurich has 15,000 inhabitants and is home to a second hidden champion, less than 250 metres from Sonova: Sensirion, the world's leading manufacturer of digital microsensors.

Sensirion is a good example of a company that focuses entirely on a single product type, defining itself as a sensor company exclusively. Thanks to this specialisation, the company has achieved significant market penetration rates in the automotive sector (one third of new cars manufactured worldwide use its sensors to monitor interior air and temperature), health (monitoring the ventilation of ten million patients) and industry (heating, ventilation and air conditioning, household appliances, gas meters, etc.).

Sensirion, which was founded in 1998 by physicists Felix Mayer and Moritz Lechner as a spin-off of ETH Zurich, focuses on innovation and high quality. The company therefore invests heavily in research and has a highly skilled workforce (approximately one in four of its 1,300 employees has a doctorate), which is essential in order to differentiate itself from strong competitors such as Honeywell or Bosch. The patented CMOSens® technology enables an intelligent sensor system by merging sensor element, digital intelligence, calibration data and digital interface into a single miniature chip measuring just 1.2 millimetres. Sensirion produces almost half a billion sensors per day.

In 2018, the company completed the IPO with a valuation of CHF 500 million. Today, the company has a market capitalisation of CHF 1 billion and turnover of around CHF 250 million.

Thanks to the increased use of environmental sensors in our daily lives, the company has some good years ahead of it.

Now, although its products might not be considered trendy by the general public, it's time to talk about Switzerland's most famous 'secret' winner,

who produces high-performance plastics (for automotive construction, mobile phones, shop windows) and speciality chemicals (adhesives for clothing, automotive electronics, packaging, etc.). The head office in Domat/Ems (8,000 inhabitants) in the Grison Alps isn't particularly spectacular either. But what it has going for it is that the owners are well-known political figures. Christoph Blocher, the figurehead of the Swiss People's Party (SVP), Switzerland's largest party with 25 to 30% of the vote, recently retired from politics. His daughter Magdalena Martullo-Blocher is a member of the National Council and now heads the EMS Group.

This company originated in the company Hovag, which was founded in 1936 by Werner Oswald to manufacture a fuel additive for vehicles based on methyl alcohol. Christoph Blocher, who earned a doctorate in law after an apprenticeship in agriculture, joined the company as a young law student at the time. In 1972, he became Chairman of the Board of Directors. After the founder's death, Blocher bought the company in 1983, which was in trouble at the time. It was an extraordinary deal. Today, the listed company is worth CHF 19 billion. The Blocher family owns 70% of it, making it one of the ten richest families in Switzerland.

With 2,700 employees and sales of CHF 2.4 billion in 2022, the EMS Group generated a cash flow of CHF 585 million, or 24% of turnover – a return that anyone would dream of. It demonstrates Switzerland's astonishing ability to maintain a high level of competitiveness in heavy industry, despite being one of the countries with the world's highest wages and strictest environmental regulations.

Johann Schneider-Ammann, President of the Swiss Confederation in 2016, is also a leading industrial entrepreneur. This kind of dual career is very atypical outside of Switzerland.

The G7 members have never been represented by captains of industry, apart from Donald Trump and Silvio Berlusconi, who were not industrialists, but real-estate and media tycoons. Schneider-Ammann, an engineer at ETH Zurich and an MBA graduate (Insead), joined the Ammann family by marriage and led the group from 1990 to 2010. His son Hans-Christian Schneider, the current CEO of Ammann, represents the sixth generation of the family.

Ammann is a leading global supplier of asphalt mixing plants, machinery and services for the construction industry. The company was founded in 1869 by Jakob Ammann as a mill construction company, subsequently switching to road construction. In 1908, the company patented its innovative Macadam machine, a combination of asphalt mixer and finisher that could remove dust from cars. In the 1980s, Ammann expanded to Europe and then to Asia.

The company now has eight production facilities in Switzerland, Germany, Italy, the Czech Republic, India, China and Brazil.

Headquartered in Langenthal, a small town with 15,000 inhabitants in the canton of Bern, the Ammann Group now employs around 3,000 people.

Johann Schneider-Ammann works in the difficult mechanical engineering industry, which is in crisis in most European countries, and is a good example of the uniqueness of the Swiss boss: he manages to combine economic success with political commitment, in keeping with the militia system, which calls on citizens to take responsibility for the community in all public matters. This is unique in Europe.

ETH Campus

ETH Zurich is one of the world's leading universities in science and technology and stands for excellent education, research, and innovation.

Through its pioneering research projects and close collaboration with industry, ETH Zurich makes a crucial contribution to solving societal challenges.

Nestlé Headquarters

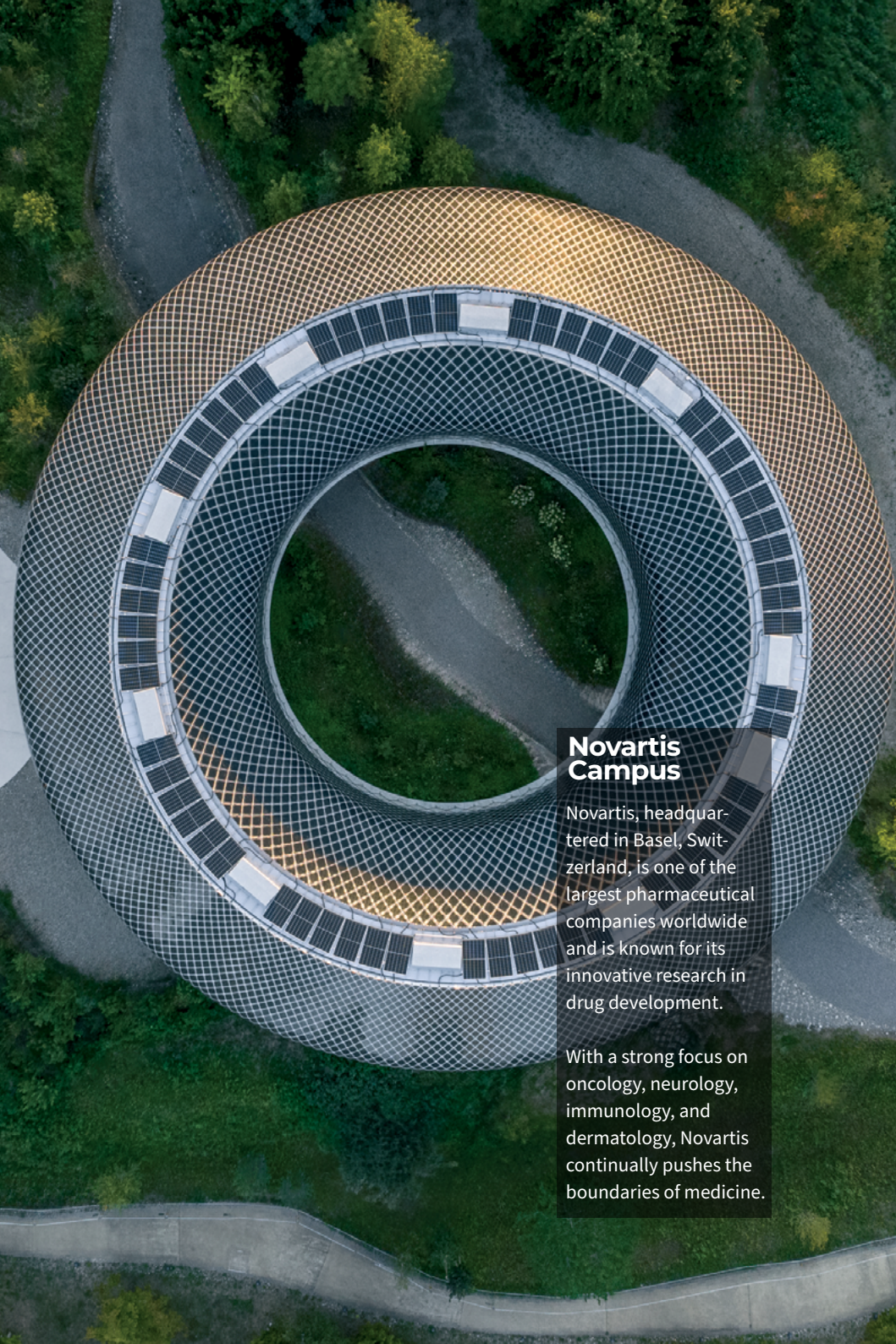
Nestlé, headquartered in Vevey, Switzerland, is considered one of the largest food companies worldwide.

Since its founding in 1866, it has evolved into a global symbol of innovation and quality in the food industry.

ABB

ABB, a globally leading technology company, drives innovation in electrification, automation, and digitalization.

Through its wide range of technological solutions and commitment to research and development, ABB plays a crucial role in shaping a more productive and sustainable future.



Novartis Campus

Novartis, headquartered in Basel, Switzerland, is one of the largest pharmaceutical companies worldwide and is known for its innovative research in drug development.

With a strong focus on oncology, neurology, immunology, and dermatology, Novartis continually pushes the boundaries of medicine.

EPFL Campus

EPFL, based in Lausanne, Switzerland, is among the leading technical universities in Europe, specializing in cutting-edge technology and interdisciplinary research.

With a strong focus on areas such as information technology, life sciences, and sustainability, EPFL promotes innovations that transform society and industry.

The Business Model 2.0

The first part of this book is devoted to describing the historical model of Swiss entrepreneurship – a clear success story. The model has proved its resilience, adapting perfectly to industrial change and globalisation.

It therefore makes no sense to fundamentally question the model. However, it must evolve to meet the new challenges of the 21st century, such as competition from American digital giants and Asian high-tech manufacturers. Today, problems of technological sovereignty are looming, which may endanger the prosperity of many of Switzerland's economic pillars. There is an urgent need to ask the right questions and to react firmly before it's too late. How can Switzerland position itself in this new, globally competitive environment? What plan of action should be implemented in practice? These are the questions addressed in the second part of this book.

Creative destruction

Switzerland needs to reinvent itself to remain competitive in the digital age. It must confront the natural and unstoppable erosion of established systems – the famous creative destruction described by Joseph A. Schumpeter (1883–1950). This 100-year-old concept is still so relevant today that it deserves a few lines here. The Austrian economist, who emigrated and became an American citizen, emphasised the important role of innovations and entrepreneurs for economic and social development. In his 1939 book *Konjunkturzyklen* (Economic Cycles) he explained that economic growth goes through three successive cyclical phases: innovation, followed by a temporary monopoly, and finally an imitation phase.

Innovations occur in clusters – that is, they are grouped around a breakthrough linked to a major technological advance, such as the introduction of new manufacturing processes, the use of new raw materials, or new markets opening up.

The success of these innovations inevitably leads to the concentration of capital, i.e. the formation of large companies run by executives (and no longer entrepreneurs) with the aim of optimising a monopolistic income. Finally, there is the phenomenon of imitation, which leads to market saturation and a drop in profitability, leading to a fall in investment and subsequently a fall in activity. The crisis can only be overcome by further waves of innovation.

In Schumpeter's view, crises are beneficial and necessary for economic progress. They make the permanent transformation of capitalism and questioning established positions possible. During a monopolistic period, the economic and social order becomes entrenched, blocking dynamic initiatives. This slows down the flow of innovation and paves the way for a recession period, and eventually crisis.

Schumpeter therefore sees the entrepreneur as an 'economic revolutionary' who plays a fundamental role in the process of change. In his view, capitalism can only develop if the spirit of entrepreneurship, which is its only source of strength, persists. Schumpeter points out that an entrepreneur not only strives for profit, but is also driven by emotional considerations such as the dream of creating a private fortune, the thrill of victory and the joy of creation. 'The entrepreneur is an ingenious character who embarks on adventures whose consequences he cannot measure,' he notes with a touch of irony.

In this vein, it's essential for Switzerland to promote the emergence of large companies in order to compensate for the planned decline of existing industries. Access to capital is essential to boosting creative forces. Schumpeter shows the vital role of the banker in the process of innovation. In his view, only the investor should bear the financial risks of innovation. The entrepreneur is not the owner of the capital invested by him: he borrows it from the capitalist. In the modern world, venture capitalists fulfil this function, which is essential for the smooth functioning of the innovation ecosystem.

The longevity of Switzerland's historic champions is remarkable, but offers no guarantee for the future. Rather, it's a risk factor – especially in areas undergoing rapid change, such as the finance or industrial sectors. Large pharmaceutical and food companies have been able to continuously reposition themselves thanks to, for example, aggressive corporate takeover strategies and investments in R&D. But how many large companies have experienced decline after poorly managed diversification? Creative destruction is at work everywhere – and it's accelerating. The figures speak for themselves: the average lifespan of the top 500 companies in the US is only 18 years, compared to 61 years in 1958. McKinsey estimates that 75% of the companies listed in the S&P 500 will be gone in ten years. They are either bought out, merged or go bankrupt.

That's why innovation is so important for the economy and society in general. It renders certain sectors obsolete (destruction) and at the same time contributes to the emergence of new industries, which in turn fuels growth and jobs (creation). This is, according to Schumpeter, 'the engine of capitalism'. Even though large corporations have the most important R&D resources at their disposal, disruptive innovations mainly come from outside established structures.

The case of Nespresso within Nestlé is the exception that proves the rule. In his 1911 *Theorie der wirtschaftlichen Entwicklung* (Theory of Economic Development), Schumpeter concluded that

'As a rule, the new does not grow out of the old, but steps alongside the old and outcompetes it'. It's up to us to draw the political conclusions and direct Switzerland towards the opportunities of the future, rather than trying to defend the achievements of the past.

Moving from a family model to a universal market

The world is changing fast and nothing is self-evident. Some of the competitive advantages that Swiss entrepreneurs had in the past are disappearing. Access to capital, knowledge, technical know-how and unparalleled global research facilities used to be the preserve of a few very wealthy countries, including Switzerland. Now, Switzerland is taking part in a global competition that challenges these privileges. The traditional Swiss business model, based on inheritance and a relatively closed network, is now competing with highly competitive platforms, where the world's best talent has direct and international access to capital, human, technological and commercial resources. The more mobile the talent, the more effective the system. Geographic origin is no longer a fundamental asset, as entrepreneurs and researchers can move to the most attractive innovation centres.

This is a consequence of the globalisation strategy of Western countries. The systematic relocation of their production sites to low-wage countries has also led to know-how transfer. Exporting countries such as China obviously did not want to settle for the unsatisfactory position of low profitability and high pollution. They've risen up the industrial value chain and have reversed the balance of power. Europe and the US have become dependent on Asia for a number of strategic high-tech materials, e.g. electronic components, photovoltaic modules and computers. Switzerland does indeed export the machine tools needed to manufacture these products – but for how long?

On the other hand, the concentration of production capacity in the Far East, which Western countries have pursued in order to reduce their production costs, is now opening up unimaginable investment opportunities for market leaders. The Taiwanese company TSMC's new factory, which will produce processors for the automotive and consumer industries from 2027, will be built in Japan as part of the Japanese government's onshoring strategy. This USD 20 billion investment will enable TSMC to achieve a significant technological advantage, including in research.

The Internet has globalised access to knowledge, even in the most advanced scientific fields. Nowadays, information circulates at the speed of light between billions of people. Access to the most expensive research infrastructures will be democratised thanks to virtual reality. For example, the fast-growing Labster company, which Swisscom Ventures holds a stake in, enables students from around the world to simulate physics, chemistry or biology experiments in 3D on their computers or mobile phones. New technologies for education (edtech) have the potential to democratise scientific education in the medium term.

Finally, resources for research, innovation and entrepreneurship are becoming increasingly accessible through venture capital and online finance platforms such as crowd funding or blockchain-based listings. Start-up costs have fallen dramatically with the advent of the cloud, open source software and 3D printing, lowering entry barriers for entrepreneurs. Swiss companies are now facing international competition, which is increasingly emerging in high-value industrial segments. In this open environment, by far the most important competitive factor is the strength of the financing ecosystem from the early stage (venture capital) to the maturity stage (stock exchanges and M&A). This factor is essential because it is the pre-condition for all the others. Capital makes it possible to attract the best human and technical resources and buy out competitors in order to gain a dominant position. As a direct consequence, the size of innovative industries is directly related to the amount of money invested in their development. This is the central thesis of this book.

Venture capital – the ecosystem's weak link

The importance of venture capital is massively underestimated in continental Europe, and in particular in Switzerland. When I take part in panel discussions, I am always amazed at how much we get bogged down in peripheral issues such as the taxation of stock options or the fragmentation of the European market. There is no consensus on this within the ruling class. Some are discouraged ('We can't fight GAFAM', 'We don't have enough good projects', 'Young Swiss people don't want to take risks') and others are complacent ('We are world champions in innovation', 'There is no shortage of money in Switzerland, good start-ups always find it'). All these arguments justify a certain amount of immobility, but lack ambition and long-term vision.

A 'politically correct sprinkling' or small doses of venture capital is not the answer. Europeans are heavily funding R&D costs and the high-risk seed phase without reaping the strategic benefits, Because without the ability to invest billions, they cannot compete on an equal footing with Americans or Asians in gaining leadership in a market of the future. The status quo is very unsatisfactory and dangerous for the future of the old continent, both for young companies and for established corporations.

Conquest strategy

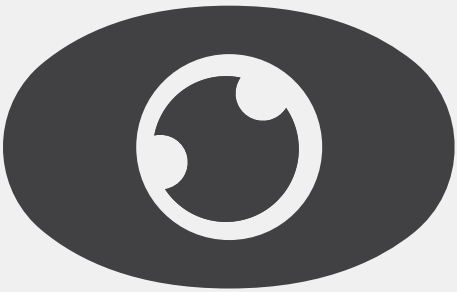
We have seen that, unlike other small nations, Switzerland has in the past pursued a bold industrial strategy of direct competition with dominant economies. It has succeeded in exporting products globally and gaining leading positions in strategic industries such as health and food. However, it has yet to succeed in asserting itself in the new digital world. In this respect, Switzerland pursues a policy of complementarity with the dominant economies – a classic survival mode for small nations that provide employees and niche technologies to the large digital companies. This approach may help limit the damage. But is this really to be Switzerland's the fate?

Why shouldn't it pursue the same strategy of conquest in the digital world as it did in the past with precision products? Why should the results of research, for which Switzerland devotes enormous resources, systematically fuel innovation from foreign competitors? Switzerland is dependent on the major digital powers, with serious consequences for all traditional industries that are currently being digitalised. Isn't it time to regain a degree of technological independence in order to secure prosperity and freedom?

Yes, it's absolutely possible! Switzerland has all the assets of a world-class innovation cluster: R&D infrastructure, highly qualified staff, a high-tech industrial cluster and a reputation for quality. What's missing are the financial resources to match the ambition of conquest. If the Swiss government is not as committed as other European countries, then a strong commitment from institutional investors (banks, insurance companies, pension funds), wealthy individuals (family offices) and large Swiss companies is essential. In this regard, you carry great responsibility. These investments are attractive because they can be both profitable and strategic for Switzerland's technological positioning. Without local investors, the only alternative will be to depend on foreign investors, as in the past (77% of VC figures have come from international funds in the last decade). The choice is yours!

Overall, in my view the Swiss business model appears to be very well adapted to a high-tech world, especially in the highly specialised deep tech sector, which requires multidisciplinary expertise in software, hardware and life sciences. The factor of extensive VC financing simply needs to be integrated. The following chapters therefore analyse the Anglo-Saxon model and propose concrete measures to adapt venture capital to the specific needs of the start-up ecosystem and Swiss culture.

The book concludes with a CHF 50 billion investment programme over ten years in eleven moonshots – in other words, very ambitious technology projects designed to make Switzerland the deep tech nation of Europe.



Technological Sovereignty

What degree of independence should Switzerland strive for when it comes to strategic technologies?

The question is not without controversy. The Central Committee of the Chinese Communist Party has set 2035 as the date by which the Middle Kingdom aims to be technologically autonomous, even adding that it wants to become the world's biggest innovator, challenging America's technological leadership. Donald Trump's presidency accelerated Chinese awareness of its dependence on the US, particularly for computer components (processors and memory) and software ecosystems. The United States is itself committed to a path towards sovereignty, symbolised by bans on Chinese companies such as Huawei. In addition, the FIRRMA Act gives the CFIUS wide powers to prohibit foreigners from acquiring or even investing in technology companies that are sensitive to national security.

Europe is caught between the technological ecosystems of China and the US and is suffering the consequences of the confrontations between these great powers. Recent challenges in supplying surgical masks, vaccines and electronic components have highlighted the importance of controlling the production chain in one's own territory in the event of a crisis. Geopolitical considerations in technology purchase decisions and relocations to Western countries are now on the agenda, which was unthinkable five years ago. Not only the economy and public health are at stake, but also national security. A serious computer attack or disruption in the supply of raw materials or critical components (such as semiconductors) can slow down or even paralyse an entire continent. Digital deterrence is now as important as military deterrence in the geopolitical balance of power. The question arises as to whether the priorities of our national budget are still in line with the realities of the modern world. Europeans spend USD 216 billion on their armies yearly, but neglect to invest in their fundamental technological interests. This chapter offers many concrete examples to illustrate the urgency of the situation.

This is a sensitive issue for Switzerland, as it is too small and too dependent on its export economy to actually be able to strive for complete technological independence.

Sovereignty is a fashionable concept because it expresses a nation's desire for unrestricted power without outside interference. But in a globally interconnected technological world, I find it nearly impossible to imagine full sovereignty except for the superpowers China and the US. As a country with a liberal culture, Switzerland must participate in international trade without succumbing to short-term protectionist temptations. In any case, boycotting foreign products would have a direct and immediate impact on Swiss export products. Extreme positions (isolationism or total globalisation) are poisonous. We must find a sensible middle point in order to maintain a good balance of power in future international relations.

The solution for Switzerland lies in the continuity of its 200-year-old economic strategy: neutrality, democracy (prioritising human capital) and entrepreneurship in advanced technology. These three assets will allow it to flourish – in a world defined by the logic of blocs, or even in the scenario of a technological 'Cold War' between great powers. Neutrality allows for an independent third way – essential, for example, for trust in data protection or intellectual property. It also provides access to markets around the entire world without having to choose sides. Liberal democracy promotes the development of human capital and remains one of the great strengths of Europe in general and of Switzerland in particular. This point should not be underestimated – I believe it's key to the long-term development of a society based on innovation and creativity. Finally, Switzerland has all the cards to capture certain global leadership positions by focusing on specific niches based on historically strong clusters that are very high value.

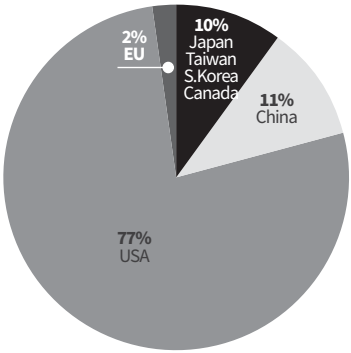
Instead of talking about sovereignty, Switzerland needs to follow a fluid logic of technological interdependence.

In certain areas it will succeed in adopting strong positions that will give it a say and a level of negotiating power. In other, it must be content with a partial reliance (dependence) on dominant technologies that it cannot fight. This pragmatic, semi-independent approach follows the tradition of realpolitik, which continues to be a strong point of Switzerland's today.

Europe's dependence on Big Tech

Due to its small size and geographical location, Switzerland shares the same fate as the rest of Europe: technological dependence. In this chapter, we will take a continental perspective to better understand the nature of the problem along the entire high-tech chain, from the production of electronic hardware to software and online services. The challenges are enormous. Europe suffers from a serious problem in its high-tech industry, which is dominated by foreign giants. The figures speak for themselves.

Market share of the top 25 high-tech companies worldwide



It's hard to believe, but Europe's share of the 25 largest high-tech market capitalisations in the world, known as Big Tech, is just 3%. There are only two European companies in this top group: ASML, the Dutch supplier of lithography machines for the semiconductor industry, and the German IT group SAP. My definition of the high-tech segment corresponds to the category of 'technology stocks'. This includes companies developing new, advanced technologies, both for hardware (semiconductors, telephones, computers, etc.) and for software and Internet services. The pharmaceutical industry, by definition, does not belong to this group, despite its strong technological orientation.

Even if we include the three largest pharmaceutical companies (J&J, Pfizer and Roche) in the top 25 high-tech companies, the European market share remains a negligible 6%. Note the omnipresence of companies financed by venture capital, which have become world leaders within 20 years and pushed technology giants like IBM, HP or Siemens into second place.

The situation is alarming. Europe has been excluded from participating in the digital world, like a bipolar Yalta: Asia controls hardware production chains, while America undisputedly dominates software and services. Excluding ASML, Europe has produced very few dominant global technology leaders in strategic market segments. Nevertheless, Europe has been the cradle of many researchers, inventors and entrepreneurs who have shaped the history of new technologies. How can this decline be explained?

Asia now controls the entire value chain of the global electronics industry, from raw materials to the production of hardware.

Rare earths

Rare-earth metals with special electromagnetic properties are needed to manufacture electronic devices (mobile phones, TVs, computers), hybrid/electric motors and many industrial components (alloys, catalysts, X-ray tubes, fluorescent lamps, lasers). China recognised the strategic importance of these metals 30 years ago and decided to reduce its dependence on the United States, which controlled more than 60% of world production in 1984. And did so with considerable efficiency: China now accounts for more than 83% of world production.

Semiconductors

Semiconductor production is an important geopolitical issue. It began in the 1960s with the invention of integrated circuits and the first electronic chips and was first under American control (Fairfield, Intel, Texas Instruments) before the Japanese companies NEC, Toshiba and Hitachi became the global top three in the 1980s. After that, the US regained economic dominance in the industry, which is now dominated by the giants NVIDIA, Intel and Broadcom, as well as South Korea's Samsung. Europe has disappeared from the global top ten. How could they neglect such a strategic industry?

To understand, we have to go back to the 1980s. At that time, Europe had very large high-tech companies such as Philips and Siemens, each with more than 350,000 employees. Under pressure from foreign, mainly Japanese, electronics manufacturers, Western countries decided to significantly outsource their production to Asia in order to optimise costs. They became fabless and focused on product design, marketing and sales. Production was seen as a barrier to dispose of as quickly as possible. The same was true of research and technological development. 'Too expensive and complicated to manage for most board members,' a former Philips executive told me. The new fabless concept was the miracle solution to offload the dirty work.

Philips was the first customer of today's global market leader TSMC to be actively involved in establishing contract manufacturing for semiconductors, known as the foundry model. Philips did not realise the strategic importance of this outsourcing activity. In 2008, it sold its 16% stake in TSMC for USD 8.5 billion. This stake in TSMC would be worth USD 99 billion today, which is 420% more than Philips' valuation. In addition, Philips sold 80% of its semiconductor business when it founded NXP in 2006. Today, NXP has a stock market valuation of USD 61 billion, similar to that of Philips. Ironically, Philips is also the originator of ASML, the world's leading manufacturer of scanners for microprocessor, which it co-founded with ASM International in 1984. However, Philips sold half of its shares when ASML was listed on the Nasdaq in 1995, at a value of approximately USD 800 million, and sold the other half in subsequent years. Today, ASML shares are 460 times more valuable (USD 368 billion). Philips was thus the creator of three semiconductor giants, all of which were sold prematurely without benefiting from a total value added of USD 800 billion. No comment.

The other European leaders of the past, Siemens and Thomson, followed a similar path with the relocation of their production and the subsequent spin-off of their semiconductor business into independent companies, Infineon and STMicroelectronics. Europe's politics seem to be losing interest in its champions. Europe did not intervene in Qualcomm's attempted acquisition of NXP in 2017 (which was halted at the last minute by a Chinese blockade).

In the meantime, TSMC has built up an oligopolistic position, with 61% of the world's semiconductor production for foundry services. The company is now valued at over USD 600 billion. The fabless model has the great advantage of encouraging innovation by lowering entry barriers and allowing entrepreneurs to bring products to market without having to build unaffordable production facilities. As a result, the United States has spawned extremely powerful fabless companies such as the microprocessor manufacturers Qualcomm and NVIDIA, which are financed by venture capital. Unfortunately, due to the lack of competitiveness in its startup finance ecosystem, Europe has not been able to produce this new generation of electronic leaders. As an investor, I have experienced this time and again (see the Quantenna story).

Worse still, Europe is dependent on Asia for its supply of electronic components, making it vulnerable to geopolitical and logistical crises. Many multinational companies such as Volkswagen had to slow down or stop production in 2020 because of problems with the supply of microcontrollers. To date, Bloomberg has estimated that the automotive industry has lost sales of USD 60 billion due to supply. NVIDIA and TSMC suppliers argue that the automotive industry is not a priority for suppliers because it is less profitable than, say, the mobile phone sector. Renault vs Apple: who wins?

Europe now has only 6% of the world's semiconductor production capacity (irrespective of the nationality of the factory owners). The European Commission is aware of the problem and has set a target of 20% by 2030. It is negotiating with the major manufacturers in order to bring them into Europe. The new Biden administration has also committed itself to reviving US semiconductor production with a USD 50 billion plan – an all-time low. Taiwan is still at the top, along with South Korea. China and the US recently invested significant resources to further boost semiconductor production.

