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Cambridge Industrial Innovation Policy

Swiss made: the role of manufacturing in Switzerland's success

CAMBRIDGE INDUSTRIAL INNOVATION POLICY

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About this paper

This paper is part of a series examining the contribution of sectors to national economic performance across different contexts. It contributes to the debate about the role of manufacturing in advanced economies, with a focus on Switzerland. We explore Switzerland's economic structure and performance between 2012 and 2021, discussing the factors that enable its global leadership and the role of manufacturing and the knowledge-intensive services. Because of their importance in Switzerland's economy, we take a closer look at the pharmaceutical and mechanical, electrical and metal (MEM) industries. We analyse their productivity, contribution to growth, competitiveness and participation in R&D.

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About us

Cambridge Industrial Innovation Policy (CIIP) is a global, not-for-profit policy group based at the Institute for Manufacturing (IfM), University of Cambridge. CIIP works with governments and global organisations to promote industrial competitiveness and technological innovation. We offer new evidence, insights and tools based on the latest academic thinking and international best practices. CIIP operates in consultancy, professional education, and thought leadership projects through IfM Engage, the knowledge-transfer arm of the Institute for Manufacturing, University of Cambridge.

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Executive summary

In this paper we contribute to the debate about the role of manufacturing in advanced economies by examining Switzerland's economic structure and performance between 2012 and 2021. Our focus is on the manufacturing sector and the knowledge-intensive services. We analyse their productivity, contribution to growth, competitiveness and participation in R&D.

We explore two industries that play a key role in Switzerland's economy: pharmaceuticals and the mechanical, electrical, and metal (MEM) industry. Pharmaceutical manufacturing, the most productive and fastest-growing Swiss industry, contributed 14.3% to the country's economic growth between 2012 and 2019. Meanwhile, the emblematic MEM industry, which includes the production of watches and clocks among other activities, is Switzerland's largest industrial employer. However, it has struggled to remain competitive since the 2008 global financial crisis, despite once accounting for one-fifth of the country's economic growth.[1]

Switzerland is one of the wealthiest and most innovative countries in the world

In 2023 Switzerland had the third-highest GDP per capita among OECD countries, just behind Luxembourg and Ireland. In 2022 Switzerland's labour productivity, measured as GDP per employee, was US$116,600, compared to the OECD average of US$89,100. In the same year, unemployment rate in Switzerland was 4.3%, lower than the OECD average of 5.6%.[2]

Switzerland has been recognised as the most innovative country for 13 consecutive years by the Global Innovation Index.[3] In 2022 Swiss applicants filed 51,445 patents globally, making Switzerland the ninth leading country of patent origin. When adjusted for population, Switzerland ranked third worldwide in patent applications per million residents, with 1,168 patents. This placed Switzerland behind Korea, which had 3,559 patents per million residents, and Japan, with 1,749 patents.[4]

Switzerland is one of the most industrialised countries in the world

Switzerland is often cited by advocates of the post-industrial society as an example of a nation specialising in services while maintaining a high living standard because of its renowned finance and high-end tourism sectors. However, as we discuss in this paper, Switzerland's success is a story of a robust and high-tech manufacturing sector group with roots dating back to the mid-16th century.[5]

Switzerland is one of the most industrialised countries in the world in terms of manufacturing value added per capita.[6] Manufacturing accounts for 22.5% of the value added of the Swiss economy and 17.5% of the employment. This is above the EU and OECD averages and more than twice the participation of manufacturing in the UK economy. Switzerland also shows higher productivity levels than the EU and the OECD, in both the manufacturing sector and the total economy, explained by

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[1] Average annual contribution to economic growth between 1998 and 2007.
[2] OECD (2023). *Economic Policy Reforms 2023: Going for Growth*, OECD Publishing.
[3] WIPO. *Global Innovation Index.*
[4] WIPO. *IP Statistics Data Center.*
[5] As highlighted by Chang, H. J. (2022). *Edible economics: a hungry economist explains the world*. Random House.
[6] UNECE. *Manufacturing value added per capita, constant 2010 United States dollars*.

the dynamism and relatively large size of medium/high-tech manufacturing industries, such as pharmaceuticals and the mechanical, electrical engineering and metal industry (Table ES1).