Moreover, Asia is moving up the value chain to design and market their own products, as Samsung has brilliantly demonstrated. US sanctions against companies like Huawei have only accelerated this trend. The Chinese government has stepped up its efforts to supply itself with semiconductors to secure its supply chains. It's therefore all the more important to promote the emergence of young, innovative Swiss companies in this field, such as Sensirion, Atolight or Kandou Bus.

Electronics

Asia clearly controls global electronics production (components and finished products), with a market share of more than 60%, of which China holds 40%. What a radical change! Western manufacturers now produce only 30% of electronics, whereas their market share was 75% in 1995. Europe holds some strong positions as suppliers of machinery and instruments to electronics manufacturers. Swiss expertise in microelectronics has long been recognised and deserves to be utilised commercially through increased investments.

Telecommunications

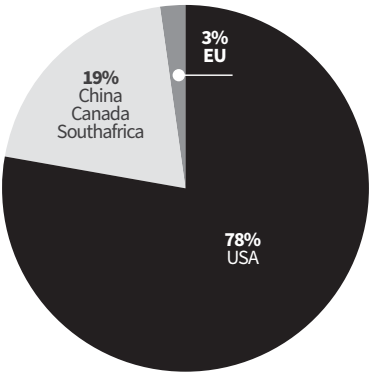
The market for telephone sets is another example of the hegemonic conquest of Asian corporations. Europeans had a pioneering role in mobile phones thanks to Ericsson, Alcatel, Siemens and, of course, Nokia, which claimed up to 50% of the global mobile phone market in 2007 before falling to 3% in 2012. Today, Europe's share of the global smartphone market is only 1% (Nokia-HMD, Fairphone, Wiko). Asian manufacturers (Samsung, Huawei, Xiaomi) now produce almost 85% of the devices sold. Considering that Apple's smartphones (14% of global production) are also manufactured in Asia, in particular by Taiwanese Foxconn, we are not far from 100% production in Asia… In terms of telecom network infrastructure, the situation for Europe is more favourable thanks to the two Scandinavian leaders Ericsson and Nokia. However, with low profitability and valuation of only USD 19 and 20 billion (March 2024) respectively, they appear to be quite vulnerable, despite their global leadership in network infrastructure and strategic importance for 5G. The Chinese company Huawei remains the global number one, despite US sanctions. Although sales growth has slowed down (3.9% in 2023), it remains higher than that of its European competitors due to the size of the Chinese market, which is reserved for it. Free trading Europe, on the other hand, does not have a strong EU preferential policy to favour its own producers of telecommunications equipment.

Photovoltaic modules

The development of Europe's position in the manufacture of solar modules is equally dramatic. The majority of the top ten manufacturers of photovoltaic modules in the world are Asian. Fortunately, increasing numbers of European companies are slowly establishing themselves in this vital industry, e.g. SMA Solar Technology from Germany.

However, Western countries initially held a very strong position in this market. French physicist Becquerel discovered the photovoltaic effect in 1839. He noted that some semiconductor materials are able to generate electricity in direct sunlight. In 1954, The American Bell laboratory developed the first applications of photovoltaic cells for household appliances and for powering satellites in 1958. The Japanese company Kyocera began large-scale production of polycrystalline silicon in 1982. In the 2000s, Germany pursued a very ambitious policy to promote solar energy, which led to the emergence of many German producers. American also entered this promising market… until China decided to enter the race with huge subsidies and investments. The result was immediate: in 2009, production capacity of global industry was twice as large as the market and prices plummeted. It was carnage for the Western countries. Within a few years, most German (Q-Cells, Sovello, Solon, Conergy, Phoenix Solar, Solarworld) and American (Solyndra, which received USD 500 million from the US government) manufacturers went bankrupt or were taken over by their Asian competitors. Western countries lost their photovoltaic industry in less than 10years.

Can European manufacturers find a way out of this desperate situation? Perhaps the Swiss industrial manufacturer Meyer Burger, headquartered in Thun (BE), can provide some answers. In 2019, the company launched an attempt to revive European industry with a radical change in strategy. Up until then, the manufacturer of machinery for the solar industry mainly supplied Chinese customers. The company had concerns about protecting its intellectual property and chronic losses, despite its undisputed technological leadership. It decided to stop supplying its Chinese customers and to transform itself into a European manufacturer of solar modules. The direct consequence of this realignment was an 80% fall in sales (CHF 407 million in 2018 to CHF 90 million in 2020, CHF 135 million in 2023).



Meyer Burger planned to cover one third of the annual demand for new European modules by the middle of the decade. CEO Gunter Erfurt described his new strategy as follows: 'We can be competitive mainly because of a high degree of automation that reduces labour costs. In addition, for sales within Europe, transport costs from China are eliminated, which currently account for up to 10% of the total cost of photovoltaic modules. Not to mention the fact that this increases the carbon footprint of the modules coming from the Far East.' While Meyer Burger has tried to take up this ambitious challenge in recent years, unfortunately these efforts do not yet seem to be fully successful.

Startups like Insolight, which has launched solar modules with 30% efficiency on the market, setting a new world record, give hope.

Europe has made the serious mistake of neglecting its manufacturers of high-tech production systems in favour of focusing on services and application software. It's no miracle cure, because the competition is also fierce here.

Another major challenge for the Swiss model is the emergence of exceptionally powerful global platforms. The digital transformation in itself is not a problem for Switzerland, rather, it's an opportunity to improve the efficiency of its products, services and infrastructure.

In fact, Swiss universities produce highly respected software engineers and start-ups with high-quality software. The large industrial, financial and pharmaceutical companies have been undergoing a digital transformation process for many years. The fundamental problem lies elsewhere: the loss of control over the decisions made by the big digital companies (functionalities, ethical and cultural considerations), the profits and the user data (people and objects) generated by the digital revolution.

Market share of the top 25 digital companies worldwide

Switzerland and Europe are totally dependent on the major US software platforms, which control 90% of the digital economy in terms of market capitalisation (see chart on the right). Europe has only one digital company in the top 25 in the world (the German SAP), accounting for just 1.8% of the total market capitalisation. What a shame! Europeans are being dominated in almost every digital category. How did it come to this?

Digitalisation: a missed historic opportunity for Europe

It all started so well. Europe has been the cradle of most of the scientists behind modern information technology. The first mechanical calculators were invented in 1623 by the German Schickard and in 1642 by the Frenchman Pascal, and finally perfected in 1673 by the German Leibnitz. Mathematician Ada Lovelace, daughter of the British poet Lord Byron, can be considered the world's first programmer, having designed a series of punch-card programmes for Charles Babbage's analytical machine in 1833. The Englishman Alan Turing made important contributions to the theory of computer science (Turing machine, 1936) and to the theory of artificial intelligence (Turing test, 1950). The invention of the first computer, in the sense of electromechanical calculators with limited memory and programming, is attributed to the German Konrad Zuse in 1938 with the Z1. Although most computer inventions after World War II were made on American soil, they were often the work of Europeans who emigrated, such as the Hungarian von Neumann, who was responsible for the architecture of programmable memory computers in 1945, or the Italian Federico Faggin, who designed the world's first microprocessor at Intel in 1971.

Europe has been competing with the United States for decades in the fields of computers, telecommunications and electronics. After IBM, which dominated the computer market until the 2000s, German Siemens and Dutch Philips were comparable in size to their American rivals Xerox, Unisys, HP and Texas Instruments. The English (Racal, Plessey), French (Alcatel) and Italians (Olivetti) were also not far behind. Introducing a telematics service in 1980, France was already a pioneer a decade before the advent of the Web (WWW). As the world's first true home computer terminal, the Minitel enabled 9 million households (25 million French people) to consult a wide range of information services, such as telephone books, dating sites, mail order services and gaming sites. It used the French communication network Transpac, which itself anticipated the Internet's future transmission infrastructure. Despite its great commercial success (EUR 1 billion in sales in 1993, at a time when the Internet was still in its infancy), Minitel did not succeed in internationalising and closed its doors in 2012. A similar interactive service (the BTX) was introduced in Germany in 1983 and discontinued in 2001. So many missed opportunities!

Europe has long been home to many of the world's best mathematicians

(46% of the Fields Medals between 1936 and 2022, the equivalent of the Nobel Prize for mathematics). It had the intellectual resources to become the global epicentre of computer science but did not know how to transfer technology to industry. Americans were the first to recognise the strategic importance of computer science, combining massive funding with academic prestige to promote the sector. Professor Vetterli illustrates this with the following observation: while universities in the United States have been talking about computer *science* for decades, European academia has long hesitated to give it equivalent academic status, preferring to call it 'information technology'.

How can the decline of European industry in the field of strategic IT be explained? Are these mistakes of industrial strategy? To be sure, there have been many mistakes, for example, over-industrialisation, a lack of political vision to support the domestic high-tech sector and the blindness of executives to technological disruption such as smartphones. But the Americans, too, have made mistakes with the loss of important electronics markets and the demise of former flagships such as Motorola, Lucent, GE, IBM and HP. Is the problem related to the entrepreneurial genius of Silicon Valley icons compared to the old Europe establishment? This explanation is unsatisfactory because Europe regularly tops innovation rankings and is home to exceptional entrepreneurs, like the many Swiss featured in the first part of this book. Does Europe lack digital competencies? Not really: with 5.5 million of all computer engineers in the world (25%), Europe has one million more than the United States (4.4 million). So, what is the source of Europe's mismanagement of high-tech governance?

An attempt to explain

The answer is obviously multifactorial and complex. But one thing is clear: Europeans have invested less in their future than their American and Asian competitors. They've taken fewer risks and retreated into defensive positions. This has been constant over the last 50 years and is the crux of the problem. I will not go into a detailed analysis of investments in basic research or development in large companies, as they seem to me to be adequate globally and in line with Europe's share of world GDP (23%). This book focuses on what I believe to be the most critical point: venture capital financing of external innovation in startups, especially with regard to the largest rounds of financing that are critical to achieving global leadership. This is vital because the promotion of new generations of entrepreneurs enables a continuous regeneration of the economy.

The weaknesses of the champions become opportunities for startups.

This entrepreneurial renewal is all the more important because state intervention is weak. European governments are not willing or able to protect their national champions, as the Chinese government is doing with Tencent and Alibaba. From a liberal perspective, the best protection is the production of a new generation of powerful technology leaders. This requires a level of investment comparable to that of competitors. This is all the more true as the current economic struggles will be decisive for the governance of the future digital world.

Shifting value to the digital giants

The information revolution that began about 50 years ago is profoundly changing modern society. Economically, it increases productivity and reduces costs through automation and intelligent use of data. But this doesn't take place in an egalitarian way – on the contrary, it strongly polarises wealth creation. Digitalisation is shifting the profits of entire industries across national borders towards globally operating digital platforms. Unfortunately for Europe, the vast majority of these mega-platforms are American or Chinese. European companies are like Gulliver in the world of the Brobdingnag giants. This is problematic in industries where economies of scale are essential over the long run.

Without drastic changes, the current system will further increase Europe's dependence on Chinese and American technology platforms (hardware and software). This also applies to areas that are still protected today, such as health, transport and education. The isolation imposed by COVID-19 will go down in history, beyond the human drama, as a unique catalyst for digitalisation. Countless psychological, regulatory and entrepreneurial barriers disappeared in one fell swoop. People tried working from home, telemedicine and virtual education, and have developed a taste for it – there is no going back. The stakes are high. For example, the company that offers the best algorithm for personalised medicine based on the analysis of the largest amount of data (genetics, medical history, fitness, nutrition, etc.) will dominate the markets for prevention, prediction, tailored treatment and rehabilitation. This mega-platform will dominate the direct relationship with the end consumer and thus access to the market. Suppliers will become dependent on it, including the pharmaceutical and food companies that are so powerful in Switzerland.

This oligopolistic trend is reconfirmed in the public cloud, an absolutely strategic area in the long term. It is nothing more and nothing less than the Internet infrastructure that will host most of the software and data from all over the world in the future. The world market leaders (Amazon, Microsoft and Alphabet) already have a combined market share of 55% and are growing faster than the rest of the market.

Even the established telecommunications providers, who are predestined to control this market, will be sidelined. Worse still – the three cloud giants will become so powerful that they will start building their own local data centres, such as in Switzerland, in order to eliminate local operators. The irony is that public cloud providers will have grown thanks to Internet networks, which the telecoms industry will have financed to the tune of hundreds of billions of dollars. GAFAM will then exert such competitive pressure that they can buy the weakened incumbents' national infrastructure at low cost and eventually complete their network with satellites.

This is not fiction: Amazon has announced that it will invest CHF 10 billion to launch a constellation of 3,200 satellites capable of transmitting the Internet to Earth. SpaceX has begun its programme to launch 25,000 satellites (ten times the number of satellites currently in orbit), and in March 2023 Salt announced a partnership with SpaceX to expand Salt's mobile network in Switzerland with Starlink satellites. This fleet of satellite will enable cloud applications anywhere in the world, further increasing their scale and attractiveness. It's coming full circle.

Europe's dependence

If we do nothing, it is clear that markets will strengthen their oligopolistic structures, as we have already seen with Google's 91% market share in Europe. The economic and social consequences are enormous and largely underestimated. Not only are many European digital industries being further marginalised in the face of American competition (telecoms, media, IT, Internet), but traditional industries and services are being particularly challenged. Even Europe's flagship industries such as tourism, food, pharmaceuticals and automotive will have to adapt their business models to face competition from digital companies. We've already seen it through Amazon's impact on retailers and their suppliers. This is just the beginning. Amazon is on its way to becoming a bank, a media company, a transport company, a telecommunications company, the dominant public cloud and soon, I'm sure, a major player in the healthcare sector.

This dynamic of extreme polarisation in the platform economy (winner takes all) is based on two fundamental competitive advantages: economies of scale in terms of size and data utilisation. The logic of consolidation means that half a dozen market opportunities worth several thousand billion dollars each can be pursued. For example, the leader in personalised medicine with the best algorithm for prevention and care will have an enormous advantage over its competitors. Who wants to entrust their health to a second-rate doctor? The market for autonomous vehicles operates along the same lines. Who will risk driving with a less secure algorithm? Other opportunities include the most cost-effective

and secure cloud infrastructure, the global online shopping platform with near instant delivery at the best price, and the most competitive digital bank in terms of cost and financial returns.

The major challenge for Switzerland and Europe is to position themselves intelligently to take part in the race for mega-platforms.

They are already far behind. Americans are already selling these visions in their storytelling. Apple is clearly positioning itself on health and is investing in research to improve Apple Watch health data. Apple has set up its own AC wellness clinics to learn how to make better use of technology in the healthcare field. A Californian venture capitalist working with Apple told me that shortly before Steve Jobs died, he told his close associates: 'The future of Apple is health!' It's a wish his team takes very seriously.

Abuse of the market-dominant position

There's therefore an urgent need for action, both at continental and national level. At the European level, the abuse of dominant positions must be tackled more decisively. This is also the view of US Congress members: 'As Google became the gateway to the Internet, it began to abuse its power,' argued David Cicilline, chairman of the House Judiciary Subcommittee on the Administrative State, Regulatory Reform, and Antitrust. He describes it as a 'walled garden' that virtually ensures that any company that wants to be found online has to pay a fee to Google. Or with regard to Amazon: 'Isn't it an inherent conflict of interest for Amazon to produce and sell products that compete directly with third party sellers?' he stated. 'Congress must act.' Conclusion: 'These companies as they exist today have monopoly power. Some need to be broken up. All need to be properly regulated and held accountable.' The Chinese authorities opened an investigation against Alibaba in December 2020 on the same grounds: suspicion of monopolistic behaviour. They blocked the November 2020 IPO of Ant Group, Alibaba founder Jack Ma's online payment company, and asked him to reduce his operational scope. Europeans are very passive when it comes to the abuse of market-dominant positions. Furthermore, according to Thierry Breton, European Commissioner for Internal Market, GAFAM's tax optimisation of accounts to a loss of EUR 100 billion for European countries.

Boiling frog syndrome

Proactive policy is needed to strengthen Europe's technology champions. If we do nothing, I fear that popular protest movements across the population will escalate in response to the loss of jobs, as we have already seen on a small scale against Amazon and Uber. This frustration risks encouraging protectionist and nationalist tendencies. History teaches us that dependent relationships are not stable in the long term. We must therefore act proactively and restore a more sustainable technological balance. But be careful: the current trade balance is misleading: The EU has a large trade surplus with the US (USD 37 billion in 2022). So, you might say that everything seems to be going well in an ideal world. But the migration of values from traditional European sectors (e.g. media, tourism, finance) to American online platforms is much more important than the import-export deficit and is not reflected in the trade balance. It represents a transfer of corporate assets worth several thousand billion dollars. Just compare the performance of the Nasdaq with the European stock exchanges. In addition, there is a trade deficit of EUR 400 billion between the EU and China, highlighting our technological dependence in key sectors such as electronics and medical technology.

From a geostrategic point of view, it's important that Europe regains control over sensitive technologies and the data generated by people and things.

Europe has lost major digital battles, particularly in the consumer Internet and cloud sectors. But it still has a chance in the relatively undigitalised sectors, where European companies still control the data they produce, such as energy, health, agriculture, telecoms, tourism, transport and industrial production. It's essential to protect access to local data, in particular machinery and infrastructure (IoT), and to promote the emergence of a strong European technology ecosystem in these areas. Where necessary, national and European laws may need to be amended in line with the General Data Protection Regulation (GDPR) adopted by Europe in 2016 in for better differentiation and protection. Unless swift financial and regulatory action is taken, European actors will not stand a chance against foreign giants, which are already in an ideal position to collect this data and use it commercially and politically. If China and America seal themselves off through protectionism, Europe must have its own technologies. It's also in Europe's interest to sell its technological know-how in order to balance its trade.

However, there is a striking discrepancy between the policy of defending economic interests, which focuses on traditional sectors, and technological development, which is much more dynamic. For example, many European states (and

even Switzerland) adopt protectionist practices for some of their industries, such as agriculture or steel, but seem to have no strategy for maintaining strategic high-tech assets, such as the supply of semiconductors or telecom infrastructure. Huge amounts of money are poured almost reflexively into existing infrastructure, while there are no resources to encourage innovation that could dramatically reduce these costs. For example, vehicle fleet management and (semi-)autonomous driving technologies have the potential to significantly improve traffic flow and offer savings on the CHF 92.5 billion that Switzerland spends annually on its transport infrastructure (CHF 76.3 billion on roads, CHF 12.9 billion on rail and CHF 4.2 billion on air transport).

With regard to media, is it normal not to have a European social network, even though it is an important cultural tool? Would we accept all Swiss newspapers and TV channels being Swiss offshoots of a globalised Fox News or China Daily? Why do we mainly use messaging services that are open to intelligence services from all over the world (e.g.Telegram–Russia, TikTok–China, WhatsApp–US) without focusing on systems under European control? Do we want to end up like frogs slowly boiling without reacting because we doesn't see the danger coming?

Of course not! We need a response that is in line with what's at stake: the preservation of our freedom – an incredibly precious value for the Swiss soul.

The good news is that we have the means to take our destiny into our own hands, and to achieve this we must act swiftly and vigorously. A debate must be launched in order to reach a consensus on the fundamental issues. What model of digital development do we want in the future? What degree of technological sovereignty do we want at the Swiss and European level? What specifically must we do to build world-class high-tech clusters?

To stimulate this debate, I propose possibilities for action at four levels: the consumer, the state, economic operators and investors.

What can consumers do?

From a Swiss framework, citizens are the foundation of the political system. Citizens always have the last word and are aware of their power, which they regularly exercise through instruments such as popular initiatives or referendums. In the capitalist system, it's more or less the same – the consumer is king.

However, we tend to forget that. Consumers often underestimates their ability to act and makes little use of their rights. Of course, companies do everything in their power to keep control. Marketing creates needs and desires that are more powerful than an individual's will. Who can resist the lure of an iconic brand? Digital applications create Pavlovian dependencies in order to increase user activity. The large technological platforms that offer a complete ecosystem (hardware, software, applications) have even managed to create a self-sufficient world that offers great user-friendliness and synergies in the use of increasingly powerful data. Everything is done to make users feel that it's difficult to escape this situation in order to regain their freedom.

And yet, it's possible. There are numerous interesting alternatives, especially in Switzerland. For example, the Geneva-based startups Gmelius and ProtonMail offer innovative and collaborative solutions to replace Gmail or Outlook. Zurich-based Threema, a paid instant messaging service, offers privacy benefits. Unlike WhatsApp, Threema doesn't store and transmit metadata for commercial purposes. The current controversy over WhatsApp's new terms of use, which require users to share their data with its parent company Meta, has highlighted the data protection issues. A significant and growing proportion of Swiss consumers are looking for an alternative to GAFAM services. It's an opportunity that Swiss startups and large corporations can take advantage of.

European startups also offer credible, free alternatives to Google's search engine. For example, the Berlin-based, social startup ecosia.org is growing rapidly, with 20 million users. Its cooperative model allows all profits generated (approx. EUR 0.5 cents per search query) from online search to be invested in planting trees. Ecosia has already planted over 200 million trees – not bad for a team of only 130 people. The French business Lilo.org also allows users to control their personal information (no third-party sales) and use the advertising revenue generated by their online search to fund charitable projects of their choice. If all were to use these social models, much of the USD 74 billion that Alphabet currently generates each year could be redistributed to charities or even returned directly to users. Why don't social network users organise themselves around non-profit or low-profit cooperative platforms in order to regain control over their data and its added value?

Each of us can change the world by using our power as consumers in a civic way. What are we waiting for? Intelligent choice is a theoretical insight that's difficult to implement in everyday life, which is why it's necessary to educate consum-

ers so that they are aware of the consequences of their digital choices. This subject must be part of the school curriculum, just like civics or environmental awareness. A modern nation formed by the will of the people must implement policies that raise awareness of critical consumption, a guarantee of progress and freedom.

What can the state do?

Switzerland's liberal economic policy favours open markets with few exceptions, such asagriculture. We should not wait for the federal government and cantons to take protectionist measures against foreign high-tech giants. As Switzerland is a small country, some issues are better dealt with at the continental level. For example, major research programmes, strategic alliances to create European technology champions or taxing Internet giants are measures that require international coordination.

At the Swiss level, the government could launch an ambitious investment programme to strengthen the innovation capital sector, à la Israel (Yozma Initiative) and Sweden (AP6 and Industrifonden), who launched their startup ecosystem with great success in the 1990s. Public funding is of great importance to our European neighbouring countries, accounting for up to 40% of total investment in some countries. The government could also introduce tax incentives to encourage individuals (business angels) and companies (CVC) to invest in young innovative SMEs, as is the case in England or France.

Finally, the government must continue to improve the framework conditions for business competitiveness. The innovation system generally works well, especially for large companies and 'hidden champions'. But it is not yet fully adapted to the particularities of the venture capital model. Startups cannot be treated like traditional SMEs. Among other things, we need to clarify the rules for the taxation of stock options, because the definition of valuations lacks transparency. Similarly, taxing entrepreneurs' wealth based on the hypothetical (because it is unrealised) value of their startup raises crucial problems when entrepreneurs cannot afford to pay their wealth tax. Let's not forget that entrepreneurs often earn half as much as their counterparts in equivalent positions in large companies. I will not go into detail about the ecosystem requirements, as they are well summarised in the Manifesto for Swiss Startups for the Federal Council, signed by the organisations Le Réseau, digitalswitzerland, the Swiss Entrepreneurs Foundation (SwissEF), the Swiss Economic Forum and NetComm Switzerland.

If Switzerland is to be one of the best locations for entrepreneurs and qualified employees in the deep tech sector, preserving the free movement of the elite is essential. It's important to attract world-class entrepreneurs who attract an entire ecosystem around them. It's no coincidence that Mark Zuckerberg left Boston and founded Meta in Silicon Valley. Switzerland has unique assets in a knowledge-based civilisation: a globally recognised scientific culture, international openness and proximity to nature. This book has been written with the aim of heightening awareness of this extraordinary innovation cluster. Perception is reality: a high-quality image gives all startups financial added value, just like a branded product. Startup Investors and buyers follow the best entrepreneurs and are willing to pay more for a quality label.

However, the ideal entrepreneur does not correspond to the general idea. We need to demystify the image of startups. Our collective unconscious associates them with a team of rebellious and carefree young people who work in a garage or a university lab and live in a low-cost shared flat without a family or financial constraints.

The Californian myth is promoted throughout the world through television series (Silicon Valley), films (The Social Network) or books (the Steve Jobs biography).

However, this romanticised image is far from reality. According to a recent MIT study published in the Harvard Business Review, the average entrepreneur is 42 years old when starting their business. Even more surprising is that the success rate increases with age and the best high-tech companies (Top 1/1,000) were founded by people who were on average 45 years old. The study shows that work experience plays a key role in this. Startups with at least three years of professional experience in the same industry as their company have an 85% higher chance of starting a successful startup than those without this experience. There are major differences between industries: 47 years old in biotechnology and cleantech, and 40 years old in the software industry. The age of founders appears to be falling in industries that target younger people, such as online games. The media distorts the business reality because they naturally focus on the precocious founders of consumer-oriented (B2C) startups, which are well known to the general public.

The vast majority of entrepreneurs in the US and Switzerland are faced with completely different realities: they are in their forties and typically have family and financial constraints. With ample professional experience in research, large companies or startups, they're also facing certain risks to their reputation. Just as certain innovations can be perfectly implemented by young people with no experience, the deep tech and professionally oriented (B2B) fields require highly specialised skills and years of advance research. Swiss high-tech startups are therefore very often made up of highly qualified and experienced teams, which is quite different from the image of a less reputable startup that is sometimes conveyed in public opinion.

What can economic actors do?

Business leaders must engage the issues of technological sovereignty and not leave this debate to politics or public opinion alone. Companies have an important responsibility, as they influence both demand and supply for advanced technology. They even have the opportunity to create economic value by finding practical solutions to the problems of dependency.

Firstly, demand. Businesses and public authorities are important clients and references, particularly in the early stages of a business. A commercial order worth CHF 1 million is much more valuable to a startup than equity financing of the same amount. In fact, startups have a fundamental need for technological and commercial validation. Established companies and the public sector should give preference to startups in technical tenders, in line with the US Small Business Act. It's also a question of attitude. Many large companies and administrations suffer from a well-known issue of conservatism, as illustrated by the following proverb: 'No one gets fired for buying IBM'. The dual training system should serve as an example. In this area, the Swiss have a remarkable mentality and make special efforts for young people. Why not for startups as well?

Secondly, the offerings. Innovative companies are bursting with ideas to reinvent the world, and the main obstacle is access to capital.

Established companies have the opposite problem: they have significant resources at their disposal, but lack innovative teams that want to do more than reinvent the wheel. Synergies between small and large companies are evident on paper, but difficult to implement in practice. Without this awareness on both sides, it's impossible to create a global cluster dynamic. Some Swiss industries have demonstrated this spectacularly, such as the watchmaking industry or the pharmaceutical industry. We must now be able to do the same across the board in order to develop interdisciplinary convergence capabilities. It's complex… so the Swiss should be interested in it! It requires large companies take startups seriously and treat them with respect. To combat condescension, or sometimes even the exploitation of imbalanced power relations, large corporations must develop codes of conduct with entrepreneurs, much like they do with their customers. Better yet, startups should be treated like the VIPs of the future. The ideal solution would be to introduce a right of first refusal (ROFR) in large Swiss companies and administrations for Swiss startups in areas that are strategically important for technological sovereignty. Finally, the resources and attention of top management must be great enough for programmes such as open innovation, co-creation and corporate venturing to envision significant results. Let's be inspired by the historical champions who spend more than 10% of their cash flow on R&D, CVC or startup acquisitions.

Startups (and investors) also need to maintain a certain respect for large companies. I have often heard patronising comments from entrepreneurs and investors about viewing big companies as endangered dinosaurs. Large companies a key role throughout the life of a startup: they are investors, technical partners, customers, business partners and, ultimately in more than 90% of cases, buyers of the company. That's a lot. How is it that some people build walls between the worlds of startups and corporations, when they are so closely connected?

What can investors do?

Last but not least, much more investment in venture capital is needed. According to a study by McKinsey and Pitchbook published in October 2020, Europe created 36% of global startups between 2009 and 2019, but produced only 14% of the unicorns. As already shown, Europe is home to just 2% of the capital value of Big Tech. These figures show that it's not enough to finance a large number of start-ups: massive resources are also needed to create world leaders out of the best. The major investors in the most advanced financing rounds are 'kingmakers'. With the same level of competence, the best financed companies will end up at the top world rankings.

In order to produce champions at the level of the US or China, European VC funding must be tripled or quadrupled.

Access to venture capital is (relatively speaking) the weakest link in the Swiss high-tech ecosystem, which all current studies bear this out. In the IMD Digital Competitiveness Report 2023 (WDCR), Switzerland ranks fifth overall, but only eighteenth when it comes to financing startups. I do not underestimate the importance of 'soft' factors, such as risk culture or legal burdens, which are described in detail repeatedly in this book. But money remains the key factor in any technology cluster, because it helps attract the best scientific and entrepreneurial talent, along with investors (VCs and stock exchanges) and corporate buyers (M&A). The growth of a high-tech industry remains a statistical equation: The more investment in R&D and venture capital, the greater the likelihood of success.

Pardon my frankness, but I have to say that there is a very strong correlation between the amount of money involved and the amount of entrepreneurial success. The United States and China have understood this very well. Together, thanks to their massive investments in venture capital, they have the vast majority of startup unicorns (73%) and market capitalisation of the top 25 publicly traded VC kids (98%). But Europeans are no less creative, inventive or entrepreneurial. They also have a world-class academic environment and infrastructure. And yet, when it comes to value added in terms of market capitalisation, Europe is failing. The main reason is the lack of ambition in high-tech investments, both in venture capital and acquisitions of young innovative companies (the two are interlinked). This critical aspect should not be tackled using a step-by-step approach, but rather shock therapy. Economists would refer to it as a budget shock – let's call it stimulating innovation capital, so as not to frighten anyone and create positive momentum.

How big are our demands?

Switzerland has three menus to choose from: an economical buffet (status quo with CHF 2.6 billion per year), a solid three-course menu (CHF 5 billion per year) and a gourmet menu (CHF 10 billion per year). The first allows the ecosystem to survive and, at the current rate, produce about one unicorn per year. That's good, but clearly not enough to claim global leadership. Over time, Switzerland will fall down the rankings as the competition rapidly develops. Startup Genome, which specialises in researching innovation clusters, predicts that over the next decade about 100 cities around the world will exceed an annual investment volume of USD 4 billion (compared to 25 today). Do we want Switzerland to be relegated to the third league in 2030 and rank between 100 and 150 in the high-tech clusters?

The second option is to double investment to CHF 5 billion per year. This investment volume makes it possible to position Switzerland as a whole among the top ten countries in the world, and even among the top five in the deep tech sector. Switzerland could become one of Europe's deep tech leaders, on par with Germany (EUR 6.7 billion of venture capital in 2023), France (CHF 8.5 billion) and the United Kingdom (EUR 17.2 billion, a significant part of which is outside deep tech). A target investment of CHF 5 billion over ten years is reasonable: this represents 20% of the annual amount spent on private and public research, a ratio comparable to that of the US (27%). It is one quarter as much as Israel (75%) and one third of Singapore (70%), countries that make very good commercial use of the success of their R&D. This scenario allows us to seriously consider producing three to five unicorns a year – in a few top sectors where Switzerland has a competitive advantage.

A massive investment of CHF 10 billion per year is conceivable at the end of the current decade.

Switzerland's large R&D capacities and access to global talent can position it as a 'small Silicon Valley' in the heart of Europe, specialising in deep tech.

CHF 10 billion may seem like a lot, but this is only the current size of the ecosystem of Singapore (USD 7.5 billion in 2023), a country comparable to Switzerland. The beauty of the cluster startup model is its exponential growth potential, far beyond national borders. The size of future clusters will become increasingly decoupled from the size of their host economies, thanks to the globalisation of capital flows. This is a unique opportunity for Switzerland.

The Swiss ecosystem needs to grow rapidly to remain competitive.

As the scientist Michael Porter has postulated for traditional industries, the size of an industrial cluster plays a decisive role in determining its overall performance.Studies by Startup Genome show that this also applies to startup ecosystems. For example, in an ecosystem with 1,000 growing startups (the size of the Swiss cluster), each startup contributes an average of USD 5.1 million. For 4,000 startups (about the size of the Boston ecosystem), the value per startup rises to an average of USD 10.6 million. Due to network effects, the larger the ecosystem, the higher the performance and average value of each startup. Let's be ambitious and optimistic.

How much Swiss money do we really need?

Let's assume the future financing target of an average of CHF 5 billion per year, balanced between Swiss (50%) and foreign (50%) investors. We should therefore aim for CHF 2.5 billion from Switzerland. We're a long way from that today: according to a study by the University of Lausanne, an average of 23% of investment has come from Switzerland in recent years, equivalent to around CHF 500 million per year. So we need to find five times as much Swiss capital. Otherwise, dependence on foreign funds will increase as the ecosystem grows, which would be problematic for Switzerland. On the one hand, some funds are putting pressure on startups to shift their strategic assets (R&D, management) to where the most powerful shareholders come from. On the other hand, there is a striking asymmetry between the high initial risk, which is mostly financed by local Swiss actors (academic and industrial R&D, support institutions for startups, business angels, small VC funds), and the lower risk of late financing for successful startups (called scale-ups), more than 80% of which are financed by foreigners. It's perfectly normal for foreign funds to adopt a wait-and-see approach, leaving the R&D work to the locals and selectively focusing on the growth of the best companies (cherry picking). But how can Switzerland realise technological sovereignty if it is a small minority shareholder of the champions produced by its own ecosystem?

Given that the majority of profits are concentrated in the top 10% of companies, it's imperative that Swiss funds are large enough to participate in the overall development of the most prestigious startups. This is quite possible: in recent years, few local players have gradually gained strength and are able to invest amounts in the order of CHF 10 to 15 million per financing round. They have made it possible to keep certain strategic assets in Switzerland and safeguard the interests of local startup teams. We must continue in this direction. I would like to emphasise that this is not at all a question of denouncing foreign funds. You are welcome, of course. In fact, they are essential in securing the growth relay to exit. They often bring with them a wealth of experience, a complementary network and an excellent reputation. I simply want to emphasise how important it is for the ecosystem to develop a strong, stable and committed local investor base – in the interest of all, including foreign investors. This is already the case in the best high-tech clusters, such as Silicon Valley.

It should be noted that investments can be financed continuously from the sixth year onwards through the sale of shareholdings (evergreen). Startup financing of CHF 5 billion for five years must therefore be found, i.e. a total of CHF 25 billion, of which CHF 12.5 billion should ideally come from Switzerland.

Technology sovereign wealth fund of CHF 10 billion

The most elegant solution would be to set up a state investment fund with the mandate to strengthen the Swiss technology ecosystem, both in the early phase (CHF 4 billion in venture capital) and in the subsequent phase (CHF 6 billion in established companies). What could be better than a sovereign fund to tackle the problem of sovereignty? The major advantages of such a structure are its very long-term orientation (50+ years) and its stability. Technically, it could be an umbrella fund that continuously invests in Swiss VC funds, just as the European Investment Fund (EIF) does with European VC funds. The current negative interest rates conditions are ideal for financing such a general interest rate structure. Keep in mind, I'm not talking about grants or loss-making loans. These are investments that are likely to be profitable in the long term because they are indexed to the entire Swiss VC sector and are therefore well diversified. In the long term, they will provide an important financial reserve for future generations. This sovereign wealth fund should be financed by public actors, not institutional investors (banks, pension funds, insurance companies). The latter have liquidity constraints that are not compatible with the strategic and perpetual nature (evergreen) of the SWF. With funding of CHF 4 billion, one third of VC invest-

ments of Swiss origin could be secured, a ratio equivalent to that of the members of the European Union. This is the minimum to have a sufficient effect.

In addition to investing in traditional VC fund structures, which are typically limited to five to ten year cycles, the sovereign wealth fund should also be able to support technology companies for decades, even if they are listed on the stock exchange. This very long-term orientation would make it possible to stabilise Swiss holdings in strategic sectors without control logic. With an additional CHF 6 billion, the sovereign wealth fund could invest in listed companies or evergreen growth funds without medium-term sales restrictions. These funds do not yet exist, but they are necessary for the ecosystem. In fact, deep tech companies need more time to develop on a global scale (ten to twenty years) than the traditional VC fund cycles (five to ten years) allow. Investors are frequently under pressure to sell prematurely, often at a low price, to better-funded competitors. If Roche or Nestlé had been financed by VCs, I fear that they would have been sold long before they had time to become global leaders. If we want to develop technological giants and retain some control in Switzerland, we need to be able to offer large amounts of financing opportunities over a very long period of time.

The US has found the solution with 'crossover funds', which invest in 'mega rounds,' sometimes worth billions of dollars, and remain invested in companies for years after the IPO. These investors are therefore replacing traditional VCs to ensure accelerated growth in the long term. Currently, the best startups in the world, including those based in Switzerland, automatically turn to the US to finance their hyper-growth and attempt an IPO. The SWF would make it possible to create an extremely attractive Swiss alternative with large crossover funds and a first-class stock exchange infrastructure (SIX). Switzerland is excellent at innovating. What is needed now is a comprehensive end-to-end financing system, both upstream with innovation capital and downstream with growth and crossover funds, the traditional IPO or innovative instruments such as SPACs or blockchain listings.

Financial institutions

However, such a sovereign wealth fund remains hypothetical, as it requires a national political debate. Without it, financing must come mainly from large families, established companies and financial institutions. They have more than enough resources at their disposal.

According to the Federal Statistical Office, the total net assets of Swiss private individuals in 2017 amounted to CHF 1,993 billion. Swiss pension funds manage

a total of CHF 1,000 billion. This amount corresponds to the balance sheet of the Swiss National Bank (SNB). It has invested more than USD 170 billion in shares, including almost USD 20 billion in GAFAM. While I understand that the SNB must support foreign assets in order to depreciate the Swiss franc, I question the strategy of investing in companies that are in direct competition with Swiss companies. However, the SNB says that it refrains from acquiring shares in banks to avoid conflicts of interest'. But doesn't the SNB also face a major conflict of interest when decisions are taken that relate to national technological sovereignty?

So the problem we face is twofold. The first is historical and cultural: continental European pension funds, particularly in Germany and Switzerland, traditionally invest much less in venture capital than Anglo-Saxon pension funds. Swiss pension funds have invested less than 0.1% of their assets in Swiss venture capital (less than CHF 500 million according to my estimates). The second is geographical: most of the Swiss funds flowing into venture capital are channelled through umbrella funds that invest globally in line with the size of the VC markets, i.e. around 1% in Switzerland (CHF 2.6 billion of the USD 252 billion invested globally in 2020).

Swiss savings therefore mainly finance groundbreaking innovations from the US, in direct competition with Swiss companies and thus jobs. Do we really want to continue this system?

Circular economy

I doubt whether this practice makes sense if we include externalities as a whole, i.e. the net balance of value creation and destruction at the macroeconomic and social level. It would be better to focus on the principles of the circular economy, in particular shorter routes. Since investments in young startups primarily flow into salary payments, Swiss institutional investors in Swiss VC funds benefit from an increase in highly qualified jobs, which in turn finance Swiss pensions and taxes.

This positive externality is significant in purely financial terms. Companies also have a strategic interest in developing a local high-tech ecosystem. In doing so, they not only generate new sales with local customers, but also significantly strengthen their ability to innovate and thus their growth.

Show me the Money!

One of Swisscom Ventures' co-investors has called its investment structure 'Show me the money'. The message could not be clearer: the aim to maximise financial returns is perfectly reasonable. What are the profitability prospects for innovation capital in Switzerland? They're excellent. In terms of financial returns, Switzerland as a high-tech location is very attractive for investors, as it is underinvested in comparison to the technological potential that can be marketed. It is an emerging cluster – discreet, less well known than other regions, but extremely competitive. It is a hidden champion in itself!

The private nature of venture capital transactions does not provide the same transparency in terms of returns as, for example, stock market indices. Therefore, there is no consolidated data for the entire Swiss VC market. But there are many sub-indicators: the recent study of 128 ETH spin-offs between 1980 and 2018 shows a money multiple of 3.6x, a pooled IRR of 28% and a survival rate of 93% for startups after five years. The only VC fund to publish its figures, VI Partners, has a clear success story. Launched with CHF 100 million in capital in 2002, this evergreen structure recently announced that, thanks to 30 exits, it has invested more than CHF 210 million in 53 startups. I can also attest to a clearly positive return on investment for Swisscom Ventures.

I estimate that the Swiss VC ecosystem has created a value of around USD 100 billion since the 1990s. This amount is comparable to cumulative investments of around USD 21 billion over the same period. Assuming a ratio of two thirds of the shares for the investors, they could theoretically have received a sum of CHF 67 billion. In reality, the amounts for investors were lower, as most of them sold their shares shortly after Actelion's IPO at a valuation well below the CHF 30 billion realised in the final sale to J&J. Even assuming a sale of Actelion shares at a minimum valuation of CHF 4 billion, the total amount from the exits is approximately three times the amount invested. In addition, 82,000 jobs were created in Swiss startups during the same period. If Switzerland has managed to achieve these results with USD 21 billion in 35 years, imagine what we can achieve with CHF 5 billion per year over the next ten years.

The grass is always greener on the other side. However, the Swiss VC market suffers from a negative image among institutional investors, who have so far invested little in it. Due to its small size, the Swiss market is considered negligible by powerful umbrella funds and asset management consultants. This conclusion was understandable in the past, as there were very few active Swiss VC funds. Fortunately, the extremely positive momentum of the last five years have made it possible to establish experienced and competitive Swiss VC teams, which can now scale.

In addition to size, lack of marketing is another disadvantage for Switzerland. In comparison, US funds backed by a well-oiled marketing machine are a dream come true for global investors. However, there is no evidence that American VC funds perform better than European VC funds. A few American VC stars such as Sequoia Capital have undeniably achieved exceptional returns, but they are inaccessible to the vast majority of European investors. Moreover, the majority of the most spectacular investments were made in B2C companies, which are inherently highly speculative. How many video platforms failed in the past before Zoom succeeded? The risk is compounded by the fact that investors tend to favour sectors that have been successful globally in the past, despite stratospheric initial valuations, fierce competition and high demand volatility. This type of investment, based on the 'momentum' of the stock market, can work as long as the markets are favourable. But what happens when they fall?

I'm also surprised that many investors do not take exchange rate risks into account in their investment decisions, without having a hedging solution, when the dollar has fallen by 50% in 20 years and against the Swiss franc by 80% in 50 years.

The more spectacular the success in a particular industry, the more capital and competition it attracts, and the more polarised the returns.

An analysis of 31,000 VC investments over 30 years (Burgiss, 2020) shows an average multiple on the total investment (TVPI: total value/paid in) of 2.2x, well above the median of 1.0x. This illustrates the VC sector's polarisation: the best quartile (top 25%) yields more than 1.99x, the second 1–1.9x, the third 0.1–1x and the last less than 0.1x. VC investments are therefore only really profitable with the best funds, including in the US. For most, getting into the top funds is anything but a given.

Thesis on investment in Swiss venture capital

In comparison, the Swiss high-tech market offers LPs much easier access to the best VC funds, as they are less in demand. Since the bulk of profits are generated by funds in the first quartile, this is a decisive factor for performance. However, the initial valuations of Swiss startups are significantly lower than in the US. Exits in Switzerland are also smaller, but rapid internationalisation allows the best startups to be listed on the most competitive foreign stock exchanges, such as the Nasdaq. Finally, the B2B and deep tech (hardware and software) orientation of most startups offers, in my opinion, less volatility and greater long-term resilience in the event of stock market downturns. An important part of its value lies in its intellectual property, which is the result of many years of academic or private research and technical testing. This knowledge (and know-how) is difficult to replicate, especially in the short term. It presents a significant barrier to entry in order to limit the number of competitors. In comparison to software, the hardware sector (wrongly) suffers from a lower profile among VCs due to technological and commercial risks. Nevertheless, it has a great future ahead of it. Mastering the complexity of hardware is fundamental to the development of key innovation platforms, as we've seen in recent years with the advent of mobile phones or NGS gene sequencers. We'll soon see the emergence of new industries based, for example, on robotics, smart clothing, green batteries or quantum computers.

To summarise, I am deeply convinced of the attractiveness of the Swiss innovation cluster for innovation capital.

To kick-start the growth momentum, institutions must create specific Swiss VC allocations that are larger than the historical market. This overweighting must be solely motivated by the prospect of financial performance, as institutions have an obligation to maximise profits. Positive externalities (social and macroeconomic impacts) should be seen as a bonus, not as compensation for poor financial returns – they're the cherry on top of the cake.

Investors should not judge the Swiss market based on the size of the startups known to the public, the international visibility of VC funds or the total volumes invested. With this analytical framework, we will always lose to well-established markets, cultivating an inferiority complex that will keep us stagnant in a vicious cycle of institutional investors that won't invest in Swiss VC funds because the market is too small to develop due to lack of capital. This is a self-fulfilling prophecy.

In contrast, the youthfulness of the ecosystem and its emerging market profile should be seen as key benefits. The enormous and still underutilised commercial potential deep tech research results and the valuations favourable by international standards point to high returns. These benefits will diminish over time as awareness of the cluster increases. Good investors anticipate trends, rather than follow them.

The VC Kids

The venture capital industry has just turned 50 years old, reaching maturity at an annual rate of approximately USD 300 billion for 27,000 transactions in the seed stage (business angels), early stage and late stage. With USD 2,500 billion of assets under management, venture capital is a relatively small asset class.

For example, it accounts for only one fifth of private equity (USD 13,000 billion) and only 2% of all publicly traded shares (USD 109,000 billion). The total amount of all VC investments in the last 50 years is only about USD 4 billion, yet it has enabled the commercialisation of an incredible number of innovations as fundamental as biotechnology, personal computers and fundamental Internet applications. Its social and economic impact is enormous: where would the US be today without Silicon Valley? For a very long time, the US was practically the only country that used capital-intensive venture capital as a tool, accounting for more than 90% of global investment, until China became increasingly strong about 15 years ago. Europe has never really gotten off the starting blocks (12% of the world's share in 2019). What would have become of technological Europe if it had invested as much as the US?

Venture capital is a large family, with its own codes, networks and specific language. At its core, it is a management philosophy that oriented towards hyper-growth and is conveyed throughout the life of the startup. It brings all the parties together in a tacit gentlemen's agreement, which is far more important than legal treaties. And it works! The foundations remain remarkably similar in all parts of the world, regardless of the entrepreneurs' countries of origin. We're talking about venture capital, i.e. investment – but above all, it's a way of working invented by entrepreneurs. Venture capitalists have adapted traditional banking practices to the specific needs of young high-tech companies, creating a highly efficient capital model. I invite you to travel through time and space to discover the key players, decipher some cultural codes and also take a step back to engage in constructive criticism.

Silicon Valley

The genius of Silicon Valley is that it was able to leverage venture capital long before other parts of the world. And yet, this financing model was not invented in California, but on the East Coast of the United States – Boston, to be precise. Georges Doriot (1899–1987), a Frenchman who emigrated in the 1920s to teach production and management at Harvard, is known as the father of venture capital. In this context, the influence of the US military is also interesting. In fact, Professor Doriot was promoted to general during the Second World War, and in 1946, the Pentagon proposed that he head a department to invest in young companies that hired soldiers returning from the front. He declined, but while he resumed teaching at Harvard, he created a similar structure with private capital, the American Research and Development Corporation (ARD). This was the first independent venture capital fund. The ARD's most important innovation was that it was open to institutional investors other than the big families like Rockefeller and Whitney, who were financing entrepreneurial projects at the time. The ARD made a number of exceptional investments, in particular the one that led to the Digital Equipment Corporation DEC, which raised USD 355 million in 1968, 5,000 times more than the initial investment of USD 70,000 (+ loans of USD 2 million) ten years earlier. The ARD finally disappeared in 1972; when Doriot retired, it was integrated into the Textron conglomerate. Doriot was also behind the establishment of INSEAD in Fontainebleau, France, which was founded in 1957 in the model of American business schools.

Venture capital first emerged in California in the 1970s.

The first startup funded by East Coast investors Hayden Stone and Venrock Associates was Fairchild Semiconductor, a pioneer in the production of integrated circuits. The emergence of the computer industry in the San Francisco Bay Area around Stanford and Berkeley attracted local investors, including Draper & Johnson in 1962, Sutter Hill Ventures in 1964, and Kleiner, Perkins, Caufield & Byers and Sequoia Capital in 1972.

Kleiner Perkins has been the venture capital industry leader for many years, thanks to major successes such as Amazon (exit of USD 1 billion for USD 8 million invested in the first round, a 125x multiplier), Genentech (the largest biotech company in the world, valued at almost USD 100 billion when sold to Roche), Google and Twitter. In 50 years, Kleiner Perkins has raised almost USD 15 billion.

The galactic Sequoia

Sequoia Capital did even better than Kleiner Perkins. It has become the most renowned venture capital firm in the world and has an exceptional portfolio in its track record. It played a key role in the emergence of many industries such as personal computers (first investor in Apple, when Steve Jobs was 22 years old), networks (Cisco, Palo Alto Networks), semiconductors (NVIDIA), digital entertainment (Electronic Arts), enterprise computing and the cloud (Oracle, ServiceNow) and Internet applications (Google, LinkedIn, Dropbox, PayPal, Instagram, Airbnb, Zoom, etc.). The companies financed by Sequoia today amount to more than USD 7,000 billion. This gigantic sum must be seen in relation to an investment amount of 'only' USD 35 billion invested by 34 Sequoia funds over 50 years with a team of less than 100 people per year on average, highlighting the exceptional leverage effect of venture capital. From an industry perspective, it's clear that Sequoia's presence in these world-leading high-tech companies, all within a radius of less than 50 kilometres, enables effective networking that benefits the young portfolio companies in search of partners – and buyers.

No one illustrates the influence of Sequoia better than its founder, Don Valentine. He was the first investor in Cisco and guided the company through its growth as Chairman or Vice Chairman of the board of directors until he was 73 years old, 15 years after the IPO. His M&A experience has been particularly important to Cisco, as the Californian giant has acquired no fewer than 228 companies for more than USD 100 billion. These acquisitions account for more than half of the Group's current turnover. At the same time, Don Valentine was in a privileged position to take Sequoia's startups public at the right time – unless they were taken over by one of the other companies in which he was on the board of directors: Apple, Oracle, Siebel, Electronic Arts and LSI Logic/Broadcom. It's a high-tech directory that is singular in the world.

I've seen Sequoia's extraordinary ability to create exit opportunities for their startups first hand. It was in February 2014 at Sequoia's headquarters, on the famous Sand Hill Road in Menlo Park, home to many of the world's leading venture capitalists. Located in California's pine forest in the immediate vicinity of Stanford's campus, the two-story buildings are undifferentiated and unobtrusive, far less opulent than many high-tech firms in the region. I visited Mike Goguen, one of ten of Sequoia's general partners, who was responsible for investing in Internet infrastructure, enterprise computing, cybersecurity and semiconductors. We were co-investors in Quantenna Communications Inc., a Stanford-based semiconductor research company with the world's most advanced Wi-Fi solution. We invested in 2009 on the recommendation of technical experts from the R&D

department of Swisscom Innovation, even before Quantenna generated its first profits. Swisscom was the first operator to market the product and became a global leader, which Quantenna used to acquire additional customers with the active support of Swisscom Ventures. The company was listed on Nasdaq in 2016 and sold to ON Semiconductor for USD 1 billion in 2019.

'Hi Mike, how are you today?' I asked him.

**'Good, very good indeed,'
he replied.**

I was a little surprised by his answer, because it sounded like an exaggeration – unusual for him. But it was actually more of an understatement. I understood why later:

**'Jim did a great job,'
he said laconically.**

He was alluding to his office neighbour Jim Goetz, who had just completed the sale of WhatsApp to Facebook for USD 19 billion, the largest-ever acquisition of a VC-funded startup. There was no exuberant triumph, but rather a simple message on the screen in the lobby: 'Well done, Brian and Jan!' – just in the tradition of Sequoia, which puts entrepreneurs before financial figures. That's a far cry from the culture of Wall Street or the City. And still, Sequoia's partners would have had good reason to lose their minds. Let's make an approximate calculation: Sequoia invested USD 60 million over three years (including a Series A of USD 8 million in 2011) for a 15% stake, valued at USD 3 billion, – so, 50 times the initial investment in less than three years, according to Forbes. We can deduct a bonus for Sequoia executives (general partners, or GPs) amounting to USD 600 million, assuming a 20% profit share, called a carry, by industry standard. The remaining USD 2.4 billion would be distributed to the fund's shareholders, known as limited partners (LPs), usually institutional investors such as pension funds and US university endowments.

Sequoia voluntarily limits the size of its venture funds to an average of about USD 1 billion in new financing every three years in order to remain active in its original business of financing young startups. Sequoia has launched some of the largest growth funds, including USD 7 billion for more mature high-tech companies and USD 2.4 billion for the Chinese market in 2018, but these remain an exception. They have yet to prove their worth. Sequoia therefore has the luxury of selecting its LPs from a long waiting list of investors attracted by the historical performance.

For example, the Sequoia Venture XI Fund, launched in 2003 with USD 387 million, has returned USD 3.6 billion to 40 lucky institutional investors twelve years later, representing a net annual return of 41%.

These staggering figures have not fundamentally changed the work of venture capitalists, a craft that remains based on the quality of contacts with a few exceptional people. You must have heard the anecdote of Mark Zuckerberg making an 'anti-pitch' in front of the Sequoia team… in his pyjamas! Later, he said he regretted this lack of respect, calling it a 'juvenile mistake'. So, Sequoia didn't invest in Facebook, one of the best opportunities in history (Accel Partners received 300 times its stake). The company could have severed its relationship with the Facebook founder – which would have been a great pity, because it later sold him Instagram, ParaKey and WhatsApp, and the list will probably grow in the future. These symbiotic relationships between investors and entrepreneurs are responsible for the riches of the Silicon Valley ecosystem. It's up to us to do the same in Switzerland.

Venture capital, a trust-based philosophy

Each entrepreneur has three financing options: self-financing, borrowing from traditional banks or selling shares to VCs. The latter has a great advantage: it's not subject to any personal guarantee such as a mortgage on the entrepreneur's house, which greatly reduces the personal risk and allows the entrepreneur to raise very large sums of money, regardless of his personal assets. Typically, a startup sells 10 to 30% of its capital in each investment round and does so five to six times until it reaches the profitability zone or an exit (sale by takeover or listing). The management team thus sees its share diluted over the rounds, often to less than 25% of the total, depending on financing needs. Investors therefore quickly obtain the majority of the capital, but ensure that they retain a sufficient amount for employees by granting additional shares (stock options), which typically amount to 10 to 20% of the total.

The young company is controlled by a board of directors composed of the founders, investor representatives and occasionally independent individuals. The system only works if shareholders and the team of entrepreneurs share the same philosophy on three key points: exit horizon, governance and growth. It's impossible to formally enforce these objectives. Anyone who tries to force entrepreneurs promise these in writing has not understood the nature of venture capital. As in a marriage, the most important rules of life cannot be spelled out in a contract, but must be shared. Unfair or excessively restrictive clauses quickly become counterproductive.

In general, there is a basic tacit agreement on an exit horizon between three and seven years. The VCs need liquidity in the medium term, as they have promised to pay out their LPs within ten to twelve years. Each VC fund invests in 20 to 40 equity holdings over a period of three to five years, giving it five to seven years to sell all equity holdings. Less than 5% of startups succeed in going public. For the remaining 95% a buyer has to be found, which takes time… a lot of time. VCs therefore need to anticipate which strategy is needed to optimise the exit chances from the very first investment. While there are currently some solutions to increase liquidity, such asselling the shares in the secondary market to other funds, these solutions are inadequate. The VC industry will have to reinvent itself to address this chronic lack of liquidity at the end of the fund. New structures need to be considered, such as evergreen funds with unlimited maturity, listed VC funds, buyouts by special purpose vehicles (SPAC: Special Purpose Acquisition Company) or even blockchain-based mechanisms.

The second necessary point of agreement is governance. An entrepreneur that sells part of the company to VCs must agree to transfer power to the board of directors, which represents the interests of shareholders, and be accountable to the board of directors. The entrepreneur would even risk their position in the event of a disagreement. Benefits for the entrepreneurs are a professional structure, improved management skills and a division of decision-making responsibilities between the chief executive officer (CEO) and the board of directors.

Finally, it's important to focus on growth ambitions. Considering the risks and the amounts invested, VCs are only interested in companies with very high growth potential and the ambition to multiply their value by a factor of five or ten. A company with less ambition or potential is quite respectable, but it cannot rely on venture capital and simply has to grow more slowly with less capital.

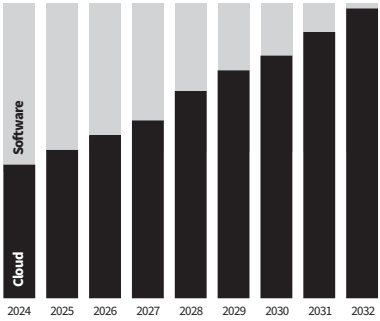
So, the system is based on trust. Contractual clauses, which are often negotiated down to the smallest semantic detail, are unable to enforce the gentlemen's agreement described above. When a VC pours a few million in cash into the account of a very young company that often does not even have a CFO, the risks are enormous. For example,at any time the founders can decide to change their business or even try to transfer some of the money to their personal account with a fake invoice. (Luckily, this happens very rarely: one time in 95 investments in my case). For this reason, experienced VCs prefer companies from reputable ecosystems where the unwritten rules are established and local actors (lawyers, co-investors, etc.) have a good reputation to defend.