TABLE ES1. PARTICIPATION OF MANUFACTURING IN SELECTED COUNTRIES AND REGIONS, 2019

Country / region	Manufacturing			Total economy
	Value-added shares	Employment shares	Labour productivity[3/]	Labour productivity[3/]
Switzerland	22.5%	17.5%	196,813	137,491
UK	9.8%	7.8%	98,688	77,676
OECD[1/]	13.4%	12.1%	95,146	85,855
EU[2/]	16.7%	14.6%	76,925	67,000

Note: [1/]OECD members excluding Australia, Chile, Israel, Japan, Korea and Turkey because of data unavailability. [2/]EU (27 countries from 01/02/2020). [3/]Value added in current US$ per worker based on OECD data.
Source: Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*; OECD (2024). *OECD Data explorer*; OECD (2024). *OECD Exchange rates*.

Medium/high-tech manufacturing and knowledge-intensive services are key sectors of the Swiss economy

In 2019 Switzerland's medium/high-tech manufacturing accounted for 14.7% of value added and 8.3% of jobs in the total economy. This sector group contributed 25.5% of Switzerland's economic growth that year. Following medium/high-tech manufacturing, knowledge-intensive services contributed 20.5% to Switzerland's economic growth. This sector group accounted for 27.4% of value added and 21.2% of jobs in the total economy in 2019.

Key industries within these sector groups include: pharmaceuticals; computer, electronic and optical products, watches and clocks; chemicals; IT and other information services; professional services; financial and insurance; and professional, scientific and technical activities. These are industries that have productivity levels above the national average, fast productivity growth and relatively large shares of value added and employment.

Pharmaceuticals is the industry with the highest labour productivity level across all Swiss industries

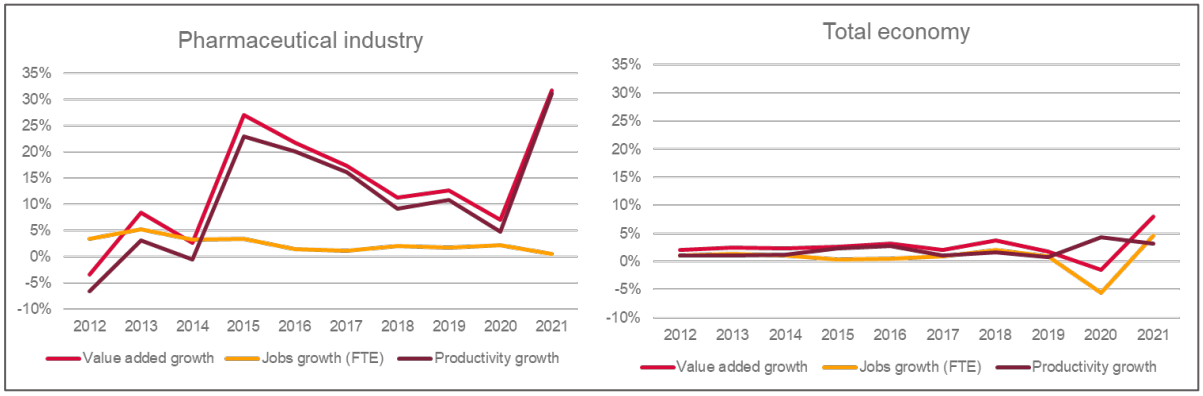
The pharmaceutical industry outperforms the rest of the Swiss economy, experiencing faster growth in value added, employment and productivity than the national average (Figure ES1). In 2019 its productivity was nearly 5 times the national average, 3.5 times higher than the OECD average and more than double that of the UK pharmaceutical industry.

Because of its relatively large value-added shares (5.8%) and fast growth, this industry contributed, on average, 14.3% of the overall growth of Switzerland's economy between 2012 and 2019.

A key factor supporting the strong growth of the pharmaceutical industry is the intensity of research and innovation. The industry's business-enterprise R&D expenditure represents almost half of

Switzerland's total business investment.[7] The country's pharmaceutical industry is export-oriented. In 2023 Switzerland was the second largest exporter of pharmaceutical products globally, behind Germany, accounting for 12% of the global export market.[8]

FIGURE ES1. SWITZERLAND: PERFORMANCE OF THE PHARMACEUTICAL INDUSTRY AND THE TOTAL ECONOMY, 2012–2021 (GROWTH RATES)



Note: FTE, full-time equivalent jobs.

Source: Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*.