When investing far away from home, VCs usually work with other trusted investors, at least one of whom is on site and carries out the due diligence (known as the lead). In order to attract the best foreign investors, it is therefore extremely important for Switzerland to have good, trustworthy domestic investors. This cannot be taken for granted: most countries do not have a local VC industry because they have not managed to create this climate of trust. In fact, the VC industry is extremely polarised around the world, with 90% of investments made in only 20 clusters – and while Switzerland is part of this, it still needs to work on its marketing (including informal links) to raise the profile of the location internationally. It's worth it: VC investors are willing to pay a higher entry price for startups, based on the image and reputation of the location.

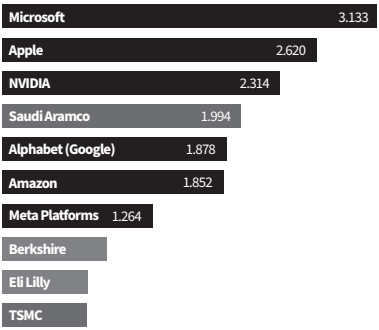
Software is eating the world

The venture capital industry is increasingly focused on software, which now accounts for almost 50% of total investment worldwide. A relative decline can be noted in most other sectors, such as energy, commercial services and consumer goods. Only the share of biotech and pharma (10%) remains stable.

'Software is eating the world,' predicted Marc Horowitz, co-founder of Netscape and now head of Andreessen Horowitz, one of the most prestigious VC funds (USD 35 billion under management, invested in Meta, Skype, Slack). On a global scale, the IT and software industry is relatively small compared to other industries. It generates revenues of USD 1.2 trillion, equal to 1.5% of the world's GDP or one third of the oil industry. But it has strategic value because it permeates all other industries, transforming them digitally and siphoning a significant part of their added value.



Access to an almost unlimited source of money through VCs allows digital platforms to choose their ideal model for growth. Your service can be free (Google, TikTok), paid (Salesforce, Office365) or both (freemium, as with Spotify).



Free is relative, because the financing is done through advertising and data collection data, as the saying goes – 'If you're not paying for the product, then you are the product.'

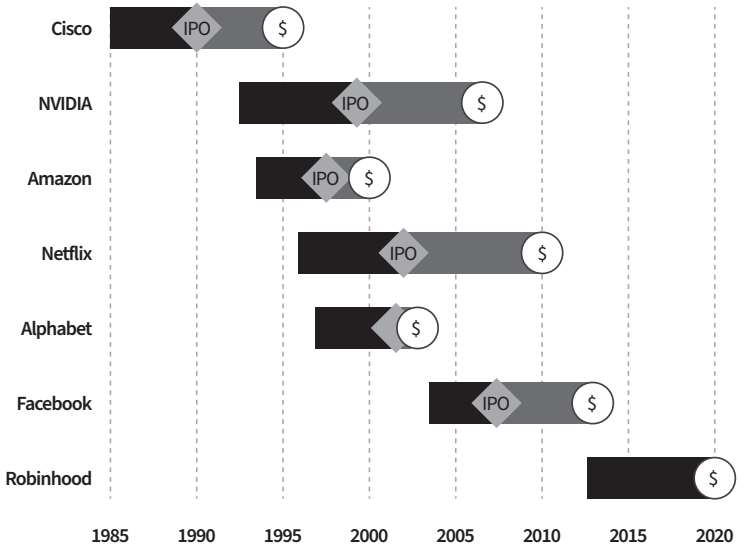
The preferred payment model for VCs is SaaS (Software as a Service), where the end user pays according to their usage and the leasing is done directly online from a cloud service provider. The advantage for the user is that they do not have to buy, install, update or maintain the hardware or software. The costs are flexible and depend directly on the actual usage. Economically, this model is very powerful because it reduces entry barriers through the option of free use for a limited time or with limited functionality. SaaS also makes it possible to embed in a relationship with recurring revenues, which means good predictability for the company and investors. Above all, SaaS enables the use of economies of scale and permits extremely fast distribution on a global scale via the Internet and the cloud.

The cloud is eating software

The purpose of the cloud is to optimise computing and storage resources worldwide by connecting servers that can function as a single ecosystem. This is an important trend: the majority of the software is gradually being migrated to the cloud, which will further accelerate the speed of development and reduce operating costs.

In the long run, we can envision an almost instant appreciation of tens or even hundreds of billions of dollars for the most popular products. In the cloud economy, the winners are those who are fastest and have the greatest economies of scale. Obviously, this is exactly the kind of investment opportunity that VCs are looking for.

Time to reach a USD 10 billion valuation



VC kids on the rise

Let's get to the crux of the matter. Companies backed by venture capital have taken over power in a growing number of strategic industries.

This is evident in the digital sector, with the emergence of GAFAM (Google [Alphabet], Amazon, Facebook [Meta], Apple, Microsoft). But this wave is also beginning to spill over into the non-digital sectors, such asthe automotive industry with Tesla. Although they account for less than 0.001% of all companies, the companies financed by VCs still occupy six spots in the top ten of the world's largest market capitalisations.

Particularly striking is their ability to create value in record time, even before they've had to prove themselves in terms of turnover or profitability. They enjoy an extraordinary amount of trust from shareholders, who are willing to accept valuation multiples infinitely higher than those of traditional competitors. Tesla has a valuation equivalent to six times its sales, compared to an average of 0.5

times for the rest of the automotive industry. Markets are therefore currently paying a massive premium for 'pure' electromobility (pure play), as long as it is not mixed with cars with internal combustion engines. The VC kids have understood this very well and apply this strategy consistently. So well, in fact, that the three highest-rated electric car manufacturers putting pure play into practice are VC kids – and their current cumulative market capitalisation is similar to that of all traditional mixed-car manufacturers (with any type of engine) around the world. Yet these three startups account for only 2% of the global automotive industry's turnover.

The competitive advantage of VC kids

The analysis of the VC kids' competition compared to traditional companies reveals three fundamental differences: risk-taking based on natural selection, a culture of conquest without limits and hyper-growth at any cost.

Natural selection
The ability of VC kids to take big risks also allows them to achieve exceptional success in some cases. This correlation between risk and reward is well known to financial experts. The more attempts, the greater the chance of success. So, venture capital's modus operandi is based on a statistical bet. For the system to work, success must be great enough to offset the losses of the majority of the portfolio's failures.

This logic cannot simply be copied by established companies, as it is difficult for them to make multiple bets simultaneously. Their resources are limited, and even when they spend large amounts of money on research and development, they tend to remain within a single logic that is compatible with the corporate culture. What large corporation would have financed USD 60 million to develop a free messaging service in 2010 without any monetisation model and facing immense competition in this area? Nobody – not even Meta or Microsoft, who would have had the resources. And yet, WhatsApp found this money on the VC market.

The great advantage of the VC system as a whole is its ability to finance the craziest bets, all of which are in conflict with or competing with each other. It's almost impossible to predict a priori that will prevail. You just have to let the Darwinian law of natural selection play out to see which winners emerge over time. In the end, the winners are not the strongest – the dinosaurs – but those who adapt best to environmental changes.

Luck plays an important role, even if certain indices (e.g.the quality of manage-

ment and the ecosystem) allow the best investors to be 'lucky' more often than others. It remains a daring undertaking, even for Michael Moritz, the former head of Sequoia:

'Every time we invest in a small company, it's a fight against statistics. We're always at a disadvantage vis-à-vis organisations that are much more powerful than us and pose a constant existential threat. It's incredibly exciting to prove everyone wrong. Nothing is more motivating!'

Culture of the impossible

They're young, talented and brazen. They're willing to work 70 to 90 hours a week for half the salary of their former classmates with the same skills.

They want to change the world – some out of idealism, others out of personal ambition. They're not afraid of anyone. Nothing appeals to them more than taking on the most powerful organisations. They have nothing to lose and can therefore challenge established practices and systems. All aboard! This buccaneering culture, combined with the professionalism of the VC model, makes it possible to form exceptionally effective teams.

Employee motivation is increased tenfold by an incomparable profit-sharing system. Whether it's founder shares or stock options, the potential gains are infinite.

Equally important for the collective dream is that a startup's exponential growth offers exceptional career prospects. What is striking (and fascinating) about young startups is their belief in their model. They believe in themselves, in their teams, in their product. Like Steve Jobs, they cultivate a certain delusion that is very useful when it comes to dedicating themselves to an impossible mission. They even believe in their business plan!

As far as I'm concerned, I don't believe in a business plan as a matter of principle. I'd like to believe it, but my personal stats are clear: out of a hundred or so investments in my life, more than half of which have proven profitable, only two startups have fulfilled their original business plan. When first meeting the entrepreneurs, I'm often so taken in by their overwhelming enthusiasm that I end up almost believing their financial forecasts… But then comes the phase where we dive deeper into topic, and the relevant questions posed by venture capitalist experts, which bring me back to factual reality. Nevertheless, this emotional cycle remains an extraordinary human and intellectual experience. Dear friends of entrepreneurs, let us continue to dream.

Growth at all costs

The VC model is fully geared towards growth in an exclusive, even compulsive way. Growth is the startup's raison d'être. Every investment is projected into a story of future growth, which must be as fast as possible. What matters is the increase in the value of equity, which depends on different factors according to the sector and stage of development. For deep tech companies that have extremely long product development cycles, value correlates with technological or regulatory advances (e.g.biotech and medtech) well ahead of sales. In other areas, revenues – if possible, on a recurring basis – allow progress to be measured. In the VC-financed phase, profitability is usually ruled out. It's better to devote all resources to ultra-fast commercial development on several R&D axes than to be slowed down by cost optimisation.

Year	Company	Financing in $M	Country
2023	Juul	1,300	USA
2023	Inflection AI	1,300	USA
2023	Anthropic	2,000	USA
2023	Anthropic	7,000	USA
2023	Stripe	6,500	USA
2023	Open AI	10,000	USA

Source: news.crunchbase.com

This philosophy creates miracles in areas that achieve large economies of scale, such as software applications using a SaaS model. The more extensive the cloud infrastructure becomes, the faster these services can be delivered. While it has traditionally taken ten years to reach revenues of USD 100 million and twenty years to exceed one billion (see chapter on 'hidden champions'), VC kids based on the SaaS model are breaking all the records. For example, Zoom's revenue reached USD 100 million in 18 months and USD 1 billion in less than four years, representing a value of more than USD 100 billion.

There are many, and increasingly striking, examples. For example, the tourism industry has experienced losses of USD 1.3 billion by 2020, and 120 million jobs are at risk according to the UN. At the same time, Airbnb was valued on the stock market at over USD 100 billion with only 6,000 employees and no proven profitability. Another example is the once very wealthy print media, whose advertising

revenue has almost entirely migrated to the Internet, of which USD 200 billion goes to Alphabet and Meta alone.

Above a certain valuation level, capital can be raised with very low dilution, i.e. almost free of charge, to finance chronic losses and thus cause competitive distortions. Better yet, markets anticipate future changes years in advance, betting that a very small number of companies (mostly VC kids) will capture the value of an entire future industry. The electric automaker Tesla was valued at USD 790 billion as of 31 December 2023, more than all automakers in the world – as if it were already dominating the global market for autonomous taxis.

The kingmakers

While every investment has its risks, the most reputable venture capital funds are much more likely to succeed. Their Midas touch is no coincidence. The emergence of a world market leader is directly connected with the financial and human resources that are available. Of course, the investors' added value is also qualitative, e.g. in the form of strategic coaching, commercial introductions and operational advice. But financing capacity remains a key differentiator, especially in the final rounds of financing, which determines who wins and who loses. This is fundamental to understanding the differences between European, Chinese and American startups.

Let's take the example of Quantenna, Sequoia's aforementioned investment. When we invested in 2009, the startup expected to break even with USD 50 million and exit in less than five years. In reality, we had to raise over USD 300 million in a dozen rounds and wait nine years before we could sell our shares on Nasdaq. The company has been through several serious funding crises. A major European investor would most likely not have had the same means to ensure the survival and development of the company. I would even venture to say that a European would probably not have ventured into such an adventure for fear of running out of fuel on the way.

It takes an average of USD 160 million to bring a private company to a billion-dollar valuation, known as a 'unicorn'. While this amount was exceptional a decade ago, it is now almost commonplace, with more than 1,370 unicorns worldwide. The geographical origin of unicorns correlates directly with the amount of venture capital invested in the ecosystem: 50% come from the US, 40% from Asia and 10% from Europe, of which half come from the UK, the European country with the most developed VC industry.

The VC model is deterministic: the higher the investment in the last financing rounds, the greater the likelihood that market leaders will emerge. The battle for the global podium is often decided in favour of the best-funded startup. They usually come from the US, as they often have five to ten times as much funding as their European competitors. There are many examples (e.g. Airbnb vs. HouseTrip). The Chinese market is often reserved for a national champion. Europeans, on the other hand, have to settle for regional positions or hope to be bought by the American consolidator. The number of mega rounds above USD 100 million has increased fivefold since 2014. There are now more than 550 mega rounds per year, with 50% of them in the US, 39% in Asia and 10% in Europe.

The probability of an investor finding a unicorn is no lower in Europe than elsewhere. According to a study by dealroom, it's even slightly higher than in the US: a European startup with seed financing has a 1.22% chance of becoming a unicorn compared to 1.07% in the US. But the chances of creating large unicorns valued at more than ten billion ('decacorn') or even a hundred billion ('octocorn') are infinitely higher in the US or China because of their investment capacity. The largest funding rounds of the last decade years have always been in these two regions, with the exception of FlipKart from India in 2022.

These figures illustrate the scale problem facing the European ecosystem. Note that the top 10 Swiss startups raised between USD 270 and 800 million (if we exclude the two companies that are of Swiss origin but headquartered in Berlin, GetYourGuide with USD 1 billion and wefox with USD 1.5 billion). This is a size ratio of 1 to 10 compared to the European leaders and 1 to 100 on a global scale. Capturing large digital markets, particularly in consumer applications (B2C), requires multi-billion dollar investments. Such investments are sometimes inappropriate for loss-making companies that have not demonstrated the viability of their business model, such as the five VC kids who have received a total of USD 80 billion in mobile applications for taxis and food delivery. The race to become giants sometimes creates speculative bubbles, which will undoubtedly burst.

Excesses and failures are part of the system. But by and large, the venture capital model works, and its large-scale industrialisation remains a serious competitive reality.

If the Europeans want to play in the same league as the Anglo-Saxons and the Chinese, they need an ecosystem of an appropriate scale.

Ultimately, it's not surprising that American and Chinese startups lead the rankings of both the top-rated and the highest-funded companies. The VC kids'

Top 25 The best funded VC kids in the world

	Company	$ collected	Year established	Country
1	Apple	97,875	1976	USA
2	Amazon	76,413	1994	USA
3	Oracle	65,265	1977	USA
4	Intel	63,028	1968	USA
5	Gilead Sciences	36,461	1987	USA
6	Crown Castle	35,828	1994	USA
7	Northvolt	35,714	2016	Sweden
8	Uber	35,049	2009	USA
9	Meta Platforms	30,809	2004	USA
10	Tencent Holdings	29,994	1998	China
11	Fiserv	28,239	1984	USA
12	Centene	25,815	1984	USA
13	Rivian Automotive	24,875	2009	USA
14	Equinix	24,658	1998	USA
15	Hologic	21,555	1985	USA
16	Celgene	21,513	1986	USA
17	AES	21,390	1981	USA
18	Starbucks	21,167	1971	USA
19	Meituan	21,031	2010	China
20	Waste Management	18,611	1968	USA
21	Netflix	17,240	1997	USA
22	Juul	16,971	2007	USA
23	WeWork	16,688	2010	USA
24	eBay	15,620	1995	USA
25	Tesla	14,402	2003	USA

valuations correlate strongly with the amounts contributed and thus with the high-tech power of a country. While noting the primacy of money contradicts the romantic vision of the self-financed genius entrepreneur, it must be accepted in order to understand the foundations of this success model.

Storytelling

In this environment of exponential growth, the VC kids have developed the ability to tell stories of growth from an early age – the art of the famous Anglo-Saxon storytelling. It allows them to generate energy around a highly motivating goal. We Europeans tend to underestimate this ability. Yet it is essential for high-tech entrepreneurs, who must raise funds and keep their shareholders content for many years, often without profits or full technological validation. Elon Musk has achieved the feat of selling his futuristic vision of autonomous cars and robot taxis, which has enabled him to finance Tesla for the last 15 years. It has raised more than USD 25 billion in 36 investment rounds, including USD 60 million in venture capital and the remainder in government and private loans, as well as stock market capital increases. This approach buys time for the original vision to finally becomes reality one day.

Tesla has a much better grasp of storytelling than other manufacturers and is therefore able to attract the full attention of the market. What's more, Elon Musk manages to make his competitors look old-fashioned and drown them out in the media hullabaloo, despite their huge investments in electrification. The stock market did not react to Volkswagen's announcement in December 2020 that it would invest EUR 73 billion in its electric cars over the next five years. It's a different story with every Elon Musk Tweet. Tesla has certainly gained a head start in the development of critical technologies (batteries, autonomous systems), but can this competitive advantage justify such an valuation? In its early days, Tesla was much less well positioned than Toyota for example, which has been marketing the Prius hybrid car since 1997.

The Chevy Volt and Nissan Leaf electric cars were introduced in 2010 and the Renault Zoé in 2013. Mercedes in particular had all the cards in its hand: automotive pioneer, prestige brand, operational know-how (e.g. electric cars with Smart). In addition, Daimler-Benz owned 10% of Tesla after the company was saved in 2009 thanks to a USD 50 million investment. Sold for USD 4 billion in 2016, this share would be worth USD 70 billion today – the same as Daimler-Benz.

Moonshot

The art of storytelling is not just an exercise in style: it's essential to the success of the craziest bets based on a very ambitious, long-term vision, known as a moonshot. Or a 'Mars shot', rather, in the case of Elon Musk, with the launch of his startup SpaceX in 2002, whose ultimate goal is to reach the red planet. At the time, the bet to revolutionise the world of space seemed crazy, given both the technical and financial domination of big government agencies NASA and ESA. And yet SpaceX is an indispensable player in the space industry today, with 13,000 employees, CHF 9 billion in sales in 2023 and more than 320 launches in total, many using reusable launch vehicles. SpaceX has thus risen to the world's number one space company, ahead of Arianespace, by breaking the market price barrier with launches for less than USD 60 million. SpaceX achieves this through reusing vehicles, fully vertically integrated manufacturing, and a modular approach to modern software engineering. According to Steve Jurvetson, Tesla and SpaceX's first VC investor, Musk calculated that the raw materials needed to build a rocket were only 3% of a rocket's sales price. He believed he could reduce launch costs by a factor of ten if he used a transgressive startup approach. This approach can therefore be applied to all types of industries, including those under the exclusive control of a state or large, frozen industrial groups.

SpaceX's revolutionary impact has already crossed the Atlantic. In November 2020, the European Space Agency (ESA) entrusted the mission of cleaning up space to a Swiss startup (ClearSpace) with less than 20 employees and a budget of EUR 86 million. This is unprecedented for an organisation that is used to working primarily with large industrialists. In addition, the ESA has stated that paying ClearSpace instead of developing its own space debris disposal system 'is the ESA's new way of doing business'. The organisation will pay for the first mission, and ClearSpace will have to cover the rest of the costs through investors. This decentralised business model, which leverages venture capital, is a major innovation in Europe. This further proves the power of VC kids, who appear in areas dominated by quasi-governmental institutions. Palantir's USD 55 billion valuation, a startup specialising in big data analysis for intelligence and defence co-founded by Peter Thiel (PayPal co-founder with Elon Musk and first investor in Meta), confirms this strong trend. The US government also uses venture capital to finance innovation in government sectors. To this end, it has established venture capital departments for the Army (Army Venture Capital Initiative) and its intelligence services. The CIA publicly admits on the In-Q-Tel website that it launched the fund in 1999 because 'government agencies, once innovation leaders, recognized they were missing out on the cutting-edge, innovative, and

impactful technologies coming out of Silicon Valley and beyond'. Venture capital is therefore becoming an indispensable tool for innovation in all sectors, including governments and large corporations.

'One hundred billion? I'm sorry, I'm not sure I understood you correctly. Are you referring to the renminbi?'

– 'No, American dollars,' answered my interlocutor, Jeffrey Li, somewhat embarrassed.

– 'Ah, yes, I understand…' It takes me a few seconds to imagine the size of a portfolio with investments worth more than 100 billion dollars. 'But what you're doing right now is extraordinary,' I finally said to him, as a compliment and, above all, an excuse for my ignorance.

It's February 2019 in the picturesque California city of Monterey on the Pacific Ocean, at the Global Corporate Venturing Summit's gala dinner, the leading conference of the corporate venture industry or corporate VC (CVC). Every year, the executives primarily responsible for the investment activities of 500 large corporations from all over the world meet there. My Chinese table neighbour Jeffrey Li, head of Tencent's investment operations, seems very discreet compared to the other colleagues I've met throughout the day, whose strong personalities are matched only by their influence in prestigious multinational companies, such as Jon Lauckner, head of GM Ventures and CTO of General Motors, or Sue Siegel, head of GE Ventures and CIO of General Electric. Everyone tries to make their voices heard in the hustle and bustle of informal meetings over coffee by more or less subtly referencing the size of the fund for they're responsible for – the famous Assets Under Management (AUM) – in order to gauge their interlocutor. In some cultures this number is revealed by the second sentence, at the latest…

In other cases, at least two or three courses are needed to gauge the 'dimension' of the fund in question. That's the case for the Tencent representative, the Chinese social networking giant known for the hugely popular messaging service WeChat, which has more than a billion users. While I knew the company, I couldn't imagine how huge its investment portfolio was at the time: more than 800 holdings, 70 of which are listed on the stock exchange, 140 unicorns (companies with a value of more than USD 1 billion), a strong presence in the biggest video game studios (Supercell, Activision Blizzard, Ubisoft, etc.) and stakes in major high-tech successes (5% in Tesla, 10% in Spotify, 13% in Snap, etc.). Tencent's CVC activities are therefore fundamental to the future of the holding company, which systematically reinvests an enormous part of its cash flow into the global

Internet ecosystem. Today (March 2024), Tencent's startup portfolio is valued at approximately USD 150 billion.

That was a key moment for me. I had just realised that corporate VC had reached a new scale. Asia was about to reach a dimension 10 times larger than that of my American role models at the time and 30 times larger than that of Europeans. It was time to wake up if we wanted to stay in the race. While Europeans think in terms of tens of millions a year, Americans think in three digits, the Chinese in billions, and Japan's SoftBank in tens of billions. Although we have the same job, we're not living on the same planet.

Corporate venturing

Although it was launched 40 years ago by some American multinational companies, the discipline of corporate VC is relatively young and unknown. It was first introduced in the US in the 1990s by Intel Capital (USD 15 billion, invested over 30 years), a spin-off of Fairchild Semiconductor, the first venture capital company in Silicon Valley. Corporate VC is tentatively established in Europe and is limited to a few telecom operators (Innovacom/France Telecom 1988 and T-Ventures/Deutsche Telekom 1998) and pharmaceutical companies (Novartis Ventures 1996). The corporate VC industry has really picked up momentum over the last ten years with the emergence of Asians who have catapulted it into a new dimension. While Americans typically invest 1–2% of their cash flow in corporate VC and Europeans less than 1%, some Asians are frequently much more ambitious, sometimes dedicating 100% of their available funds to it. The numbers speak for themselves: Where corporate VC's largest Western investor, Intel Capital, invests USD 500 million per year, China's Tencent or Alibaba invest between USD 5 and 10 billion annually and have built up equity portfolios worth more than USD 100 billion in just a few years.

Corporate VC is no longer an optional side activity, but is becoming a central element of large Asian digital companies' growth strategy. They see it as an opportunity to develop their underlying digital ecosystem (applications and infrastructure), from which their parent company directly benefits, to diversify their activities. Japanese telecom group SoftBank has been the most aggressive in this process of industrialising corporate VC with the launch of the over USD 100 billion Vision Fund in 2017, the largest fund in the history of venture capital, 15 times larger than the largest US funds. These huge investments are gradually transforming the parent company into an asset manager with an investment holding company that is rapidly expanding beyond its original core business, enabling the group to reorient itself rapidly. Even if some mega-investors will fail, one trend is clear: corporate VC is no longer just a tool for technology monitoring

and partnering with startups (open innovation). It can also become an instrument of diversification and sometimes even the strategic reorientation of the group, provided that the amounts invested are sufficiently large in relation to the size of the parent company.

The great dynasties

Corporate VC has already proven itself spectacularly. For example, the humble South African press conglomerate Naspers managed to fundamentally transform itself by investing USD 32 million in 31% of an obscure Chinese startup in 2001. This investment is now worth more than USD 100 billion. The startup? Tencent, which itself is valued at more than USD 340 billion. Steeped in the culture of profitable corporate VC, it's no surprise that Tencent wants to repeat this logic itself.

This intergenerational transmission can also be seen in the SoftBank family (USD 85 billion market capitalisation) – Alibaba (USD 180 billion) – Ant Group (valued at USD 200 billion prior to the aborted IPO). Masayoshi Son, a young South Korean immigrant to Japan and founder of SoftBank, made a bet in 2000 and invested USD 20 million in a Chinese e-commerce startup: Alibaba. His stake is now valued at almost USD 55 billion, even after selling more than a third over time. This achievement is exceptional, both because of the 250 multiple achieved, and because of his ability not to sell too quickly. Most VCs sell their shares less than two years after the IPO. Due to the necessity to close the funds in less than 12 to 15 years, Apple's investors (Sequoia Capital and Venrock) sold their shares after the IPO in 1980 at a price of USD 1.7 billion, worth about a thousand times less than today. They regretted it afterwards. Companies that invest their own money do not have this restriction and can take a (very) long-term perspective, as the two previous examples show. Here too, the 'mother' Alibaba is copying the aggressive approach of 'grandmother' SoftBank and investing heavily in hundreds of startups, one of which, ANT Financial, is also highly active in corporate VC in order to finance the fourth generation of the family.

SoftBank is experimenting with a new capital-intensive model that mixes activities that are culturally extremely various and have traditionally been carried out in closed silos. Investing in minority positions in startups (CVC), acquiring publicly listed, sometimes majority shareholdings (such as Warren Buffet's Berkshire Hathaway) and managing assets for third parties (independent VC). The former telephone providers (SoftBank in Japan and Sprint in the US) have evolved into global high-tech conglomerates. Will they reorient themselves again and become chiefly fund managers?

A new strategic function emerges

The aim of large-scale CVC activity is to transform the parent company, both strategically and financially. First and foremost, I'd like to stress that a positive return on investment is essential in the long run. I do not believe in the continued existence of loss-making CVC funds, even if they invoke 'strategic' considerations to justify their existence. Without profitability, they are weakened and discontinued as soon as the parent company has to make drastic savings. On the contrary, the goal of a CVC unit must be to become a cash cow. It takes patience to get there, but it's feasible after the first round of investments and exits. The size of the returns correlates with the amount invested: companies that invest only 1% of their cash flow in CVC cannot expect miracles. But those who invest more than 10% can really hope for a significant contribution, which is sometimes crucial because it is delayed. It's ideal to invest continuously in the good years to create future reserves. A short calculation shows that a regular distribution of 10% of the cash flow over 20 years in CVC investments generates a 2x multiplier after five years and, if systematically reinvested (evergreen), enables the creation of a portfolio that is 7.5x the cash flows of the parent company in the 20th year.

Apart from financial considerations, the role of the CVC is also to create strategic value for the parent company and startups. CVC activities contribute to six essential functions: strategy (identifying new trends, growth opportunities or risks of disruption in emerging markets), M&A (acquisition opportunities), business development (working with startups and partnership agreements), R&D (technology monitoring, working with startups to develop new products), human resources (recruitment on university campus and in the high-tech ecosystem, fostering a culture of intrapreneurship) and communication (positive image associated with startups). That is quite a lot, especially as these strategic contributions can be free of charge. The CVC team contributes to internal objectives, provided that the investments are profitable, in addition to managing external investments.

New skills for top management

Right here, at the intersection of the realms of large companies and startups, is where value creation takes place. CVC is a bridge between two worlds that need each other but struggle to communicate and collaborate. Mastering the language and culture of both enables exceptional synergies. The companies with the greatest CVC expertise develop a real competitive advantage over their competitors because they take advantage of opportunities that arise more quickly and (re) position themselves in line with changes in the market. Your CVC leadership skills will then become essential for growth and innovation. I'm not just talking about the CVC team, which of course has a direct impact on the results. I'm also thinking of the top management of the parent company, which has to make important decisions regarding the CVC budget, often in direct competition with dividend payments, acquisitions or R&D investments. Top management must compare the return on investment (ROI) of the CVC division with the internal projects and determine the consequences for the resource allocation.

It's equally important that the board of directors and executive board members develop the know-how to leverage the strategic value of CVC. How can the group's strategy be adapted to external signals (business opportunities or disruption risks) that are identified by the CVC team? How can you facilitate the collaboration between external startups and the line? What opportunities should be exploited to open up new growth areas through the acquisition of startups?

The pharmaceutical industry has developed these skills to a very high level, which is no coincidence. The pharmaceutical industry has been implementing CVC activities for a very long time (40 years for J&J, 25 years for Roche and Novartis). They've already integrated CVC into their business model. CVC units continuously monitor the ecosystem and advise their parent companies on the acquisition of innovative startups. They then integrate the startups into their own R&D infrastructure and commercial sales channels. The system is well established and offers significant savings at all levels. The startups dedicate their resources entirely to research, knowing that they will be bought out (or taken public) before putting their drugs on the market. Pharmaceutical companies can outsource part of their very expensive R&D in collaboration with the most promising startups. They develop ecosystems in emerging industries to better understand them. For example, the Global Health Innovation Fund has enabled Merck to develop growth possibilities in digital health.

Top management is regularly informed about the progress of these startups and devotes time to the most promising young entrepreneurs. I can testify to the great interest of the CEOs of giant pharmaceutical companies in the executives of the small companies in our portfolio, despite the enormous size differential. In comparison, I see a lack of respect for startups in many other industries, as if arrogance (or ignorance) is blinding them to changes in the outside world. The exchange between startups and corporations requires humility, curiosity and open-mindedness on both sides if it is to bear fruit.

The genetic mutation of the Homo entrepreneurius helveticus

Henri Nestlé
Nestlé 1866

Reinhard Straumann
Straumann 1954

Daniel Borel
Logitech 1981

Madiha Derouazi
AMAL 2012

Strategic investor for startups

Corporate VCs also bring a strategic dimension to startups. The contributions are manifold at all stages of development: R&D (technical validation on full-size infrastructure), commercial (product purchasing, solution co-development, access to marketing channels), communication (brand awareness) and exit (acquisition). Some investors and startup executives underestimate the importance of good relationships with large companies. While they are in fact difficult to control and conservative, they also offer exceptional opportunities for startups that know how to exploit synergies. The CVC teams are also there to facilitate positive cooperation between the two parties, which are very different but complementary – yin and yang.

Venture capital: the word is a dreamy allusion to Californian high-tech successes, but the European translation is depressing – 'Risikokapital' (risk capital) in German or 'capital risque' in French.

This term, which has negative connotations, is semantically wrong: the word venture refers above all to a daring initiative, an (ad)venture that requires courage and boldness. The Collins Dictionary defines it as an 'activity which is new, exciting, and difficult because it involves the risk of failure', with the following four synonyms: 'undertaking, project, enterprise, chance'. This is a perfect definition of the entrepreneurial spirit, a far cry from the shorthand 'risk' capital, which is misunderstood by the general public in Europe and often confused with other classes of high finance with frightening names such as vulture capital, junk bonds and distressed debt – in other words, irresponsible speculation, Russian roulette and Wall Street wolves. The association with private equity (pejoratively referred to as 'grasshoppers' by some in Germany) is also common and contributes to this negative image.

The limits of the VC system

It must be made clear that VC world also bears its share of responsibility. Our industry is not a role model when it comes to social inclusion and, above all, the fight against inequality. The share of women in management roles in the 2,472 corporate VC funds worldwide is 5% (GCV Global Corporate Venturing, 2019). According to my estimates, it is also below 10% for partner positions in VC and CVC funds in Switzerland. This is unacceptable. We need a significantly more diversified recruitment policy in order to catch up. Our industry is not regulated, which means have a personal responsibility to find solutions. We cannot remain outside the course of history, which is fortunately enabling women to reach the highest positions. The fact that there are so few women in the investment world is directly correlated with their lack of representation in the world of entrepreneurship. In Europe, only 11% of startups are led by a female CEO (Pitchbook 2019). In Switzerland, 6.5% of the rounds were conducted with female CEOs, for only 4% of total investment (Startupticker Radar 2012 to 2020). Nevertheless, in the medium term I remain highly confident about the representation of women in venture capital, because a very talented generation of young women is on its way. The process takes time, as there are very few VC professionals trained in the Swiss market. It takes years of practice in the field to gain the necessary experi-

ence and the role of partner. It's worth striving for the proportion of women in the VC to correspond with the proportion of female entrepreneurs and researchers. According to the Federal Statistical Office (FSO), women account for 36% of those currently engaged in research and 34% of business founders (all sectors, not just startups). The underlying indicators are very positive and constantly improving: women now make up 52% of master's students, 47% of doctoral students and 36% of R&D personnel in Switzerland (26% in private companies and 44% at universities). The differences between the R&D sectors are large: 25% of the women work in engineering and technology research, 48% in health and 57% in agronomic and veterinary research.

Beyond the statistics, I would like to mention three extraordinary women who are world-class researchers and entrepreneurs: Emmanuelle Charpentier, co-founder of CRISPR Therapeutics, winner of the 2020 Nobel Prize in Chemistry for her contribution to the development of CRISPR technology, a revolutionary gene editing tool. Martine Clozel, co-founder of Actelion and Idorsia Pharmaceuticals, and Madiha Derouazi, founder of AMAL Therapeutics.

The representation of women in executive positions is now a statutory requirement in some countries. This applies to any publicly traded company headquartered in California. VCs need to increase the number of women on the boards of startups in preparation for IPOs if they want to take part in the most competitive rounds.

It must also be recognised that the venture capital financial instrument is not always used with a sense of proportion, which can sometimes lead to distortion. Any good thing can become poisonous if it's misused, as is the case with venture capital, which becomes a powerfully addictive drug if used for too long. Designed for financing young innovative companies in the growth phase, some mature startups also cannot do without it. They are structurally deficient and owe their survival only to regular financial injections. The problem is not so great for the investors, who are aware of the risks, nor for the employees who are paid thanks to these financial contributions. Rather, there is a risk of unfair, not to say illegal, distortions of competition resulting from sales at a loss (dumping) for all competitors who do not benefit from this windfall. A business model that relies on sales at a loss for ten or more years raises competition issues. Especially if it is spread through an IPO, which can prolong this situation almost indefinitely. This model is extremely effective in eliminating competition and, in the long term, establishing a quasi-monopoly situation, a far cry from the original raison d'être of venture capital.

Examples of companies 'on steroids' abound: Uber, for example, has swallowed more than USD 15 billion from venture capital and USD 10 billion from the stock market, totalling USD 25 billion for a simple mobility app. Its long-term vision is powerful: the multifunctional (people and goods), autonomous taxi car. However, this economic model only works in a quasi-monopoly situation or without drivers – we're still a long way from that. This unlimited inflow of capital also creates a sense of power, as if entrepreneurs are above the law. Their reasoning is subtle: the innovation of its new service makes it possible to break down the cumbersome nature of existing taxi networks, thus serving the common interest of consumers. Uber has managed to establish itself on every continent, creating a global brand valued at more than USD 160 billion, even though the company was profitable until 2023, and its HR is regularly sued in courts around the world.

The culture of transgression allows startups to fulfil impossible missions and even change the world. But this culture must be kept under control. It's tempting to get used to more and more transgressions, even skirting the law, making it our job as experienced investors to help entrepreneurs find the right balance.

The Swiss Start-up Ecosystem

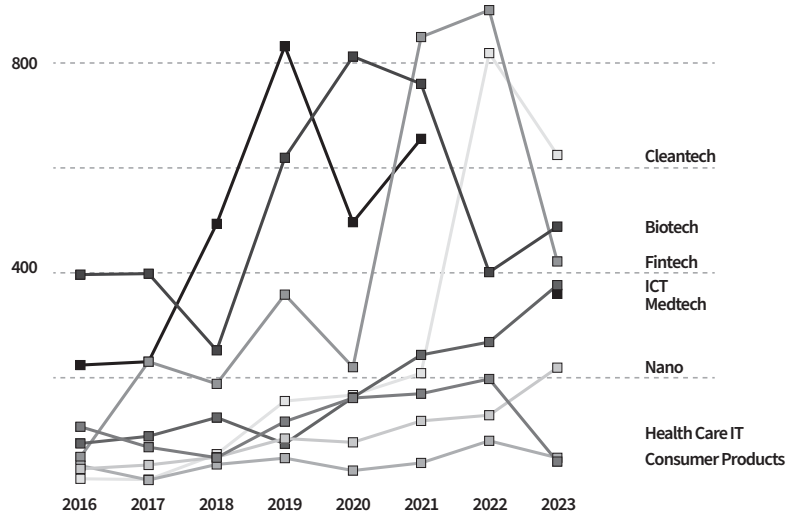
‘It’s just THE place to be!’ Christian Wenger, President of the Startup Days since its founding in 2003, partner of the Zurich law firm Wenger Vieli and Swiss Business Angel of the Year 2018, promotes the annual event, which brings together the best entrepreneurial talents in the country, with his usual enthusiasm: 800 people representing 400 start-ups, around 50 investors, a dozen specialised lawyers and around 50 large corporations.

25 September 2018 was a special day for him. He had the pleasure of interviewing the Swiss President, Dr Schneider-Ammann, himself a renowned entrepreneur and owner of the Ammann Group described in Chapter III. He came to encourage entrepreneurs and announce his sponsorship of the Swiss Entrepreneurs Foundation (SEF). It was a consecration for Christian, who has been passionate about the Swiss start-up community for two decades.

We’ve come a long way in fifteen years. The amounts invested by companies as innovation capital have risen from less than CHF 200 million per year in the 2000s to CHF 2.6 billion in 2023.

According to a 2020 study by Startupticker/HEC Lausanne, the Swiss start-up cluster consists of 4,000 start-ups with 50,000 employees. It is gradually rising in the European hierarchy, reaching fifth place behind the United Kingdom, Germany, France and Sweden.

VC Investments in Switzerland



Nevertheless, on a global scale, it remains rather modest compared to the American, Chinese and Israeli clusters, which are 50 times, 25 times and 4 times larger, respectively. Switzerland has an image deficit, especially in the global cluster rankings by city, with a modest 36th place for Zurich, while Lausanne, Bern and Basel are not even in the top 40 of the Global Startup Ecosystem Report 2023. Switzerland does not have a particularly entrepreneurial reputation, unlike some European cities that have built their cool image around a few well-known successes, such as Spotify and Skype in Stockholm, Farfetch in London or Rocket Internet in Berlin, as well as incubators such as Station F in Paris.

In comparison, Swiss cities do not have the critical size on a global scale. Swiss start-ups are located across the country in some 30 innovation parks, mostly in cities with less than 200,000 inhabitants. This decentralisation enables them to offer excellent living conditions in close proximity to magnificent landscapes, lakes and mountains. However, this remains a weakness in terms of marketing strength. In a global environment of geographic concentration (the top ten clusters produce more than two thirds of total value added) and hypercompetition for the best researchers, entrepreneurs, investors and buyers, visibility is an important issue. It is therefore necessary to think at national level and not at the level of the 26 cantons. Silicon Valley covers a region the size of the Swiss Plateau and has a similar population. Why not communicate around a homogeneous cluster that can call itself Swiss Tech Valley, Deep Tech Valley or Deep Tech Nation, as Israel does as a start-up nation?

Deep Tech

The Swiss cluster is clearly focused on complex technologies resulting from scientific research. The universities generate around 100 academic spin-offs per year, almost half of them on the ETHZ and EPFL campuses. But the private sector also produces industrial spin-offs, such as Actelion from the Roche laboratories. In a broader sense, the deep tech world also includes start-ups that have developed their own technologies ex nihilo in areas of high scientific complexity. The most important categories for deep tech investments are currently biotech, artificial intelligence, big data, computer vision, robotics, nanotechnology, blockchain, Internet of Things (IoT), semiconductors, drones and medical devices (medtech). By contrast, light-tech or low-tech companies use existing technologies such as online sales websites. In the low-tech sector, value creation is primarily linked to marketing and organisational skills, financial resources and an innovative business model. Technology can be ubiquitous in low-tech, but these are incremental technological improvements and challenges that are operational rather than scientific. Some companies like Amazon have a mix of low-tech (e-commerce) and deep tech activities to differentiate their offerings (drones or artificial intelligence) or to optimise their operations (Amazon Web Services).

In the last ten years (2014–2023), about 40% of VC investments in Switzerland have been in the healthcare sector (biotech, medtech and medical IT solutions), compared to 15% of global VC investments. On average, information and communication technologies (ICT) account for just over 40% of investment, particularly in fintech. The remaining 20% is in highly specialised deep tech sectors, which are often perceived by VC investors as difficult to assess, but in which Switzerland plays a very important role. These include robotics, drones, cleantech, nanotechnologies, nutrition, high-precision optics, new energy sources (e.g. fusion), micromechanics and materials sciences or quantum computing. Two thirds of VC investments in Switzerland have a strong connection to deep tech.

Thanks to its specialisation, Switzerland ranks among the European top five for deep tech investments behind England, France, Germany and the Netherlands, and on a par with Sweden. It can therefore claim to play a world-class role in certain niche or historical sectors such as biotech and medtech.

Low-tech

On the other hand, Switzerland has not succeeded in establishing a leading international position in low-tech markets, where it has no competitive advantage. For example, digital business-to-consumer (B2C) applications require so much capital to achieve a leading global position that it is almost impossible for Swiss start-ups to compete on an equal footing. Knowing that the winner will ultimately be the one who has the greatest financial means to be the last one standing after many years of losses, this type of investment is very risky. At Swisscom Ventures, a number of talented Swiss entrepreneurs approached us and asked us to finance a taxi application along the lines of Uber. But how can you fight a competitor with a financial advantage of USD 28 billion?

The start-up HouseTrip, which was once a success story of the Swiss ecosystem, is unfortunately a textbook example to illustrate this unequal struggle. Everything started off well for this nice little start-up, which was founded in Lausanne in 2009 by two students from the EHL Hospitality Business School, Arnaud Bertrand and his wife Junjun Chen. HouseTrip quickly became the European market leader in online platforms for holiday home rentals. Financed by the three largest European innovation capital funds, Index Ventures, Balderton Capital and Accel Partners, HouseTrip raised USD 60 million – a record for a European start-up, and a Swiss one at that. In an interview with the *Tages-Anzeiger* newspaper on 9 December 2013, HouseTrip co-founder Arnaud Bertrand estimated the value of his company at almost CHF 1 billion. 'Every week I get an offer to buy my company.'

In hindsight, it is clear that a sale at this point would have been a good decision, as the competition from Airbnb was growing. Financed by Sequoia Capital and Jeff Bezos of Amazon, Airbnb received 100 times more money (USD 6.4 billion). Airbnb, now valued at more than USD 80 billion – despite the standstill caused by the coronavirus crisis – swallowed everything in its path. HouseTrip was not up to the task and in 2016, was ultimately sold to another American company for a modest price: TripAdvisor.

‘HouseTrip did not make any mistakes,’ says Beat Schilling, founder of the Institut für Jungunternehmer (IFJ) and one of Switzerland’s most active business angels, to the *Handelszeitung* newspaper. ‘In Switzerland, we don’t have investors who can invest hundreds of millions of francs in a start-up,’ he continues. As a co-founder of Venturelab, the remarkable coaching organisation that has helped 90% of Swiss start-ups, Beat knows the reality of this B2C market like no other. Some internet companies founded in Switzerland have decided to move to Berlin in order to gain access to more capital and pursue a very ambitious development strategy, such as GetYourGuide, an online platform for the tourism industry, and wefox, an online marketplace for the insurance industry.

Fortunately, there are still excellent investment opportunities in Swiss B2C start-ups, provided they either have a technological distinction or focus on a local market. The online jobs platform Jobs.ch managed to take the lead in a certain category in Switzerland before international competition came on the scene. The company was sold to the media groups Ringier and Tamedia (TX Group) for CHF 415 million. This niche logic also applies to business-to-business (B2B) applications, as demonstrated by the successful launch of bexio, the SaaS platform for SMEs sold to Mobiliar. The e-commerce company LeShop.ch, co-founded by Alain Nicod (a well-known VC at VI Partners) and taken over by Migros, is also a good example of a national leader that is not directly exposed to global competition.

In the Swiss start-up ecosystem, 77% of investments come from abroad and 23% from Switzerland, according to a study conducted by the University of Lausanne in collaboration with startupticker.ch for the period 2010–2019. US VC funds account for half of the international contributions; they have no offices in Switzerland and invest from their London offices or directly from the US. The rest of the foreign money comes mainly from London and a small part also from Germany or France. The larger the financing round, the more important the share of foreign capital becomes, with the most mature companies often exceeding 90%.

Swiss capital is mainly focused on the early stage (seed capital, first rounds), although the sharp increase in the size of some Swiss funds in recent years now allows them to participate in later rounds.

By international standards, the Swiss market is characterised by a significant under-representation of institutional investors and a very low contribution from state sources. State-owned funds in Europe (European Investment Fund, High-Tech Gründerfonds in Germany or Bpifrance) account for between 30 and 40% of VC financing. In Switzerland, there is no direct federal investment in start-ups or VC funds. State funding is available only for research projects (e.g. Innosuisse) and support for cleantech companies (Technology Fund). There are also some cantonal funds for projects in the start-up phase (e.g.FIT). On the flip side, private investors contribute much more than the European average of 8%. Business angels contribute the bulk of the financing upfront and are often also present in growth rounds. Large companies are quite present thanks to their corporate venture funds. However, institutional investors (banks, pension funds, insurance companies, fund managers) are under-represented compared to the European average of 40%.

Business angels

Private investors, so-called business angels, play a very important role in Switzerland. They cover a broad spectrum of start-up financing, from the seed round to the second or third round. They have a huge investment capacity, with some individuals able to invest millions in a single company. They invest directly or via platforms (investiere.ch, BAS, A3 Angels, GoBeyond, SICTIC), the most powerful of which have now reached an investment volume similar to that of the VC funds. Banks also play an important role, as they regularly present investment opportunities to their wealthy clients and can thus broker large amounts, sometimes in excess of CHF 10 million.

Family offices

In Switzerland, too, there are many management companies for wealthy families, the family offices, which act as business angels for the smallest or as VC funds for the largest, such as Waypoint Capital (Bertarelli family) or Hammer Team (Ariel Lüdi).

Independent venture capitalists

Around fifteen independent VC funds are active in Switzerland. Although the largest generalist funds (Index Capital and Lakestar), specialists in life sciences (HBM Partners, Endeavour Vision) or the environment (Emerald Technology Ventures) have offices in Switzerland, they invest globally and therefore mainly outside Switzerland. redalpine and B2V are active throughout Europe, but with a larger share in Switzerland. The Swiss Entrepreneurs Fund is a fund of funds mainly focused on Swiss VCs with some direct investments. VI Partners is fully focused on the Swiss market, as are some smaller seed funds such as Wingman Ventures or Alpana Ventures.

Corporate VC

Corporate venturing plays a particularly important role in Switzerland with around twenty companies, some of which have gained significant strength over the past five years. Some funds, like their parent companies, operate primarily internationally, e.g. Novartis Venture Fund, Roche Venture Fund and ABB Ventures. Others focus on Switzerland, such as ZKB Ventures, PostFinance or Zühlke

Ventures. Swisscom Ventures has opted for a dual strategy in which at least 50% is invested in Switzerland and the remainder abroad.

Swisscom Ventures

Launched more than fifteen years ago, Swisscom's corporate venture unit is committed to innovation. For example, the Digital Transformation Fund DTF I, launched in 2018 and financed mainly by a dozen pension funds, as well as its successor DTF II (December 2020), has a hybrid model that is unique in the world. These two VC funds systematically co-invest with the corporate venture unit Swisscom Ventures. This model enables to utilisation of strategic synergies and thus clearly sets them apart in order to enter the most competitive investment rounds and manage the portfolio according to the best practices of independent VC funds.

Swisscom Ventures was founded in 2007 with a small team of 4.5 full-time employees, a modest budget and a start-up culture. Each year, they receive more than 1,000 investment proposals from start-ups from all over the world, of which no more than ten (i.e. less than 1%) receive an investment of between CHF 1 and 20 million in exchange for a minority position of typically 1 to 25%. As a member of the board of directors (director or observer) of their portfolio companies, they take an active part in their strategic and often operational development. In particular, they facilitate interaction within the Swisscom Group with the aim of exchanging information, proving technical feasibility (POC) or, in the best case, establishing a contractual relationship.

For example, the innovation of a voice remote control in Swiss German dialect for Swisscom TV was implemented with the voice recognition expertise of KeyLemon, a Valais-based company in which they had a stake. This is a good example of a successful collaboration between a large company focusing on differentiation through innovation and a Swiss start-up looking for customers. KeyLemon was sold to the AMS Group in 2017, which gave them a financial profit in addition to technical support.

The transition from laboratory prototyping to commercialisation is a critical phase. For the Swiss ecosystem to flourish, it is important that established companies show openness and a certain ability to take risks in order to give young teams a chance. This is exactly what the television group Teleclub did in 2008 with the start-up LiberoVision. The ETH spin-off, which was founded in 2006 by two Swiss doctoral students who were passionate about sports and IT, grew out

of the laboratory of Professor Gross. LiberoVision had developed an image analysis solution for the display of graphics during sports broadcasts. The Swisscom Teleclub division was therefore the first to take the risk of using its technology live for a 1. Liga classic football match. This was the turning point for the start-up, which then received calls from ZDF and BBC and eventually became the global market leader for digital sports animation. The company was sold in 2009 to Vizrt, a leading provider of technology for TV studios, whose sports department is still headed by the CEO of LiberoVision. Swisscom, as the only external investor holding a stake in the capital of this start-up, has thus achieved a good financial transaction.

Over the years, Swisscom Ventures has developed into a platform for exchanges between two very different ecosystems: on the one hand, start-ups looking for technological validation and new customers, and on the other, Swisscom looking for innovations for its own customers, private customers and small and large companies. These two worlds sometimes find it difficult to understand each other, and Swisscom Ventures' task is, in particular, to build communication bridges to facilitate the implementation of joint projects. This positions them as strategic investors that complement independent VCs.

A home run. I chose this quintessentially American term to acknowledge the culture of success that has enabled some venture capital funds to achieve exceptional returns in the United States. This is no coincidence; they are the result of fifty years of development and a well-established (eco)system.

In comparison, the exits of Swiss start-ups are much more modest, with the notable exception of world-class superstar Actelion. This is perfectly normal, as the Swiss ecosystem is young and relatively poorly financed. With investments of just CHF 21.5 billion since 1990, more than fifty Swiss start-ups have been valued at more than CHF 100 million at the time of their IPO or takeover (the list can be found in Appendix 4). These results are very encouraging, and the best is yet to come.

Unicorns

Around a dozen Swiss companies financed by innovation capital have surpassed the value of USD 1 billion, and have thus achieved the status of the famous unicorns. Two thirds come from the ICT (information and communication technology) sector, but the most spectacular exits are biotech companies: Actelion (CHF 4 billion at IPO, sold 16 years later for USD 30 billion), CRISPR (valued at USD 5 billion on 31 December 2023 on Nasdaq), NBE Therapeutics (acquired by Boehringer Ingelheim for EUR 1.18 billion in 2020) and AC Immune (briefly over CHF 1 billion in 2018, currently valued at CHF 300 million). u-blox, the ETH Zurich spin-off specialising in IoT communication modules, also briefly surpassed the CHF 1 billion mark on the stock exchange in 2016, but is currently valued at CHF 620 million. Climeworks and SonarSource were valued at several billion Swiss francs each in the last round of financing. Kandou and beqom will soon join this illustrious circle of Swiss unicorns.

Five blockchain companies based in the Swiss Crypto Valley (Ethereum, Cardano, DFINITY Foundation, Cosmos and Polkadot) have crossed the billion mark in valuation, but their business model as a crypto-money exchange platform is not comparable to that of a traditional start-up. Taking into account the strong links with Switzerland at the level of investors and management, three unicorns from the internet/ICT sphere can be added to this list. They started in Switzerland, but then moved to Germany (Hybris, wefox and GetYourGuide). I would also like to mention Heptagon Micro Optics, which was sold to the ams Group in 2016 for USD 850 million. Although the company was founded in Finland and then relocated to Singapore, it is one of the success stories of the Swiss ecosystem. The company, which specialises in high-performance sensors for mobile phone cameras, was created in 2000 through a merger with a CSEM spin-off. Since then, the global research and development centre has been located in Rüschlikon near Zurich. The representative of Nokia Growth Partners (NGP) Capital, Bo Ilsoe, is also privately based in Geneva.

Ambitious unicorns

The ecosystem has gained momentum thanks to the rapid growth of investments by local Swiss funds over the past five years. A dozen scale-ups have emerged with the ambition to become unicorns, and are giving themselves the means to do this. Atlas Agro has completed its most spectacular financing round in 2023 with CHF 282 million. Also worth mentioning is the robotics platform Distalmotion, which acquired a total of CHF 134 million in 2023 to finance its growth. The ETH spin-offs Scandit and Beekeeper also raised significant funds from well-known international investors. This development is very encouraging because, for the first time, Swiss VC investors have demonstrated their ability to support the most promising start-ups up to an advanced stage of development. This is particularly important in order to stabilise the shareholder base during the growth process, especially in times of crisis. COVID-19-related travel restrictions made it much more difficult to invest as a lead investor in a Swiss start-up from abroad without physically meeting the management team. Swisscom Ventures has therefore taken the lead in several important rounds in recent years in order to facilitate foreign co-investments, and the Swiss ecosystem is thus clearly gaining in self-confidence and strength. The following pages describe the entrepreneurial paths of nine iconic Swiss VC kids: the most highly rated company (Actelion), the best exit of a female entrepreneur (AMAL), five emerging ICT unicorns who have obtained more than CHF 100 million (Nexthink, Sophia, Kandou Bus, Scandit, Climeworks), and my favourites with great development potential (Proton and On).

Thirty billion dollars – the acquisition of Actelion by J&J in 2016 is the largest acquisition ever for an innovation-funded company in Europe, yet it went almost unnoticed. Typical Basel! Discretion is a fundamental principle in the culture of the city on the Rhine. The many millionaires (and a few billionaires) are known to live here as average people and show no outward signs of wealth. Let's live happily, let's live hidden!

Founded in 1997 in Allschwil, on the outskirts of Basel, Actelion is a world leader in the treatment of pulmonary arterial hypertension (PAH) with its flagship drugs Tracleer and Opsumit. The company is highly profitable (CHF 428 million was distributed to shareholders in 2016 prior to the acquisition of J&J, i.e. 18% of turnover) and reinvests more than 20% of turnover in basic research. In less than ten years, it has developed into Europe's largest biotech company. Co-founder Jean-Paul Clozel, winner of the EY World Entrepreneur of the Year Award 2008, had very high ambitions at the time: 'We want to achieve in twenty years what global market leader Genentech has achieved in thirty years. And we want to prove that it is also possible outside the United States.'

While this has not been entirely successful, since Genentech had turnover of USD 7.6 billion in its 30th year (compared to USD 2.6 billion in 2016 at Actelion), Actelion's performance remains exceptional. Little known outside the medical world, this company is a role model for the Swiss start-up ecosystem. For the new generation of entrepreneurs, it is very interesting to understand the history and values of Actelion, to be inspired by it and to try to repeat this great success.

Actelion's origins date back to the late 1980s in Roche's Basel laboratories. French researcher and paediatrician Martine Clozel was working with Swiss biochemist Walter Fischli on a molecule called endothelin, which is 'similar to a snake venom that causes heart attacks. If we can block its effect, it can be used to treat heart disease,' explains Martin's husband, cardiologist Jean-Paul Clozel. But the pharmaceutical giant abandoned clinical trials in favour of another drug. Martine and Jean-Paul therefore decided to found Actelion in 1997, together with Walter Fischli and German cardiologist Thomas Widmann, who became their first CEO. This entrepreneur was a multi-talented (he founded Hesperion among other companies) and sadly passed away in 2019. I was fortunate enough to meet Thomas in his third career as an innovation capitalist, and I'd like to use these lines for a posthumous tribute to him.

This team of scientists was quickly surrounded by very high-level managers, in particular André J. Mueller from Geneva, former Sandoz manager and CFO of

Biogen. Biogen is a pioneer in biotechnology and is today valued at more than USD 31 billion. The company was founded in Geneva in 1978 by some of the world's best biologists, two of whom won the Nobel Prize. Actelion researchers were inspired by the founding of Genentech two years earlier, moving their headquarters to Cambridge, Massachusetts, in the United States. As CFO, Müller was responsible for several financing rounds and for Biogen's IPO on the Nasdaq. He was also a founding partner and Investment Director of Genevest in Geneva, the first VC fund in Switzerland, which was created out of Reference Capital under the leadership of Sven Lingjaerde and José Galeano. This experience was instrumental in giving Actelion the means to compete with the best, in particular by raising CHF 18 million from VC investors in the first six months, a first in Switzerland at the time. His experience enabled Actelion to raise CHF 1.2 billion on the stock market in 2000, its third year of existence. The timing was perfect and the company reached a record valuation of almost CHF 4 billion in its early days. 'We knew nothing about finances and we owe a lot to André. When he first talked about the IPO, I had no idea what it was all about,' says Jean-Paul.

Passionate researchers

The passionate research couple Jean-Paul and Martine Clozel look a bit like Pierre and Marie Curie. They share a common passion for medicine and discovery, both are French and studied at the University of Nancy's Faculty of Medicine, and they met in their twenties on research-oriented courses. Jean-Paul, a cardiologist, and Martine, a paediatrician, have managed to pursue parallel careers. They lived in Montreal and then in San Francisco, a stronghold of biotechnology, where they worked as postdocs. Jean-Paul worked for eleven years in hospitals, then twelve years at Roche before founding Actelion. The scientific curiosity of the two researchers was legendary. 'If the company library still had the lights on at 11 p.m., Clozel would be found there,' says Roland Haefeli, a member of Actelion's Executive Committee. 'We were not a company founded just to make money, but we were researchers who wanted to meet medical needs,' says co-founder Walter Fischli.

To sum it up, Actelion embodies the typical characteristics of the greatest entrepreneurial successes in the high-tech sector:

1. A world-class team with complementary profiles, a passion for technology, an almost obsessive customer/patient focus and international experience.
2. Very ambitious – fast raising of capital.
3. Great willingness to take risks.
4. A powerful ecosystem, as Jean-Paul Clozel confirms: 'We couldn't have done this anywhere else but in Switzerland. Basel has the best specialists and a first-class industrial and economic environment.'
5. And last but not least, luck. Walter Fischli admits: 'It could have gone wrong too.'

Idorsia

For the former Actelion shareholders, the adventure was not over, as the Clozel couple had negotiated to exclude a significant part of the projects under development from the J&J transaction. They were able to found the new company, Idorsia Pharmaceuticals, under the management of Jean-Paul Clozel. His intentions were clear from the beginning: 'We have 20,000 patents and between 10 and 20 projects in progress. I am very much looking forward to creating another Actelion with Idorsia.' In addition, the company received CHF 1 billion in seed capital, including CHF 580 million from a convertible loan from J&J. Idorsia was listed on the stock exchange in 2017 by a CFO named André C. Muller (not to be confused with André J. Muller, CFO of Actelion). With 800 employees, mainly in Switzerland, the company reached a value of CHF 4.2 billion in its fourth year of operation, which is equivalent to the value of Actelion at the same age. Roche's granddaughter is well on the way to creating a new entrepreneurial empire in the tradition of her illustrious parents!

‘I had no experience in finance. When my first investor asked me about my accounts, I just sent him my bank statements!’

The founder of AMAL Therapeutics, Madiha Derouazi, was brave enough to embark on an entrepreneurial adventure in 2012. In her thirties, she had a comfortable position in the Division of Oncology of the Hôpitaux universitaires de Genève (HUG) university hospital as a senior lecturer. With a master’s degree from the Technical University of Berlin and a doctorate in biotechnology from EPFL, she had developed a cancer vaccine at the Laboratory for Tumour Immunology at the University of Geneva. This research is the basis for the KISIMA® platform, which forms the technological foundation of her company AMAL. Unlike prophylactic vaccines, which immunise a patient to prevent infection before it occurs, therapeutic vaccines fight existing diseases. By presenting antigens to the patient’s immune system, a vaccine can elicit tailored reactions.

The first four years were financed modestly, on the one hand by prizes (Venture Kick) and on the other by loans from Swiss innovation promotion agencies (FIT, CTI). An important milestone was reached in 2016 with a first financing round of CHF 3 million with the German pharmaceutical company Boehringer Ingelheim, followed by two further rounds with the entry of Swiss funds (BioMedPartners, VI Partners, Schroder Adveq) totalling CHF 45 million. AMAL was ultimately sold in 2019 for EUR 325 million (depending on clinical, development and approval results), to which up to EUR 100 million will be added if certain commercial milestones are reached. Madiha Derouazi continues to lead the AMAL team in Switzerland and is leading the integration into the oncology R&D family of Boehringer Ingelheim. Talented and dynamic, she is sure to inspire many women to embark on an entrepreneurial adventure.

Nexthink

'No, thank you.' My refusal to invest in the young start-up Nexthink in 2014 is the biggest regret of my career at Swisscom Ventures. While missed opportunities are part of every venture capitalist's life, it is still painful. This is one of the most beautiful nuggets in the Swiss ecosystem.

The company was founded in 2004 by three young researchers in the field of artificial intelligence at EPFL, and they were Pedro Bados (CEO) from Spain, and Vincent Bieri and Patrick Hertzog from Switzerland. The company filed two patents in 2006 for artificial intelligence of abnormal behaviour and for real-time visualisation of end-user behaviour. Nexthink manages the computer equipment of large companies remotely. The software monitors terminal activity and end-user feedback to automate the resolution of IT problems and optimise the digital experience of employees.

Today, Nexthink employs more than 960 people. The company has raised a total of USD 345 million in eight rounds, the latter being financed by renowned international investors such as Permira, Index Ventures and Highland Capital Partners. But the Swiss fund VI Partners, headed by Alain Nicod, deserves the credit for supporting Nexthink since the 2006 seed round. The quality of the president/CEO duo (Alain and Pedro) was decisive in getting through the difficult years. When a start-up crosses the famous 'Valley of Death,' its CEO works tirelessly to optimise its product to meet the needs of the market, while the president tries to persuade their VC colleagues to join the company before it can prove its success. It's a great art. After the turning point, of course, the situation changes radically. This is when the rounds become very competitive and the company can choose its investors. The role of the president is also changing, with the focus on growth and exit.

Ironically, Swisscom's rejection was rational at the time, because it was based on analyses that showed the technical and commercial limitations of the time. But we underestimated the start-up's ability to pivot its model to fit the market. I have learnt from this experience that every assessment of an investment has an expiry date and needs to be updated regularly and without prejudice. Quality start-ups are agile, they learn quickly and manage to (re)position themselves in the right niches over time.

'No, sorry! Our medical expert gave an unfavourable opinion. I have to refuse.'

SOPHiA's first attempt at Swisscom Ventures in 2013 was unsuccessful despite an attractive valuation of CHF 4 million. The young French CEO, Jurgi Camblong, tried his luck again a year later and finally got our financing. I have to admit that I didn't call in our expert this time. I trusted SOPHiA's team, which is at the forefront of genetic research at EPFL, Geneva and Stanford. SOPHiA's vision is to democratise access to medicine based on personalised data. The bioinformatics company provides an online analysis platform for rapid and accurate diagnostics, particularly useful in the detection of hereditary anomalies and in oncology.

SOPHiA was founded in 2011 by Jurgi Camblong, Pierre Hutter and Lars Steinmetz in the EPFL Innovation Park and now employs more than 400 people worldwide. The company has raised more than CHF 500 million in six rounds. Its fundraising policy is a textbook example: the profile of investors has changed with each round of financing to meet a specific need. Most rounds were oversubscribed, which allowed SOPHiA to select investors. It all started with a local loan (FIT)102, followed by financing from regional business angels, then Swiss VCs (Endeavour Vision, Swisscom) and European VCs (Balderton Capital and Alychlo), then global VCs (Generation Ventures) to help enter the US market. The 2020 round completed the geographical diversity, especially with the Israeli (aMoon) and Japanese (Hitachi Ventures) funds. SOPHiA GENETICS finally went public via IPO in 2021 and has since been listed on the Nasdaq.

The composition of the Board of Directors has changed radically over time to support the growth of the company. This cannot be taken for granted; so many start-ups are stymied by an outdated board that is not adapted to their growth strategy. By contrast, SOPHiA decided to hire a world-class president in 2020, American Troy Cox, former CEO of direct rival Foundation Medicine, which was acquired by Roche in 2018 with a valuation of more than USD 5.3 billion. And yet SOPHiA has had the perfect president since 2013 in Antoine Duchateau from Belgium, founder of Swiss banking software company Odyssey, which was sold to Temenos in 2010 and had 600 employees at the time. He brought his entrepreneurial experience from the European growth phase and recruited a world-leading healthcare provider to give SOPHiA the best chance to take the next steps. Antoine remained on the Board of Directors until mid-2021 to ensure the transition. This philosophy of rotation on the Board of Directors is essential to provide the necessary skills at every stage of growth.

Kandou Bus

Smaller, faster and more precise. What is an obsession in many sectors dominated by Swiss companies, such as the watch industry, measurement technology and sensor technology, also applies to semiconductors.

One of the best examples of high-precision technology in electronics is Kandou Bus, a spin-off of EPFL. Kandou was co-founded in 2011 by Professor Amin Shokrollahi, a world-leading researcher in the field of information communication. Originally from Iran (the word Kandou means 'hive' in Farsi, the symbol of collective wisdom), Amin is a true citizen of the world. He received his doctorate in computer science in Germany and worked for the Californian start-up Digital Fountain. With more than 150 papers published and 150 patents filed and granted, the mathematician has combined entrepreneurial experience with teaching and research. He is the main inventor of chordal codes, a new class of codes specifically developed for wired communication between electronic chips. The company Kandou Bus was founded to market the fruits of his research.

I mention all these details because they perfectly illustrate the type of professor-researcher-entrepreneur that EPFL is looking for. This threefold dimension is obviously an essential factor in stimulating innovation at the highest level, and very few universities manage to bring these three cultures together on the same campus.

It is therefore no coincidence that Kandou Bus has managed to be financed by one of the oldest (founded in 1974) and most renowned venture capital funds in the world: Bessemer Venture Partners. Together with Swiss financing companies (Swisscom Ventures, Forestay Capital and Climb Ventures), the company raised a total of more than CHF 170 million before the market launch of its products. The company's technology significantly reduces the energy consumption of electronic devices and also allows faster communication speeds between processors and storage devices as well as printers and other peripheral devices. I'll spare you the more complex technical details. That's deep tech, really deep!

Kandou is a poster child in a new generation of Swiss start-ups that are sufficiently financed to target exits of more than CHF 1 billion. This view is shared by well-known investors such as Felda Hardymon, a partner at Bessemer since the 1980s, who said in a press release that in his 41 years in the industry he has 'never seen such an essential semiconductor technology,' at least 'not since the advances in microprocessors in the late 1970s'. If this vision becomes reality, the Swiss deep tech ecosystem will enter a new dimension.

Founded in Zurich in 2009, Scandit is the perfect example of a modern hidden champion that cleverly uses venture capital to accelerate its growth.

It has all the classic characteristics of a good Swiss student – the founding team consists of four PhD students from ETH Zurich who have conducted cutting-edge research at MIT, ETH Zurich and IBM Research, namely: Samuel Müller (CEO), Christian Floerkemeier (CTO, VP of Product), Christof Roduner (CIO, VP of Engineering) and Robert Adelmann (until 2012 only). They have implemented a single-product strategy that focuses on a niche they dominate around the world. Their computer vision software enables barcodes to be read at a much lower cost and with higher performance than conventional laser barcode scanners. The Scandit application is integrated directly into mobile phones, robots or drones. Amazon uses it in its warehouses, Apple uses it in its stores worldwide. In Switzerland, it is also integrated into Coop's self-checkout system.

The company now employs over 450 people with a team of world-class experts in moving image processing, augmented reality and the Internet of Things. Computer vision is a bridge between the physical and the digital world; this is an important trend. It is also a strategic issue for Switzerland and Europe, as it concerns the control of data collection, particularly in the industrial sector.

Scandit has succeeded in attracting very high-ranking shareholders with complementary profiles: Swiss (Ariel Lüdi, Swisscom) and international investors (Google Ventures, Atomico, Salesforce Ventures, Nokia GP) with a good mix of strategic and independent VCs. A total of CHF 270 million was raised in several financing rounds. As with SOPHiA and Nexthink, it should be noted that the CEO and investor Ariel Lüdi, who financed the business angel round in 2014, worked closely together. Ariel is very close to the entrepreneurs and has done a remarkable job of mentoring the founders. He was also actively involved in winning Atomico, one of the leading European investors in the Series A in 2017. This was a key moment in the financing of the company.

All subsequent rounds were tremendously oversubscribed, meaning Scandit could dictate its terms and choose its investors.

Ariel Lüdi is not just anyone: Hybris, an IT company specialising in e-commerce solutions, was sold to SAP in 2013 for EUR 1.5 billion. Hybris has a connection to Switzerland, as the company was founded in Zug in 1993 and received capital from Daniel Gutenberg, a renowned entrepreneur and former partner of the Swiss fund VI Partners. However, it then moved its headquarters to Munich and positioned itself as a German company. The Swiss Ariel Lüdi, a former student at ETH Zurich, has established his domicile on the historic Hammer estate in Cham, which is also the name of his investment instrument in innovation capital. Today, he is involved in around twenty start-ups. Experienced entrepreneurs are happy to support exceptional young teams; this is the beginning of a new line of entrepreneurship that I hope will bear fruit over several generations.

Climeworks

A machine that filters the air and captures 1% of the world's annual CO_2 emissions. This is an ambitious goal for a start-up, and an excellent example of a Swiss moonshot.

This kind of visionary project is very risky, has no limitations to its technical complexity and is very capital intensive, requiring a lot of courage, idealism and time. It's better to start young – this is the case for Christoph Gebald and Jan Wurzbacher, the two German co-founders of Climeworks. They studied together at ETH Zurich and obtained their doctorate in chemical and physical CO_2 technologies. Founded in 2009 as an academic spin-off of ETH Zurich, Climeworks has developed a technology that allows CO_2 to be filtered directly from ambient air by means of an absorption-desorption process.

Climeworks has a remarkable track record, both technologically and financially (USD 780 million in nine rounds of financing). Financing by Venture Kick in 2009 and 2010 enabled the development of a prototype, followed by a first round of financing in 2014 with Zürcher Bank ZKB, which has been particularly active in supporting the project. The company then merged with the car manufacturer Audi and received support from the Swiss Federal Office of Energy and several European R&D projects. In 2017, the company opened the world's first commercial CO_2 filter plant in Hinwil, Switzerland. Eighteen modules capture 900 tonnes of CO_2 per year, which are sold to a greenhouse operator as fertiliser. A demonstration project was launched in 2017 with the Hellisheiði geothermal power plant in Iceland.

Climeworks' technology, combined with the storage process developed by the Icelandic company CarbFix, removes carbon dioxide from the air and stores it permanently inside the earth. In 2020, Climeworks managed to raise CHF 73 million in the midst of a difficult climate. The principal investor (a family office) did not disclose their name. Finally, in 2022, Climeworks received USD 630 million from several fantastic investors (Partners Group, Microsoft Climate Innovation Fund, Swiss Re, GIC Singapore, etc.) This is the largest private investment in direct air capture to date. Like photovoltaics or new energies such as nuclear fusion, direct air capture requires long-term government investment to promote research and make the business model viable in the long term. This type of technology cannot be developed in a restrictive environment governed solely by the laws of the venture capital market. The economic model needs to be made more attractive in order to attract institutional investors. Certain R&D costs must be borne by the state as part of the fight against global warming. Revenue must also be supported by the monetisation of positive (filter premium) and negative (emissions taxes) externalities. As a technology leader in carbon capture and hydropower, Switzerland plays an important strategic role in decarbonising the planet.

The CERN cafeteria in Geneva is a great place for inspiration. Is it the dialogue between engineers and physicists from all over the world or the view of the snow-capped Jura summits that inspires creativity?

In any case, it is the hotbed of many successful start-ups, such as Proton, which offers one of the world's most popular end-to-end encrypted messaging services. Unlike popular vendors such as Gmail or Outlook.com, Proton uses client-side encryption to protect the content of emails before they are sent to its servers. The company was founded in 2013 by a top-notch team working at CERN, including founder and CEO Andy Yen (PhD in particle physics from Harvard) and CTO Bart Butler (PhD in Physics from Stanford). With more than 100 million users in 2024, the company's growth is exceptional.

This is all the more remarkable given that Proton has become very profitable with minimal initial funding. A crowdfunding campaign on Indiegogo (USD 500,000 from 10,000 supporters) and a small investment round of USD 2 million with VC Charles River Ventures and the Geneva Foundation for Technological Innovation (FONGIT) were enough to get off to a successful start. Proton clearly highlights the advantages of Switzerland on its website: Neutrality and data security. 'Proton Mail is based in Switzerland, which means all user data is protected by some of the world's strictest privacy laws.'

The company reveals that its servers are hidden 1,000 metres underground in granite.

The location is an important marketing argument, also for Swiss banks. In the digital world, 'based in Switzerland' is becoming a modern version of 'made in Switzerland' for physical products.

Co-entrepreneur: a new title for Roger Federer, for once not in the world of tennis, but in business, more precisely in the running brand On.

His significant investment in this Zurich start-up in 2019 was widely commented on in the press: was he looking for a new career in entrepreneurship or even venture capital? In any case, he would not be the first athlete to actively take this path. For example, Serena Williams has already made more than fifty investments with her VC fund Serena Ventures. Let's hope that Roger Federer will be inspired by his experience at On to become more involved in the Swiss ecosystem. After all, appetite comes with eating!

There is no lack of appetite and ambition. As a result of a meeting between a professional athlete (Olivier Bernhard, three-time Duathlon World Champion and winner of six Ironman triathlons) and his sports friends Caspar Coppetti (engineer) and David Allemann (design, marketing), On was founded in Zurich in 2010. They patented an upholstery technology developed at ETH Zurich in order to achieve an ambitious goal: to revolutionise the sport of running. The brand is based on a radical formula: soft landings and explosive take-offs. The slogan 'Running on clouds' can be taken almost literally – that is how successful the product is. On is now marketed in more than sixty countries. Initially financed by local business angels, Roger Federer's investment helped accelerate its very rapid growth.

Why did I choose this B2C company with a consumer product that is atypical in the Swiss high-tech world? Simply because it also represents the Swiss entrepreneurial heritage: passion for technology, high-quality industrial design and expertise in textiles. In marketing its brand, On emphasises the 'engineered in Switzerland' promise, thus becoming a widely visible ambassador who carries Swiss values to the world.

Eleven Moonshots for Switzerland

Now we've reached the heart of our reflection on the priorities for technology investment over the next ten years. Let us assume that the innovation capital sector will have CHF 50 billion available for investment during this period, i.e. an average of CHF 5 billion per year. This amount would be a powerful tool, provided there is a targeted approach in a few areas where Switzerland leads in know-how globally – a legitimate right to play. We used the following filters to select the most important sectors:

- Market size of over USD 10 billion worldwide
- Sector in which Switzerland is highly competitive, with high R&D intensity, technological complexity and maximum value added
- Strategic impact: Contributes to solving a major societal problem

Some of you may be amazed by this last point. After all, VCs are there to make money, not to save the planet, you'll say. It's true that profitability is the essential basis for the investor's business. But it's also clear that this success must be responsible if it's to last in the long term. Especially if we're talking about a country like Switzerland, which is fortunate enough to be able to choose its battles. That's why we can just as well focus on the sectors of the future that are both profitable and sensible. No one can demonstrate that these two dimensions are contradictory.

It's certainly possible to make profits in polluting, speculative and morally dubious industries – but is it worth the risk? Would the Swiss people accept it? Let's have the ambition to lead the country to success financially, socially and environmentally. Switzerland's image has exceptional value for new industries that are based on trust, security and well-being. So let's invest in this direction, rather than venturing into new areas that are not in line with our values and our know-how.

The aim is to finance 1,000 startups in order to create 50 companies valued at over CHF 1 billion ('unicorns') by 2030, including five companies with a value of more than CHF 10 billion (let's call them 'Actelions' in honour of our national champion) that will become Switzerland's new economic engines.

This list of moonshots does not claim to be exhaustive. They're an invitation to the different actors in the ecosystem – small and large companies, researchers and practitioners – to come together in community for large collaborative projects.

In this book, eleven exceptionally ambitious and inspiring projects are presented, known as 'moonshots'. These come from the following areas:

1. **Medicine**
   Precision medicine, personalised and preventive medicine
2. **Agriculture & Food** Precision agriculture and food Innovation
3. **Sport & Wellness**
   Digital sports and wellness services
4. **Industry 4.0**
5. **Learning & Skills**
   Digital learning and
   skill management
6. **Fintech 2.0**
7. **Digital Trust**
   Trust in the digital economy
8. **Smart Cities**
   Humanised smart cities
9. **Environment & Sustainability**
10. **Conquering Space**
11. **Artificial Intelligence**

Precision medicine, personalised and preventive medicine

Problems/needs

The traditional approach of undifferentiated medicine (one size fits all) has reached its limits in terms of efficacy and side effects of medication. Health systems that focus on treatment rather than prevention are struggling to cope with the medical and financial challenges of chronic diseases (cancer, diabetes, etc.). People, whether sick or not, are increasingly searching for holistic health management.

Solutions

The convergence of informatics and nanotechnology with biotechnology has led to major advances in prevention and early diagnosis, along with individual treatment approaches and continuous disease monitoring. Tailor-made medicine, known as precision medicine or personalised medicine, takes into account the individual characteristics of each person's genes, environment and lifestyle. Advances in biotechnology have made it possible to develop increasingly precise drugs coupled with accompanying biomarkers. The rapid deployment of cost-effective NGS platforms for genetic diagnostics is now being complemented by precision analysis instruments at the cellular level (e.g.single cell analysis). The new generation of biosensors, which can measure different vital signs such as blood pressure, pulse, respiration and body temperature, will revolutionise the way we monitor our health.

Challenges

Health issues are difficult to solve not only because of the complexity of the human body, but also because of the interactions between regulatory authorities, doctors, insurance companies, the research community and end users, not to mention the multitude of ethical issues and laws protecting patients' medical data.

Strengths and weaknesses

Switzerland has exceptional assets to become a world leader in precision medicine. It's home to pharmaceutical giants (Roche, Novartis), medical technology (Medtronic, Synthes) and food (Nestlé, Givaudan). Equally important is the presence of IT giants (Alphabet, IBM), who are increasingly interested in health, as data is at the heart of pharmaceutical innovation. The Basel region is known as the second-largest pharmaceutical cluster in the world after Boston. The Swiss healthcare cluster comprises more than 300 startups in the fields of biotech (e.g.Cutiss or Versantis, the latest winner of the Top 100 Swiss Startup Award),

medtech (Ava Women, Piavita), bioinformatics and genetic diagnostic tools (SOPHiA GENETICS, BC Platforms). Others specialise in telemedicine (Medgate, Oviva, DomoSafety) or digital self-monitoring, known as quantified self (LMD, Sleepiz, Aktiia). The ecosystem is highly efficient and concentrated. In a small area, it brings together decision-makers from world-renowned hospitals (Zurich University Hospital was ranked among the top 10 of the world's best hospitals by *Newsweek* in 2024 [Basel ranked 14]), university and industrial R&D, insurance companies, the Swissmedic regulatory authority and companies.

The ecosystem has all the ingredients for great success: a long-standing tradition with world-renowned historic players, high intensity of research and development, strong brand image and a VC track record. The machine is ready to go. Now we need to step up VC funding to reach a critical global scale.

Ambition for 2030

- **Cluster among the world's top three and number one in Europe for biotech and precision medicine**
- **15 startups valued at over CHF 1 billion**

Measures

1. **CHF 15 billion innovation capital over ten years**
2. **Cooperation programme between hospitals and startups to avoid duplication in R&D. This is a recurring problem in the wealthiest institutions that, for political reasons, develop their own services in-house instead of using the cheaper and more sophisticated services offered by Swiss startups operating globally.**
3. **Networking and collaboration between ecosystem members**

Precision agriculture & food innovation

Problems/needs

- By 2050, ten billion people on Earth will need to be fed while reducing environmental pollution (pesticides, CO_2).
- 2.8 million tonnes of food are lost every year in Switzerland. Switzerland has set itself the target of halving food losses by 2030.
- 39% of the world's adults are overweight (1.9 billion); 13% are obese (600 million).

Solutions

R&D for adequate, healthy and environmentally friendly food for all is involved in the entire process, from sustainable primary production to packaging recycling, nutraceuticals (the integration of curative or preventive nutrients), weight management, kitchen robots and nutritional advice based on biomarkers or microbial foods. Precision farming adapts agricultural equipment to make it smarter and more environmentally friendly. Artificial intelligence is used to reduce waste and analyse the needs of plants and animals. Vertical farming enables hyper-local and demand-driven production.

Challenges

Poor nutrition results from several factors, including cultural and behavioural causes. Purely technical solutions are not enough. They often need to be combined with personal coaching or medical supervision. Many innovations are still needed in sustainable agriculture to solve structural problems such as costs, labour shortages, lack of land and large-scale logistics.

Strengths and weaknesses

Switzerland has a very strong -food and agroecosystem, with a high density of research centres (26 in total, including Agroscope, Nestlé, Bühler, Givaudan, Firmenich, Syngenta) and an estimated annual R&D expenditure of CHF 1 billion. The four largest agricultural trading companies in the world, the ABCDs (ADM, Bunge, Cargill and Louis Dreyfus), have a significant presence in Switzerland. In the case of sugar, for example, their share of the world market is 50%; for coffee, it's 60%. In addition, 300 startups are active in areas such as robotics in precision farming (ecoRobotix, Aero41), vertical farming (Growcer), food quality (SNAQ, Swiss-DeCode), health (Microcaps) or novel foods (Planted Food, yamo*).

Ambition for 2030

- **Clusters among the top three in the world and number one in Europe**
- **Four startups valued at over CHF 1 billion**

Measures

1. **CHF 4 billion innovation capital over ten years**
2. **Promotion of the Swiss cluster with existing initiatives such as Swiss Food and Nutrition Valley or Cluster Food and Nutrition**
3. **Networking and collaboration between ecosystem members**

Digital Sports and Wellness Services

Problems

According to the World Health Organisation (WHO), 23% of adults and 81% of school-age adolescents worldwide are not sufficiently physically active. Lack of physical activity is a major risk factor for non-communicable diseases (NCDs) such as strokes, diabetes and cancer. Regular exercise and movement also protect the brain (memory, language and learning) from age-related disorders.

Solutions

New technologies generally contribute programmes promoting education and sports and the regular and safe pursuit of athletic activities. In particular, precision technologies for personal tracking (quantified self), based on sensors (watches, clothing) and real-time analysis, make it possible to increase comfort and performance and reduce physiological risks. They also encourage the development of telemedicine for continuous remote diagnosis and monitoring, in particular for treating chronic diseases and addiction problems and for supporting the elderly.

Strengths

Switzerland has a density of international sports organisations like no where else in the world. There are 38 in total, 25 of which are in the canton of Vaud, close to the International Olympic Committee, which has been based in Lausanne since 1915. The most famous sports federations are based in Switzerland, such assoccer (FIFA and UEFA), cycling and track and field. It is also home to numerous bodies linked to sport management, such as the international Court of Arbitration for Sport (CAS), which plays the same role in the Olympic world as the International Criminal Court in The Hague among nations. Its neutrality, political stability, tax exemptions specifically for international federations and quality of life make Switzerland a logical choice for sports organisations. Pierre de Coubertin, the founder of the modern Olympic Games, said in regard to his decision: 'The Olympic movement will find, in the independent and proud atmosphere that permeates Lausanne, the necessary freedom it needs to move forward.'

By world standards, sport plays an important role in everyday life in Switzerland. Switzerland is one of the top three sporting nations in Europe: more than 80% of the inhabitants meet the minimum recommendations for physical activity. The proportion of the population participating in sport for at least three hours per week has increased from 44% to 51% over the last six years. The number of people who self-identify as non-athletes has fallen from 26% to 16%.

The sport-related economic sector is well developed, in particular with high-quality infrastructure for mountain and water sports. Some 'hidden champions' have established themselves, for example in the middle and top tiers of cycling (BMC, SCOTT, Stromer) and skiing (Stöckli). The most promising startup at the moment is On Running, which was described in chapter six. Many companies are innovate in the field of personal tracking (Gait Up, Magnes, Myotest), intelligent materials (BComp), digital platforms (I believe in you) or image analysis tools (uniqFEED, Seervision, Bodygee).

Weaknesses

Switzerland has failed to develop a smartwatch industry for medical and sports purposes. This would be a great development opportunity for a country that is already very active in the watch industry, micro-technology and health. It's even a strategic imperative on the defensive level. Numerous projects have been launched, both by large (Swatch, Hublot) and small (Ava Women, Limmex, MyKronoz) companies, but they have not reached a critical scale. Compared to digital giants like Apple Watch and Samsung Galaxy Watch, they've lost a lot of time, which is very worrying. The watch industry ecosystem, highly efficient with traditional watches, appears passive on this issue. Some CEOs of digital startups have told me that they are having a hard time getting the attention of watch industry executives on digital issues.

It's therefore necessary to fundamentally rethink the subject of smart wearables (watches, jewellery, clothes, glasses, etc.). If watchmakers and jewellers aren't investing heavily in this sector, should digital players take the lead in this area, since it deals with an online platform? Or those in the health and wellness sector? Finally, they are the primary beneficiaries of the physiological data collected. Should Roche, Novartis, Nestlé or Swisscom be actively involved? Or should they just wait for GAFAM and Samsung to build connected healthcare mega-platforms that integrate the biometric sensor (watches, blood pressure monitors, sleep sensors…) and digital application (medicine, sports, environment…) ecosystems? Should our sole aim as investors be to sell Swiss startups and thus Swiss know-how and innovation to these global platforms?

Unfortunately, this is currently the only way out. In order to break out of this vicious circle, a Swiss player must consolidate this sector with an ambitious acquisition strategy, as the historic Swiss champions are well acquainted with. Could the purchase of Fitbit (acquired by Alphabet) or Withings have laid the foundations for a Swiss smartwatch with the ambition of becoming the European market leader and the first credible alternative to Apple and Samsung?

Ambition for 2030

- **Leading cluster for sport innovation in Europe, particularly in the areas of watches, accessories and smart clothing.**
- **Forming a Swiss mega-cluster for wellness in the broadest sense (health and wellness valley). The sport-tech cluster is important for Switzerland's image and complements the pharmaceutical and food clusters.**
- **Three startups valued at over CHF 1 billion**

Measures

1. **CHF 3 billion of innovation capital over ten years**
2. **National Task Force to facilitate the emergence of a quantified-self ecosystem of smartwatches, clothing and accessories.**
3. **Development for domestic and foreign brands.**
4. **Involve well-known Swiss athletes as ambassadors of a sport-tech community, with representatives from sports organisations, R&D centres, startups and established companies.**
5. **Networking and collaboration between ecosystem members**

Industry 4.0

Problems

The very high average wage in Switzerland (CHF 6,538, three times higher than the EU average) poses a challenge for maintaining industrial production in Switzerland.

In 2023, more than 900,000 accidents at work occurred in Switzerland.

Decentralisation abroad poses problems with regard to supply chain control, such as intellectual property theft, loss of flexibility or disruption of the transport chain in the event of a pandemic.

Solutions

Intelligent automation and continuous innovation make it possible to make Swiss industrial locations more competitive.

Computer vision and autonomous mobile robotics technologies are particularly important for preventing accidents, improving quality and reducing costs. To maintain maximum flexibility, maintain part of the production in Switzerland and retain the made in Switzerland label, they are of strategic importance.

Employee safety on hazardous construction sites can be ensured remotely by using robots and drones equipped with object detection and positioning systems and collision alarms.

Challenges

Many technological challenges have to be solved in order to be able to give robots a sufficient degree of autonomy. There are also social challenges in compensating for the loss of jobs. A new form of ‘cooperation’ between humans and robots must be invented, taking into account the interests of all parties.

Strengths and weaknesses

Switzerland has a strong presence in the micromechanics, robotics and autonomous systems fields. The established companies (ABB, Schindler) are world class, as are the laboratories for robotics and computer vision at ETH Zurich and EPFL in particular. For example, 40% of European scientific citations in robotics originate from Switzerland. The dense network of SMEs specialising in the local production of precision and high performance components (Maxon Motor, FAULHABER, Phoenix Mecano) also offer an important contribution. Switzerland has become 'Drone Valley' thanks to the many startups and successful exits in this field (senseFly was sold to Parrot, for example). Startups are particularly strong in integrated drone and robot systems for inspection on industrial sites (Flyability, ANYbotics, Voliro Airborne Robotics), mission control software and computer vision (Sevensense Robotics, Eyeware Tech, Miraex). Other startups are mainly concerned with track and trace (SkyCell, Nexxiot) and 3D printing for industrial applications (9T Labs, Mobbot).

Ambition for 2030

- **Industry 4.0 cluster among the top five in the world and in the top two in Europe**
- **One of the three safest countries in the world in terms of number of accidents at work**
- **Three startups valued at over CHF 1 billion**

Measures

1. **CHF 3 billion in innovation capital over ten years**
2. **Provision of 5G infrastructure across the entire area**
3. **Networking and collaboration among digital learning and skill management ecosystem members**

Digital learning and skill management

Problems

- School closures due to COVID-19 temporarily kept 1.6 billion children out of school in 2020.
- According to UNESCO, 258 million children and young people around the world still had no access to schooling in 2018, and about 200 million young people had not acquired the skills needed for the labour market by the end of their schooling.
- The OECD's 2019 Future of Work report predicts that over the next 15 to 20 years, 14% of today's jobs will be lost as a result of digitalisation and 32% of job profiles will change dramatically. Some 1.1 billion people will therefore need to acquire new skills in the next 20 years.

Solutions

Online learning platforms such as Coursera, Labster and Khan Academy provide high-quality learning content around the world, making learning scalable and less costly. Learning management systems such as Google Classroom or Moodle help teachers communicate with their class online, create assignments or even exams, and have them corrected automatically. Digital learning tools based on AI technology and virtual reality make individually tailored learning processes possible.

Challenges

The biggest challenge is to overcome the digital divide, which is reliant on access to the Internet and the necessary hardware. Digital learning content must be adapted to the target audience and traditional learning methods (e.g.class teaching). An important pedagogical innovation is the essential digitalisation of teaching.

Strengths and weaknesses

The Swiss education system is the legacy of a long tradition, with world-famous pedagogical theorists (Jean-Jacques Rousseau, Johann Pestalozzi and Jean Piaget), a dual education system and leading universities. EPFL is a pioneer of massive open online courses (MOOCs) in Europe and nowadays has two million online students from all over the world. Educational research is carried out at many Swiss universities. The Swiss EdTech Collider based in Lausanne and funded by the Jacobs Foundation, as well as the Kickstart Accelerator in Zurich, run incubation programmes for young companies with a focus on edtech. Around 80 edtech startups are currently active in Switzerland. The main segments are online learning management platforms (beecome, Cikumas, Taskbase), digital learning tools (Labster, Classtime, Dybuster, SYLVA), professional development (Coorpacademy, Dual Academy, MaxBrain, LUCY Security) and skill management (People Analytics, Janzz, Skillhub).

Ambition for 2030

- **Swiss edtech clusters among the top five in the world and among the top two in Europe**
- **Three startups valued at over CHF 1 billion**
- **Switzerland ranks at the top in the area of digital learning in PISA 2025**

Measures

1. **CHF 3 billion of innovation capital over ten years**
2. **Strengthening the specialised agency educa.ch, in particular the focus on education technologies (pilot projects, roll-out support)**
3. **Networking and collaboration between ecosystem members**

Fintech 2.0

Problems/needs

- Customers' expectations of banks have changed radically with the advent of the Internet. Their bank must now be functional 24/7, mobile, personalised (with relevant real-time recommendations) and at the best value for money.
- New decentralised technologies such as blockchain are challenging the role of the financial intermediary. At the same time, they exponentially increase the number of digital assets that need to be managed and the infrastructure requirements (security, storage, legal compliance, trading, etc.).

Solutions

Financial institutions have embarked on a major digital transformation project to reduce costs, make their processes more agile and tailor their offerings to customer needs. The most important of these advanced technologies (with decreasing priority, according to a PwC study) are: data analysis tools, mobile platforms, artificial intelligence, cybersecurity and identification through biometric detection, robotic process automation.

(RPA), blockchain and the cloud.

Distributed ledger technologies (DLTs) such as blockchain will enable the digitalisation of countless assets, especially financial ones (e.g. title deeds, loans or currencies).

Challenges

Financial institutions are in a race against time to keep up with the very high pace of innovation of the new fintech players. According to a PwC survey, 88% of traditional bankers worldwide believe that fintechs pose a threat to their business. The threat to banks comes not only from startups (e.g. N26 or Revolut), but also, and especially, from large high-tech companies that are not banks, such as Apple, Amazon, or social media that is starting to offer financial services to their users.

Strengths

The Swiss financial centre is the largest in continental Europe, with two cities in the top 15 of the GFCI Global Financial Centres Index (Zurich and Geneva). Its banks and insurance companies operate worldwide (UBS, Credit Suisse, Zurich Insurance) and SIX Group is the third largest stock exchange operator in Europe after Euronext and London Stock Exchange/Borsa Italiana. Switzerland is a world leader in cross-border private banking: more than a quarter (27.5% market share) of the assets under cross-border management worldwide are managed in Switzerland. The total assets under management of banks in Switzerland amounted to CHF 8,830 billion at the end of 2017. It's therefore no coincidence that two leading IT companies in core banking originated from Switzerland (Avaloq, which was bought by NEC in 2020 for USD 2.2 billion, and Temenos, which is valued on the stock exchange at CHF 5 billion).

Blockchain is a market with high potential because it requires capabilities that have been historically present in Switzerland: a reputation based on trust, technical know-how in the fintech field, proximity to financial players and an adequate legal framework. Regulatory innovation is crucial to create the right conditions for the emergence of these new services. Both policymakers and the Swiss Financial Market Supervisory Authority (FINMA) have understood this.

Switzerland has become an important location for blockchain companies. The 'Crypto Valley' in Zug in the Zurich region is known worldwide for its crypto start-ups. It is home to numerous foreign startups (Cardano, DFINITY, Cosmos Network and Polkadot) and from Switzerland (Ethereum). The fintech ecosystem includes more than 300 startups operating across the entire financial sector value chain, including insurance, digital payment systems, data analytics, asset management, credit platforms, equity finance, information portals, blockchain applications, transaction platforms, online banking and banking security.

Weaknesses

The fintech ecosystem has failed to produce leaders in the retail sector (B2C). The great European success stories can be found in London (Revolut, Check-out.com), Berlin (N26), Amsterdam (Adyen) and Stockholm (Klarna). The lack of massive investment in venture capital is certainly one reason, along with a missing B2C culture and insufficient experience with big Internet platforms. The emergence of a Swiss fintech unicorn in the B2C sector is possible and desirable of course, but I believe that Switzerland's best fintech opportunities lie in the B2B segments and the deep tech technologies that underpin the financial infrastructure, in continuity with its excellent historical track record.

Ambition for 2030

- **Fintech leaders among the top five in continental Europe**
- **Eight companies valued at over CHF 1 billion**

Measures

1. **CHF 8 billion innovation capital in ten years**
2. **Networking and collaboration between ecosystem members**

Confidence in thedigital economy

Problems

Globally, the annual cost of cybercrime is estimated to be USD 10.5 trillion by 2025.

Solutions

According to EPFL's Centre for Digital Trust, three pillars are needed to create a climate of trust in a digitalised world: cybersecurity, transparency of distribution and storage processes, and privacy protection so that personal, medical or financial information is not passed on to undesirable third parties. One of the most important innovations is blockchain technology, which makes it possible to offer secure digital services such as commercial contracts, rights management or custodial accounts. In future, the advent of quantum computers will revolutionise services that rely on large amounts of data processing, such asfinance, R&D, healthcare and cybersecurity.

Challenge

The costs associated with cybercrime are enormous. These include data damage and destruction, stolen money, loss of productivity, theft of intellectual property, personal and financial information, disruption of normal business after an attack, and reputational damage. Our vulnerability to attacks increases with the increasing digitalisation of data, which is the most relevant information about people and organisations, but also infrastructures and connected items.

The future digitalisation of paper documents by blockchain will increase the importance of digital security.

Switzerland's strengths

Switzerland has a long tradition of activities based on trust and long-term stability: banks and insurance companies, of course, but also in the areas of security, data (digitalisation, health, intellectual property, etc.) and international organisations. Trust is an essential part of the Swiss brand abroad. It's also characteristic of relations within the country: According to an OECD study from 2017, almost 80% of Swiss citizens trust the national government, which is almost twice the average of OECD countries.

Switzerland is home to some very powerful companies in the security sector. With 89,000 employees, a turnover of CHF 6.6 billion and a cash flow of CHF 810 million, the Geneva-based SGS Group is currently the world leader in the testing and inspection of goods, as well as their marketing and transport. dormakaba, for its part, is one of the world's leading providers of access systems, with 15,000 employees. The very discreet SICPA from Lausanne dominates the world market for secure inks for banknotes and sensitive documents such as passports. It also provides digital authentication and traceability services. The most important areas of the Swiss ecosystem are cybersecurity, authentication, access control, artificial intelligence, counterfeit security, data confidentiality, blockchain, traceability, the General Data Protection Regulation (GDPR), forensic services, authenticity testing and quantum security.

Weaknesses

Strong competition for a limited number of cybersecurity specialists is a hindrance for the growth of IT companies in Switzerland.

Switzerland has made great strides in digitalising government services, but still lags behind the best countries (16th place in the Global Innovation Index).

Ambition for 2030

- **Cybersecurity clusters among the top three in Europe and among the top 10 globally**
- **Top five in the world in the digitalisation of government services (Global Innovation Index)**
- **Three companies valued at over CHF 1 billion**

Measures

1. **CHF 3 billion in innovation capital over ten years**
2. **Supported by Tech4Trust from Trust Valley, an alliance of public, private and academic stakeholders**
3. **Partnership with the Swiss Armed Forces' cybersecurity training programme (based on the Israeli model)**
4. **Networking and collaboration between ecosystem members**

Humanised Smart Cities

Problems

- There are nine million deaths worldwide every year due to air pollution. The world's urban population will grow by 2.5 billion by 2050.
- Globally, 1.3 million people are killed on the road every year, and between 20 and 50 million are injured. The world's 1.3 billion cars are used only 5% of the time; the cost of congestion is EUR 120 billion per year in Europe.

Solutions

The smart city concept has already been partially implemented. Sensor technologies (Internet of Things, loT) and analytical tools can now be extensively used to collect data on, for example, transport and transport systems, power plants, public facilities, water supply, waste, crime detection, information systems and hospitals.

In the future, autonomous driving systems will be safer than drivers and save lives. Electric propulsion using lithium batteries or hydrogen-oxygen fuel cells will reduce air pollution and noise in cities. Fleets will be centrally managed and optimised to make better use of urban space.

Autonomous taxis, which are convenient (on-demand, point-to-point, 24-hour service) and inexpensive (very high capacity utilisation due to the logic of the shared economy), could replace many underused bus or regional rail lines. The degree of automation thus becomes an essential factor in a country's competitiveness.

Challenges

Smart cities: in addition to the technological and operational complexity of setting up systems for collecting and processing information, cities must also ensure that citizens' rights are respected. Indeed, serious ethical problems can arise if the information leads to partisan political decisions, growing inequality or active discrimination.

Autonomous vehicles: Although partial autonomy is already available, such as semi-autonomous convoys in platooning (the first truck has a driver, those following do not), car driver assistance systems or shuttles on closed routes, it will take decades to achieve full autonomy across the board. Social and trade union resistance will be strong because it threatens drivers' jobs. Whole sectors are in danger of disappearing, such ascar parks. Legal and ethical issues will be the subject of lively political debate.

Strengths and weaknesses

Switzerland is known for its high-quality infrastructure in the areas of transport (SBB/CFF), telecoms (Sunrise, Swisscom) and buildings (Schindler, dormakaba). It also has a strong culture of protection for data and citizens' rights. This trust capital, combined with a robust legal framework, should make it possible to build intelligent systems that are compatible with Western democratic standards. There are also many startups in the multimodal mobility sector (UNIMOBILITY, FAIRTIQ), intelligent housing (Tayo, DomoSafety), property management (Locatee, Allthings), personal security (GEOSATIS, Morphean) and e-governance (PROCIVIS).

As far as autonomous driving is concerned, Switzerland does not have the critical mass necessary to develop a global automobile or aircraft manufacturer for the general population. However, Switzerland has cutting-edge competence in the industry for high-precision components (sensors, lidar systems, motors) and in software for autonomous systems used in small machines such as drones (Flyability) and robots (ANYbotics). Other startups offer navigation systems (INVOLI) or embedded systems (Fast 3D, LIGENTEC) and decision-making software (Daedalean, embotech). For example, although Switzerland is lagging behind Sweden in range testing for autonomous cars, it can catch up with a proactive policy at national level, i.e. involving the authorities and large and small companies. The consultation procedure on the revision of the Road Traffic Act (SVG), which was completed in January 2021, is a step in the right direction. The Federal Council wants to act quickly, because vehicle assistance systems are constantly being improved. The government stated that 'In order to be able to react quickly to such developments, the Federal Council is now being given the power to adopt the relevant regulations by ordinance under the Road Traffic Act.'

Ambition for 2030

- **Technology cluster among the top five in the world**
- **Three companies valued at over CHF 1 billion**
- **Switzerland must set itself the ambitious goal of becoming the first country in the world to implement full level five autonomy. This is a critical infrastructure for the security, sovereignty and competitiveness of the country.**

Measures

1. **CHF 3 billion in innovation capital over ten years**
2. **Smart cities: large-scale roll-out based on Swisscom's pilot projects with the connected canton of Thurgau and the connected cities of Sion, St. Gallen, Pully, Winterthur and Lugano.**
3. **Autonomous driving: creation of a top-of-the-line ecosystem using drones, modelled on the Swiss Autonomous Valley initiative. This initiative proposes three levels of action: permanent access to physical test sites under real conditions, virtual simulations and cooperation with the regulator.**
4. **5G infrastructure across the country to achieve low latency and sufficient data volumes.**
5. **Networking and collaboration between ecosystem members**

Environment and Sustainability

Problems/needs

- At the global level, the protection of nature in the broadest sense (air, water and soil quality, flora and fauna biodiversity) is a major challenge in the fight against environmental pollution, resource limitation and global warming.
- Since records began in 1864, the average temperature in Switzerland has risen by 2°C, twice the global average.
- Each Swiss resident produces 15.4 tonnes of greenhouse gases per year (more than double the world average of 6 tonnes per capita): Transport is responsible for 32% of all emissions, 24% by buildings, 24% by industry and 19% by agriculture and waste management.
- By ratifying the Paris Agreement, Switzerland has made another commitment to halving greenhouse gas emissions by 2030 compared to 1990 levels.

Solutions

Transport: the electrification of the vehicle fleet and its autonomous management are the two biggest challenges to be overcome (see moonshot on smart cities).

Industry and agriculture: precision and automation technologies will make it possible to reduce energy losses and air, water and soil pollution (see moonshot on precision agriculture and moonshot on industry 4.0).

Building construction: Thermal insulation is the key factor for energy efficiency. In order to achieve climate neutrality by 2050, old buildings must be refurbished as quickly as possible and plus-energy houses built (buildings that use renewable energy and whose annual energy balance is positive). They must comply with the Minergie® standards, which were developed in Switzerland and are among the strictest in the world. The use of CO_2 neutral building materials and intelligent, automated building technologies will make it possible to optimise resource consumption.

Recycling: Switzerland is world champion in recycling: 93% of glass, 91% of aluminium cans, 83% of PET beverage bottles and 67% of batteries were recycled in 2015 (source FDFA, Swiss Confederation). The focus should now be on products that are more difficult to recycle, such as electronics.

Challenge

The challenges are simultaneously scientific, political, operational and social. They can only be solved through a concentrated, massive national effort. There's also a lot at stake financially: state aid is indispensable to accelerate, for example, energy efficiency measures in buildings or the production of renewable energy, as long as the economic model is not yet sustainable through simple market laws.

Strengths and weaknesses

Switzerland has a strong culture of environmental protection. It ranks ninth among countries with the highest environmental performance index (EPI 2022, Yale & Columbia University). Swisscom, for example, was voted the world's most environmentally friendly telecoms provider in 2023 for the third time in a row (*World Finance* magazine). However, it should be noted that Switzerland has traditionally been active in sectors with high environmental impacts such as agrochemicals, cement, foodstuffs and industrial production in general. The pollution it caused has forced Switzerland to develop cleantech solutions that it can now export around the world.

In the construction sector, Switzerland boasts world leaders such as Lafarge-Holcim (cement plant, 63,000 employees), Geberit (sanitary facilities, 11,000 employees), ABB (electricity, 105,000 employees) and dormakaba (access protection, 15,000 employees). The R&D activities at ETH Zurich, EPFL, Empa and Eawag are world-leading in the field of smart and sustainable buildings.

On the other hand, in the field of environmental technologies there are few, underfunded specialised funds. Investment in startups is unusually low compared to demand (between CHF 100 and 150 million per year). It is essential for governments, municipalities and companies to work to make the risk-reward ratio of investments more attractive. Otherwise, the Swiss cleantech industry will not be able to make the most of its great potential. Over 200 cleantech startups have been founded in the last ten years, 26% of them spin-offs from ETHZ or EPFL. They are particularly active in the fields of decarbonisation (Climeworks, South Pole), energy efficiency, water purification, waste and recycling (Selfrag, UniSieve), renewable energy generation (Insolight, Energy Vault), sustainable materials (Dimpora, CompPair) and new forms of transport (Cargo Sous Terrain).

Ambition for 2030

- **Switzerland is number one worldwide in the EPI ranking**
- **Swiss cleantech cluster number one in Europe**
  Five startups valued
  at over CHF 1 billion

Measures

1. **CHF 5 billion of innovation capital over ten years**
2. **Promoting initiatives to protect ecosystems such as CleantechAlps**
3. **Networking and collaboration between ecosystem members**

Conquering Space

Problems/needs

The number of satellites in space will increase from 2,700 today to 27,000 in 2030, according to the CEO of Ariane Espace2. Major corporations from the US (SpaceX, Amazon, Meta) and China are launching mega constellations of satellites for commercial and military purposes. China is preparing to conquer the moon (collecting lunar samples in 2020 with the Chang'e 5 mission) and is planning manned missions until 2030. In October 2020, Elon Musk announced that SpaceX was planning an unmanned mission to Mars in 2024 and a manned one at a later time.

Challenges

Humanity's space odyssey has only just begun. Everything (or almost everything) still needs to be developed: transport, communication, security, tourism, environment cleaning and maintenance, habitat, use of natural resources, etc. While it's true that space technologies exist for special niche projects, they have not yet been tested a large scale. The transfer of technologies and business models from the terrestrial world to space (and vice versa) is a formidable challenge, but also a great economic opportunity. Space is likely to become the most important investment sector for venture capital in the coming decades and centuries.

Strengths and weaknesses

Switzerland is not a major space nation: space is dominated by the world's superpowers. But as a founding member of the European Space Agency (ESA), it is involved in many important projects. Their high-precision technologies are in great demand in space travel, such as the Maxon engines that power robots on Mars. The ESA has just entrusted the Swiss startup ClearSpace with the mission to clean up debris in orbit in 2025 with a budget of EUR 86 million, a world first. The EPFL startup was in competition with twelve other candidates, including some European industrial giants. The space cleaning market represents an opportunity of several billions a year in the long term. The ESA has also launched an incubator (ESA BIC) in Switzerland. Some 20 companies already belong to this group, such as satellite image analysis (Picterra), telecom (LiGenTec), aerospace design software (Neural Concept), photonics (Miraex) and environmental sensors (MIRO). In addition, Astrocast, an EPFL spin-off, has just launched some micro-satellites to track objects on Earth. SWISSto12 has developed a 3D printing system to produce ultra-light satellite antennas.

The memorable circumnavigation of the solar aircraft Solar Impulse – a startup closely linked to the ETHZ and EPFL ecosystem – showed the world the unique Swiss know-how in stratospheric aviation (at an altitude of 20 kilometres) and electric aviation. This visionary project with deep emotional resonance is a source of inspiration and marketing for a Swiss cluster focused on a sustainable approach to space development. ClearSpace is the first concrete example of this – others will follow.

Switzerland has good strategic opportunities in the space sector, which will become increasingly important over the decades and will probably eventually overtake terrestrial activities in Switzerland. Switzerland's historical strengths can (must!) be extended into space. Its neutrality ideally positions Switzerland to offer trustworthy services to all countries, as is currently the case with international organisations or the Swisscom spin-off TOGEWA, one of only two global roaming platforms. It will be necessary to set up technologies for arbitration between countries, such as for avoiding satellite collisions. The Swiss values of quality, confidentiality and security will be very useful for highly secure data transmission and storage services. Robotics and autonomous systems will form the basis for a space conquest before the arrival of humans and the exploitation of massive resources. In the shorter term, Switzerland's vast experience in the luxury industry and its know-how in dealing with the wishes of the ultra-rich will be very useful in selling and supporting tourist stays beyond gravity.

Ambition for 2030

- **Top three in Europe for deep tech space technologies**
- **Three startups valued at over CHF 1 billion**

Measures

1. **CHF 3 billion in innovation capital over ten years**
2. **Networking and collaboration between ecosystem members, including the ESA, the Swiss Armed Forces and the Swiss Space Office (SSO), the authority responsible for the Swiss national space programme**

Artificial intelligence

Problems/needs

In our data-driven era, traditional methods of data analysis and processing that rely on manual, time-consuming processes are reaching their limits. Companies and society are faced with the need to use growing amounts of data efficiently to foster innovation, optimise decision-making and provide personalised services. In addition, sectors such as health, finance, energy and transport require efficiency improvements in order to achieve the Sustainable Development Goals. The transformative power of AI, with potential breakthroughs in almost every industry, presents a unique opportunity, but also geopolitical challenges. In particular, developments in the US and China's efforts to catch up underline the importance of a strong domestic AI sector for Switzerland in order to maintain its geopolitical position and mitigate the risks posed by generative AI, in particular for the integrity of direct democracy.

Solutions

Artificial intelligence offers pioneering solutions to these challenges by enabling the analysis of large volumes of data, pattern recognition and predictability. Technologies such as machine learning, deep learning and natural language processing open up ways to automate complex tasks, refine decision-making and create personalised user experiences. A thriving AI ecosystem is driven by a strong research base and the close cooperation between academia, industry and government, with the ETH AI Center a pioneer in the research and development of artificial intelligence.

Challenges

Integrating AI technologies into various areas raises ethical, legal and social questions, including those of data protection, security risks and responsibility for AI decisions. It's also crucial to strengthen public confidence in AI technologies and to ensure their accessibility and inclusion. The need to attract top researchers and qualified specialists are other significant challenges.

Strengths and weaknesses

Switzerland benefits from excellent research facilities and a dynamic startup landscape, supported by high-quality education and a strong tradition in mathematics and engineering. Political stability, a high standard of data protection and Europe's strategic position offer Switzerland a unique competitive advantage. In contrast, however, there are limited resources in the domestic venture capital market and the challenge of keeping up with massive investments in AI centres as in the US and China.

Ambition for 2030

- **Positioning Switzerland as a global centre for ethical and sustainable AI development.**
- **Establishing at least ten AI startups with a valuation of more than CHF 1 billion.**

Measures

1. **Investing 5 billion CHF in AI research and development over the next ten years.**
2. **Establishing a national AI innovation centre to promote collaboration between universities, startups, established companies and the government, including initiatives such as the cooperation between Swisscom and NVIDIA.**
3. **Promoting AI education programmes and workshops at all levels to attract and train talent.**
4. **Developing an ethical framework for the responsible use of AI to promote trust and ensure social acceptance.**

In addition to financial investment, it is above all necessary to promote an innovation culture. This applies not only to entrepreneurs and scientists, but to all of us, from ordinary employees to the country's elite. Preserving our economic freedom and to intelligently shaping the world of tomorrow is our most precious national asset. It must be addressed and given special attention in education, the workplace, the media and politics. In contrast to dictatorships, which can only innovate through stimulus of the ruling regime, Swiss democracy offers an ideal framework for innovation –for transforming ideas into value creation. Let's use this and be ambitious, both economically and socially.

Culture and countercultures

One of the main reasons why I love working as a venture capitalist s its creative dimension. It's a great privilege to be able to participate in innovative activities. A scientific discovery is a rare moment of great intellectual and emotional beauty, as is the development of an innovative product or a disruptive business model. Creation is a deeply human act. The entrepreneur brings a product into the world in a creative dynamic comparable to that of a craftsman, or even sometimes an artist. It is therefore extremely important to promote contacts between the worlds of science, business and art. Radical interdisciplinarity, i.e. the coming together of culture and countercultures, opens up new modes of thinking. Debates between idealists and realists, alternatives and capitalists are very enriching for everyone. This is not a naive vision: it's the reality in Silicon Valley. This became clear to me in the course of my many conversations with Californians. I've become accustomed to asking my hosts (I always stay in private accommodation and not in impersonal hotels) the same question every time I travel: what has made Silicon Valley successful? Their answers can be summarised in three words: Science + venture capital + hippie culture. That's an explosive cocktail! Entrepreneurs like Steve Jobs have managed to blend these three cultures, which are a priori incompatible and yet so complementary. California remains heavily influenced by the hippie subcultures that emerged in the 1960s north of the San Francisco Bay Area (particularly Berkeley). Although the peaceful activism of the Flower Power movement is less visible, a certain revolutionary vision of the world remains, opposing established models. Without access to venture capital and leading scientists, this culture would remain utopian. But with abundant resources, this mentality can actually change the world.

Use of innovation capital

Active

Partially active

Not active

Switzerland definitely does not have as subversive a mentality as California. It therefore has less cultural affinity for more disruptive models. Nevertheless, it is very active in the creative fields. Take the example of the entrepreneur Claude Nobs, founder of the Montreux Jazz Festival, which has become a global exemplar. Swiss architecture schools are also a model for the interdisciplinary interaction of science and art, with many world stars such as Herzog & de Meuron, Diener Diener, Valerio Olgiati and Peter Zumthor, to name but a few.

Societal impact

We also need to broaden our horizons to include social issues. Consider the broadest possible framework, such as the 17 areas of priority for a more sustainable world defined by the United Nations. What impact does venture capital have on these priorities at the global level? VC investments have helped improve healthcare, education (e.g. Internet technologies, MOOC distance learning) and the economic situation in the few countries benefiting from these investments. VC also finances technologies that make the best use of the planet's resources, both in the field of cleantech (renewable energy, recycling) and through IT optimisation solutions (reduction of electricity consumption, road traffic, etc.).

That's a lot, but the potential for development is still enormous. The VC industry has still not recovered from the post-traumatic shock of the near-collapse of the cleantech segment. The term has a bad reputation due to the miserable performance of VC funds that specialise in this area. They were hit hard by, among other things, the collapse of the European solar cell industry due to Chinese dominance. The long development cycles of these green technologies (five to ten years, often longer) do not lend themselves to VC fund structures that are designed for shorter cycles. The development of truly revolutionary technologies such as nuclear fusion or transparent solar cells (a speciality of EPFL under Professor Graetzel, the scientist with the most scientific citations in the world in 2017) has been under development for decades and still requires huge investments to be commercialised. Ultimately, the VC industry devotes less than 5% of its resources to cleantech, even in Switzerland, which has great potential in this area.

Let's take a different look

So why are the VCs reluctant to invest heavily in achieving the 17 UN goals, even though they represent huge markets? For economic reasons, of course, but not only – there are also cultural blockades.

Financially, some technologies discourage VCs due to their long and costly development cycles. For example, let's look at the pharmaceutical industry, which has solved this problem by sharing tasks along the value chain. According to Interpharma, the association of Switzerland's research-based pharmaceutical industry, the market launch of a new drug takes twelve years and costs an average of CHF 2.6 billion. Out of 10,000 substances studied and controlled in the laboratory, only ten reach the stage of clinical trials, and only one passes all the tests and ends up on the market as a drug. In order to deal with such high risks, investors have specialised. They fund only the first phase of research and sell the startups to large pharmaceutical companies, which then use their technical infrastructure and commercial channels for clinical trials and commercialisation. With open innovation, the pharmaceutical industry has thus found an intelligent solution for outsourcing part of its research in collaboration with innovative startups. Resource pooling (databases, biobanks, tumour libraries, technical platforms) and external scientific and technological collaborations complement internal translational research.

Big Pharma invests huge sums every year in acquiring startups in order to 'buy back' external innovations when their risks are reduced and the medical results are promising enough. The geographical, intellectual and often capital proximity (thanks to corporate VC units) between startups and large corporations is strong throughout the process. In addition, most Swiss biotechs are spin-offs from large corporations or university laboratories. So, the VCs' money is not lost in unnecessary, highly costly and risky commercialisation attempts. In addition, their return on investment is enhanced by the high transparency of exit prospects.

The biotech ecosystem has optimised risk and resource management. Why not do the same with industry in general and cleantech in particular? For this to happen, Europe must first promote takeovers of startups by large corporations, which are unfortunately still far too rare today. In this context, state aid to support certain strategic industries is essential. China and the US are systematically promoting their strategic sectors such as electric cars, batteries and solar cells, for example with the US loan of USD 465 million to rescue Tesla in 2010. Switzerland's Technology Fund is a step in the right direction – it simply needs more ambitious resources.

The problem of underinvestment is also mental. In VC culture and finance in general, there is a kind of dogmatic aversion to the term impact. It's associated with the practice of impact investing, which involves financing charitable projects without the need to make a profit. There seems to be a fundamental misunderstanding here. Investors assume that the higher the positive impact of the investment on society or the environment, the lower the return. Similarly, classic VC culture assumes that financial returns are inversely related to the 'strategic' value creation in corporate ventures. However, the validity of these two hypotheses has never been proven. Many examples suggest the opposite. For example, the performance of funds that create strategic, environmental or social value tends to be more sustainable thanks to a strong focus on the interests of their stakeholders. On the stock market, ESG (environmental, social and governance) funds have certainly performed better than countervailing indices, for example the oil and defence industries. Entrepreneurs are particularly sensitive to such issues. Aimée-Mimi van der Wolde, Managing Partner of the innovation funder SEIF, estimates that one third of Swiss startups are impact-driven.

Externalities

This debate deserves to be launched. The baby boomer generation was brought up with the general investment theory, which holds that the highest returns go to those who are not constrained by sustainable or other environmental and social constraints. But this world view does not take externalities into account, which are becoming increasingly important in an interconnected world. Fortunately, modern society is changing and tends to give more and more economic value (costs or benefits) to the externalities caused by production or consumption activities. An externality can be positive or negative, depending on whether its effects on well-being are favourable or unfavourable. Pollution in all its forms is a typical example of a negative externality. On the other hand, vaccination against infectious diseases, like other technological effects of innovation geared to the common good, are positive externalities. The network effect is a typical example of a reciprocal positive externality: the value that a consumer attaches to a network service increases as the number of consumers of that service increases. From a holistic perspective and in the interest of all (including shareholders), it's high time that these externalities are fully taken into account in decisions related to innovation capital.

New generation

Former American Vice President and Nobel Peace Prize laureate Al Gore has made just that his mission: changing the way we think about investment. He is co-founder and chairman of one of the world's largest funds specialising in sustainable investments in listed and unlisted companies: Generation Investment Management, with an endowment of USD 22 billion. The investments integrate sustainability analyses into the decision-making process and focus on long-term performance. 'We're in the early stages of a global sustainability revolution that has the magnitude of the Industrial Revolution, but the speed of the digital revolution,' he said. His fund therefore invests in companies 'helping the health of the planet or individuals, or those driving financial inclusion,' such as SOPHiA GENETICS in 2018. Al Gore visited the team in Lausanne and is personally committed to accelerating the commercialisation of his personalised medicine solutions in the United States. Financial performance is not incompatible with assessing externalities. If we can attach a value to these externalities (as we have done with CO_2 and recycling), certain investment business models will become profitable and thus expand the size of the Swiss market for innovation capital.

Allow me to make one final wish, which is idealistic at the moment, but that I hope one day will become a reality. Innovation capital must devote part of its resources and know-how to developing a largely unexplored but important segment: social innovation. I'm not talking about Swisscom Ventures and the DTF Fund, which has an investment mandate geared towards digital transformation. I'm talking first and foremost about the future fund managers and their financial sponsors. The power of the VC model can help solve major societal problems and lead to peace, justice and good governance, which are at the heart of the UN's list of 17 goals. The technologies are there; they only have to be used intelligently and in a targeted manner. For example, artificial intelligence for conflict resolution or expert systems that offer neutral and qualified recommendations for good governance based on international best practices, a virtual digital government 'in a box'.

EPFL's EssentialTech Centre is already developing 'essential technologies' (in particular medtech, cleantech and peacetech) adapted to developing countries. This programme supports academic spin-offs such as HMCARE, which offers the transparent HelloMask hygiene mask at no more than 15–20% of the price of conventional masks. Another spin-off company, Pristem (low-cost X-ray machines), has received CHF 14 million in its first round of financing from two African and two Swiss investors, who justify their approach as follows: 'The device

is robust, innovative and inexpensive. It can also work in our [Western] hospitals.' EssentialTech Director Klaus Schönenberger talks about the technological convergence between rich countries and the rest of the world: 'It's potentially a universal model.'

There's no shortage of ideas. It's now necessary to find economic models that make these investments profitable. The VC system has already poured tens of billions of dollars into business models for trivial innovations like Angry Birds or TikTok. Can we not develop effective compensation for entrepreneurs and investors who help solve global problems that cost trillions of dollars each year? The world is in the process of creating such a compensation system for climate change. Why not also on other social issues?

Switzerland is well situated to play a leading role in this area. It is home to over 100 international organisations, including the United Nations and the World Health Organisation. This is why startups such as 'diplomatic spin-offs' should be given targeted support. They cannot develop within existing organisations, but thrive in close contact with them. Many startups and large organisations were created this way. When Henry Dunant of Geneva (the first Nobel Peace Prize winner in 1901) founded the International Committee of the Red Cross (ICRC) in 1863, he didn't wonder if his project was viable, but whether it was necessary. His idea of neutral humanitarian aid in war zones was not credible at the time. If he had drawn up a business plan that envisaged 97 million volunteers by 2020 and 300,000 employees, he would have been declared mad. And yet, he did it.

Switzerland offers ideal conditions for inventing, testing, exporting and exchanging innovations that have a positive impact on humanity. That has been their historical mission and is also their future.

Now, my dear readers,
it's your turn!

Dominique Mégret

Appendix

Thank You

At this point I would like to pause and express my thanks. Writing a book about deep tech is not a solitary endeavour, but a journey accompanied by many.

I cannot go without mentioning the families, friends and mentors whose support and encouragement were indispensable.

This book is the result of all these contributions, and for that I am deeply grateful.

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Top 10 Quality of life by city ranking

City		Country	Population	Change in %
1	Vienna	Austria	2,000,000	+1.2
2	**Zurich**	**Switzerland**	**442,000**	**+1.3**
3	Auckland	New Zealand	1,474,000	–
4	Copenhagen	Denmark	650,000	–
5	**Geneva**	**Switzerland**	**203,000**	**–**
6	Frankfurt	Germany	767,000	–
7	Munich	Germany	1,578,000	–
8	Vancouver	Canada	706,000	+0.95
9	Sydney	Australia	4,700,000	–
10	Düsseldorf	Germany	655,000	+0.5%

Source: Mercer, Google Search

Ranking Political stability

Country		Index	Population	Change in %
1	Singapore	98.5	5,400,000	–4.2
2	Finland	95.7	5,500,000	+0.2
4	Norway	94.7	5,408,000	+0.5
5	Switzerland	92.8	8,700,000	+0.8
6	Austria	92.3	8,900,000	+0.5
8	Japan	90.9	125,000,000	–0.5
11	USA	90.2	331,900,000	+0.1
12	UK	89.1	67,330,000	+0.4
14	Sweden	88.1	10,420,000	+0.6
15	Netherlands	86.8	17,530,000	+0.5

Ranking Quality of public services

Country		Index	GDP in billion $	Population per km²
1	Singapore	100.0	397	8,592
2	Switzerland	92.8	800	223
3	Denmark	92.1	400	137
4	Finland	90.9	297	19
5	Norway	87.5	482	8.5
6	Netherlands	85.5	1,013	424
8	Sweden	82.4	635	25.2
11	Austria	80.1	480	109
16	South Korea	75.6	1,811	533
17	Japan	75.5	4,941	338

Source: Global Innovation Index, Google Search

Ranking Government online services

Country		Index	National languages	Currency
2	Finland	98.2	2	Euro
3	South Korea	98.1	1	Won
4	Denmark	97.8	3	D. Krone
5	Singapore	95.8	4	Singapore Dollar
9	USA	92.3	1	US Dollar
10	Japan	90.0	1	Yen
11	Netherlands	89.2	2	Euro
13	Sweden	89.0	1	S. Krone
15	China	87.6	3	Yuan
49	Switzerland	86.8	4	Swiss francs

Source: World Economic Forum, Google Search

Top 10 Listed companies Switzerland

	Company	Year established	Valuation in billions	Industry
1	Nestlé	1866	283	Food
2	Roche	1896	212	Pharma
3	Novartis	1886	201	Pharma
4	UBS	1854	101	Finance
5	Richemont	1948	99	Luxury
6	ABB	1891	89	Technology
7	Zurich Insurance	1872	80	Finance
8	Glencore	1972	65	Commodities
9	Holcim Group	1912	49	Industrial
10	Sika	1910	48	Industrial
	Total		**1,227**	

Top 10 Listed companies Austria

	Company	Year established	Valuation in billions	Industry
1	Verbund AG	1947	23	Electricity
2	Erste Group Bank	1819	17	Finance
3	OMV	1956	14	Oil & gas
4	Raiffeisen Bank	1927	7	Finance
5	Andritz	1852	6	Industrial
6	A1 Telekom Austria	1887	6	Telecom
7	Oberbank	1869	5	Finance
8	Voestalpine	1938	5	Industrial
9	Strabag	1835	5	Construction
10	Vienna Airport	1938	5	Transport
	Total		**93**	

Top 10 Listed companies Sweden

Company		Year established	Valuation in billions	Industry
1	Atlas Copco	1873	76	Food
2	Investor AB	1916	72	Pharma
3	Volvo Group	1927	51	Pharma
4	Spotify	2006	47	Finance
5	EQT	1994	32	Luxury
6	Hexagon	1975	31	Technology
7	Assa Abloy	1864	30	Finance
8	Skandinaviska Banken	1972	29	Commodities
9	Evolution Gaming	2006	26	Industrial
10	Sandvik	1862	26	Industrial
	Total		**420**	

Top 10 Listed companies Israel

Company		Year established	Valuation in billions	Industry
1	Mobileye	1999	21	Automotive
2	Check Point Software	1997	19	Technology
3	Teva Pharmaceutical	1950	14	Pharma
4	NICE	2000	14	Technology
5	Bank Hapoalim	1950	12	Finance
6	Bank Leumi	1902	11	Finance
7	CyberArk	1999	11	Technology
8	monday.com	2012	10	Internet
9	Mizrahi-Tefahot	1923	10	Finance
10	Elbit Systems	1966	9	Transport
	Total		**131**	

Top 10 Listed companies France

Company		Year established	Valuation in billions	Industry
1	LVMH	1854	439	Luxury
2	Hermès	1837	247	Luxury
3	L'Oréal	1909	247	Luxury
4	Dior	1946	152	Luxury
5	Total Energies	1918	151	Energy
6	Schneider Electric	1836	118	Industrial
7	Sanofi	1947	116	Pharma
8	Air Liquide	1902	95	Industrial
9	Essilor Luxottica	1972	93	Luxury
10	Saffron	1915	79	Technology
	Total		**1,737**	

Top 10 Listed companies Germany

Company		Year established	Valuation in billions	Industry
1	SAP	1972	212	Technology
2	Siemens	1847	138	Industrial
3	Deutsche Telekom	1866	118	Telecom
4	Alliance	1890	103	Finance
5	Mercedes-Benz	1926	75	Automotive
6	BMW	1916	72	Automotive
7	Merck KGaA	1668	71	Automotive
8	Volkswagen	1937	69	Pharma
9	Siemens Healthineers	1847	64	Automotive
10	Munich RE	1886	60	Industrial
	Total		**982**	

Top 10 Listed companies UK

Company		Year established	Valuation in billions	Industry
1	Shell	1907	206	Industrial
2	Lime tree	1879	202	Industrial
3	AstraZeneca	1993	189	Pharma
4	HSBC	1865	148	Finance
5	Unilever	1929	126	Consumer goods
6	Arm Holdings	1990	123	Semiconductor
7	Rio Tinto	1873	110	Raw materials
8	BP	1909	103	Energy
9	GlaxoSmithKline	1848	84	Pharma
10	Diageo	1759	82	Food
	Total		**1,373**	

Top 10 Listed companies USA

Company		Year established	Valuation in billions	Industry
1	Microsoft	1975	3,019	Technology
2	Apple	1977	2,857	Technology
3	Alphabet (Google)	1998	1,811	Technology
4	NVIDIA	1993	1,782	Technology
5	Amazon	1994	1,752	Technology
6	Meta Platforms	2004	1,173	Technology
7	Berkshire Hathaway	1956	856	Finance
8	Eli Lilly	1876	705	Pharma
9	Tesla	2003	586	Technology
10	Visa	1958	567	Finance
	Total		**15,108**	

Top 25 Swiss VC kids exits

	Company	Rating in millions	Buyer	Industry
1	Sport radar	29,946	IPO	Business products
2	Actelion Pharmaceuticals	29,600	M&A	Healthcare
3	On	14,798	IPO	Consumer products
4	Sport radar	2,448	Private	Business products
5	NBE Therapeutics	1,397	M&A	Healthcare
6	ADC Therapeutics	1,308	IPO	Healthcare
7	VectivBio	1,199	M&A	Healthcare
8	SOPHiA GENETICS	1,140	IPO	Healthcare
9	FunPlus	1,007	M&A	IT
10	Arvelle Therapeutics	960	M&A	Healthcare
11	Therachon	810	M&A	Healthcare
12	Advanced Bionics	740	M&A	Healthcare
13	Actelion Pharmaceuticals	724	IPO	Healthcare
14	Pharvaris	636	IPO	Healthcare
15	AC Immune	609	IPO	Healthcare
16	VectivBio	597	IPO	Healthcare
17	CRISPR Therapeutics	551	IPO	Healthcare
18	Molecular Partners	505	IPO	Healthcare
19	T3 Pharmaceuticals	501	M&A	Healthcare
20	Advanced Bionics	489	M&A	Healthcare
21	ObsEva	439	IPO	Healthcare
22	Symetis	435	M&A	Healthcare
23	Calypso Biotech	425	M&A	Healthcare
24	Spexis	424	IPO	Healthcare
25	OncoEthix	375	M&A	Healthcare

Top 25 Current Swiss VC kids

	Company	Financing	Establishment	Industry
1	Sport radar	1,269	2001	Business products
2	ADC Therapeutics	1,014	2011	Healthcare
3	TradePlus24	918	2016	Financial services
4	Climeworks	786	2009	Business products
5	On	614	2010	Consumer products
6	CRISPR Therapeutics	531	2013	Healthcare
7	SOPHiA GENETICS	504	2011	Healthcare
8	Basilea Pharmaceutica	488	2000	Healthcare
9	Pharvaris	420	2015	Healthcare
10	beqom	378	2009	IT
11	Carvolution	362	2018	Consumer products
12	Molecular Partners	354	2004	Healthcare
13	Nexthink	351	2004	IT
14	ObsEva	342	2012	Healthcare
15	Atlas Agro	333	2021	Materials
16	Copper.co	328	2018	IT
17	Utopia	323	2010	IT
18	Santhera Pharmaceuticals	318	2018	Healthcare
19	Teylor	315	2019	Financial services
20	VectivBio	311	2002	Healthcare
21	Addex Therapeutics	310	2011	Healthcare
22	Kandou	307	2008	IT
23	CeQur Simplicity	272	2009	Healthcare
24	Scandite	272	2003	IT
25	AC Immune	265	2017	Healthcare

Technology and innovation

AI
Artificial Intelligence
AI enables computers to learn and perform tasks that normally require human intelligence, such as recognizing language or making decisions.

Big Tech
The largest and most influential technology companies, often dominating the Internet, software and hardware sectors.

Biotech
A sector that uses biological processes and organisms to develop products that improve quality of life, such as medicines and agricultural products.

Blockchain
Technology for the secure and transparent recording of transactions on a chain of blocks without the need for a central authority.

Cloud
Allows for data storage and access to resources over the Internet instead of on local computers, increasing flexibility and scalability.

Cyber
Often used in the context of cyber security, it refers to the protection of computer systems and networks against digital attacks.

Deep tech
Breakthrough technologies based on significant scientific discoveries or technological innovations with the potential to bring about major changes.

R&D
Research & development
A sector in companies and organisations dedicated to developing new products or improving existing ones through research.

Fintech
An area that uses technology to make financial services more efficient, accessible and often cheaper, e.g. through online banking, digital payment systems or robo-advisors.

ICT
Information and communication technology
Describes products and services that assist in the electronic collection, storage, processing and transmission of information.

Medtech
Use of technologies and equipment to improve health care and services.

Nano
Nanotechnology is the technology and science of the very small things, typically smaller than 100 nanometres.

Quantum mechanics
A field of physics that describes the behaviour of matter and energy at the level of atoms and subatomic particles.

Silicon Valley
A region in California known as the premier centre for advanced technology, innovation and startup companies.

Software

Alpha mode
Early test phase of a product or project, that is primarily about the internal verification of the basic functionalities, often still containing many errors.

Beta mode
The subsequent testing phase, involving a wider audience to test the product in real world conditions and gather feedback before it is officially released.

Open source
Software whose source code is publicly available and can be used, modified and improved by the community in order to foster cooperation and innovation.

SaaS
Software as a Service
Software that is not purchased and installed, but is used as a service over the Internet, where customers pay a subscription.

IaaS
Infrastructure as a Service
Provides virtual infrastructure such as servers, networks and storage over the Internet.

PaaS
Platform as a Service
Provides development and deployment environments in the cloud to make app creation easier.

DaaS
Desktop as a Service
Provides access to virtual desktops over the Internet.

FaaS
Function as a Service
A cloud-native development model that allows developers to execute code in response to events without having to worry about infrastructure.

Finance and economy

GDP
Gross domestic product
The total value of all goods and services produced within a country over a given period; functions as an indicator of economic performance.

M&A Mergers & acquisitions
The process of the consolidation (merger) takeover (acquisition) of companies, often in order to promote growth or strengthen a market position.

Moonshot
An ambitious, exploratory and groundbreaking project without regard to the immediate profit potential, aiming at major societal or technological advances.

Pivoting
A company or startup changing strategy, often in response to market feedback or the identification of new opportunities to increase the chances of success.

Scale-up
Phase in which a company or startup grows rapidly, often by expanding the market, product range or customer base.

Spin-off
The spin-off of a business unit or technology into a stand-alone company, often to target specific innovations or markets.

In the dynamic world of technology, trends and players are continuously changing. This list provides an overview of some of the leading sources in this sector, without claiming to be exhaustive. Due to the fast-paced environment, the relevance of a leading source today may diminish by tomorrow.

Startup
A young company in its early stages that develops innovative products or services and is often geared towards rapid growth.

Unicorn
Startup with a valuation of over USD 1 billion, even before it goes public or is bought by a larger company.

Decacorn
Companies that are valued at over USD 10 billion and represent the next stage of extraordinary growth.

Hectocorn
Top of the start-up world with a valuation of over USD 100 billion.

Venture capital
Capital provided by investors to finance startups with high growth potential, often in exchange for company shares.

Specific areas and concepts

Fields Medal
One of the highest honours in mathematics, awarded to exceptional talents under the age of 40 for outstanding contributions to mathematics

Tech & Start-up

Ars Technica, CNET, Computer World, DailyDev, Detailed, Engadget, Gizmodo, Goodwall, Harvard Business Review, HubSpot Blog, Mashable, MIT Technology Review, ReadWrite, SaaStr, Startupsavant.com, Tech in Asia, TechCrunch, Techdirt, TechRadar, TechRepublic, Tech World Times, The Next Web, The Verge, VentureBeat, Wired, Y Combinator Blog.

Organizations

Federal Statistical Office (FSO), Federal Office for the Environment (FOEN), European Union (EU), International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), Statistical Office of the European Union (Eurostat), Statista, United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations (UN), World Bank (WB), World Economic Forum (WEF).

Universities & Research Institutions

CERN (European Organization for Nuclear Research), EMPA (Swiss Federal Laboratories for Materials Science and Technology), EPFL (Swiss Federal Institute of Technology Lausanne), ETH Zurich (Swiss Federal Institute of Technology in Zurich), University of Bern

Software & Services

Alphabet (Google) Search engines, cloud, AI. **Microsoft** Operating systems, cloud solutions, productivity software. **Amazon** E-commerce, cloud computing. **Oracle** Databases, cloud solutions. **SAP** ERP and business solutions. **Salesforce** CRM and cloud solutions. **ServiceNow** Business services. **Adobe** Creative software. **Dropbox** Cloud storage. **Palantir** Data analysis. **Shopify** E-commerce platform. **Zoom** Video communication.

Semiconductors & Electronics

AMD, Intel Microprocessors. **Samsung** Semiconductors, smartphones, electronics. **TSMC** Semiconductor manufacturing. **Broadcom** Semiconductors and software. **NVIDIA** Graphics processors, AI. **Texas Instruments** Semiconductors. **Qualcomm** Semiconductors, telecommunications. **ASML** Photolithography for semiconductors. **Sony** Electronics, gaming. **Panasonic** Electronics. **Micron Technology** Memory solutions.

Telecommunications & Networks

Swisscom Telecommunications, IT. **Cisco** Network devices. **Ericsson** Telecommunications. **Huawei** Telecommunications, smartphones. **NEC** IT and network solutions..

Cloud Infrastructure & Platforms

IBM IT, cloud solutions. **Alibaba Cloud** Cloud services. **Google Cloud** Cloud solutions. **Microsoft Azure, Amazon AWS** Cloud computing platforms.

Consumer Hardware

Apple Smartphones, computers, wearables. **Samsung** Smartphones, tablets, TVs, household appliances. **HP** Computers, printers. **Dell** Computers, technology solutions. **Logitech** Peripheral devices. **Sony** Consumer electronics, gaming consoles, cameras. **Lenovo** Computers, tablets, smartphones.

Space Industry

Beyond Gravity, Maxon, APCO Technologies, Swissto12 Space technologies. **SpaceX** Rockets and space exploration. **Boeing** Aircraft, space industry. **Lockheed Martin** Defense, space industry. **Airbus** Aircraft, space technologies..

Automation & Manufacturing

Siemens Industrial automation, energy. **General Electric** Energy, technology. **Honeywell** Automation and control technologies. **ABB** Robotics, electrification technologies. **Schindler** Elevators and escalators. **Rockwell Automation** Industrial automation and information solutions. **Mitsubishi Electric** Electrical and electronic equipment, automation solutions.

Materials & Components

3M Diverse science and materials. **DuPont** Chemicals, materials. **Corning** Specialty glass and ceramics. **EMS Chemie** High-performance polymers, specialty chemicals. **BASF** The largest chemical company worldwide, offers a wide range of chemical products. **Dow** Material sciences, develops a variety of plastics, chemicals, and products.

Cybersecurity

Check Point Software Security solutions. **Palo Alto Networks** Network security. **CyberArk** Security software. **Cloudflare** Content delivery network and security services. **Symantec (NortonLifeLock)** Security software, especially for end-users. **Fortinet** Wide range of security and network solutions.

Internet & Social Media

Facebook (Meta) Social networking, VR technologies. **Instagram (Meta)** Photo and video sharing, social media marketing. **LinkedIn** Professional network, career development. **TikTok (ByteDance)** Short video platform, viral content. **Snapchat. YouTube** Video sharing, wide range of content..

Artificial Intelligence & Big Data

IBM AI, cloud. **NVIDIA** AI, graphics processors. **Tesla** Autonomous vehicles, AI. **Google** Leading in AI research, machine learning, and data analytics. **Amazon** AI applications in AWS, Alexa, and machine learning. **Facebook (Meta)** AI for image and speech recognition, social network analytics. **Microsoft** AI integrations in Azure, Office 365, and Bing. **Baidu** Chinese company, leading in AI research and related technologies. **OpenAI** Innovative AI research and development, creators of GPT and DALL-E.

Pharmaceuticals & Biotechnology

Roche, Novartis, Pfizer, Johnson & Johnson (J&J), Sanofi, Merck Globally leading pharmaceutical and healthcare companies. **BioNTech, Lonza, Moderna, CureVac** Biotechnology firms known for their work with mRNA vaccine technology. **CRISPR Therapeutics, SOPHiA GENETICS, Actelion Pharmaceuticals** Companies focusing on genetic research and personalized medicine.

Venture Capital Funds

Each of these companies plays a crucial role in fostering innovation and developing forward-looking solutions globally **ABB Technology Ventures, Accel Partners, Alphabet (Google), Ant Group, Balderton Capital, Bank Hapoalim, Berkshire Hathaway, Bessemer Venture Partners, Charles River Ventures, EQT, European Investment Fund (EIF), Forestay Capital, GIC Singapore, HBM Partners, Highland Capital Partners, HSBC, Index Ventures, In-Q-Tel, Investor AB, Lakestar, Mizrahi-Tefahot, Novartis Venture, Partners Group, Permira, Pitchbook, PwC, Redalpine, Roche Venture Fund, Sequoia Capital** and **Swisscom Ventures.**

Credits

All
Illustrations, Graphics, and Charts
by Danny Accola

Janus illustration created with Ideogram (ideogram.ai) [prompt: modern Janus in minimalist style and clear background]. ***Rocket illustration*** [prompt: stylistic rocket minimalist style and clear background, logo like]. ***Pirate illustration*** [prompt: stylistic pirate skull minimalist style and clear background, logo like]. Vectorised, refined and adapted by Danny Accola

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```
# This is not the End!
def continue_exploring():
    while True:
        learn_new_technologies()
        innovate_solutions()
        challenge_the_unknown()
    # Remember: the future of technology is an endless loop of possibilities!
    return "Stay curious!"

# Call the function to keep the adventure going
continue_exploring()
```

In a high-tech world dominated by American and Asian giants, where does Switzerland fit in?

How can we ensure a sufficient degree of technological sovereignty?

The author opens the debate and provides food for thought based on the enduring entrepreneurial values that have enriched Switzerland over the last 200 years. He emphasises the strategic importance of venture capital for the future development of Switzerland and calls for the country's resources to be mobilised for eleven ambitious and future-oriented technology programmes, called 'moonshots', in which Switzerland can play a leading role globally.

The author, Dominique Mégret, is CEO of Ecorobotix and was previously head of Swisscom Ventures from its founding in 2007.

As the publisher of this book, the Deep Tech Nation Switzerland Foundation is committed to promoting the Swiss innovation ecosystem in order to place Switzerland at the global forefront of technological progress.

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