The mechanical, electrical and metal industry plays an important role in the Swiss economy, but it is struggling to sustain its competitiveness

The machinery, electrical and metal (MEM) industry is a term used by the Swiss government to refer to a combination of sub-sectors including: computer, electronic and optical products; watches and clocks; machinery and equipment; metals; and transport equipment.[9] The MEM industry is Switzerland's largest industrial employer. It employs more than 320,000 people and accounted for 7% of Switzerland's value added[10] and 14% of business R&D expenditure in 2019.

Within the MEM industry, computer, electronic and optical products, watches and clocks, and machinery and equipment account for more than half of the value added and employment. Computer, electronic and optical products, watches and clocks is also the most productive sub-sector, with labour productivity 1.4 times the national average in 2019.

Watches and clocks, in particular, are the largest MEM export, contributing 7.1% of Swiss goods exports.[11] Switzerland is the largest exporter of watches and clocks in the world, accounting for around half of the global exports in 2023.[12]

Although the MEM industry contributed one-fifth of Switzerland's economic growth between 1998 and 2007, its impact has diminished in recent years. Between 2012 and 2019, it accounted for only 1.0% of the country's growth. However, the industry showed strong resilience during the COVID-19 pandemic, contributing 31.2% to economic growth (Table ES2).

[7] OECD (2024). *OECD Data Explorer. Business enterprise R&D expenditure by industry*.
[8] UN Comtrade.
[9] Kantonschwyz (2016). *Swiss Mechanical, Electrical and Metal Industry*
[10] Switzerland Global Enterprise. *Swiss Mechanical, Electrical and Metal Industry*
[11] UN Comtrade.
[12] Ibid.

TABLE ES2. SWITZERLAND: CONTRIBUTION TO THE GROWTH OF THE MECHANICAL, ELECTRICAL AND METAL INDUSTRY

Economic activity	Value-added shares in MEM, 2019	Employment shares in MEM, 2019[1/]	Contribution to growth (annual average)	
			2012–19	2020–21
Manufacture of computer, electronic and optical products; watches and clocks	41.9%	32.3%	1.9%	14.4%
Manufacture of machinery and equipment n.e.c.	20.7%	22.2%	-0.6%	7.0%
Manufacture of fabricated metal products, except machinery and equipment	18.6%	23.7%	0.4%	5.5%
Manufacture of electrical equipment	8.4%	8.2%	-0.9%	1.0%
Repair and installation of machinery and equipment	3.4%	5.6%	0.5%	0.1%
Manufacture of other transport equipment	3.2%	3.2%	0.2%	2.5%
Manufacture of basic metals	2.7%	3.6%	-0.4%	0.8%
Manufacture of motor vehicles, trailers and semi-trailers	1.1%	1.2%	-0.2%	-0.1%
Total mechanical, electrical and metal (MEM) industry	56,038 million	322,518	1.0%	31.2%

Note: [1/]FTE, full-time equivalent jobs.

Source: Federal Statistical Office of Switzerland. *Industries production account (59 industries)*.

Increasing competition and a decline in innovation pose challenges to Swiss leadership

Switzerland is renowned for being one of the most innovative and competitive countries globally. Several factors contribute to this success, including its robust high-tech manufacturing base, innovation-driven industries, highly skilled professionals and strong export orientation.

Although Switzerland remains one of the most innovative countries in the world, this leadership is challenged by increasing competition and a related trend among companies towards incremental innovation and R&D outsourcing.[13] Additionally, there is a noticeable relocation of R&D-intensive companies abroad. Swiss private R&D expenditure in foreign locations rose from ₣9.8 billion (~US$11 billion) in 2000 to ₣15.9 billion (~US$18 billion) in 2021.[14]

Nonetheless, the Swiss federal government is responding to these challenges by, among other measures, expanding its industrial technology-transfer infrastructure, with a focus on emerging technologies.[15] In 2019 the government announced plans to establish a network of 12 technology-transfer centres – Advanced Manufacturing Technology Transfer Centers (AM-TTC) – in areas including 3D printing for medtech, robotics and photonics.[16,17]

[13] Gersbach, H. and Wörter, M. (2024). Op. cit.
[14] Ibid.
[15] Swiss Federal Council (2023). *Funding approved: Two more technology transfer centers for Switzerland.*
[16] Greater Zurich Area (2019). *Technology transfer centers receive funding*.
[17] Swiss Federal Council (2023). Op. cit.

Introduction

Switzerland is one of the wealthiest and most innovative countries in the world. The country ranks among the top 10 economies worldwide in terms of gross domestic product (GDP) per capita in the world,[18] having one of the lowest unemployment rates among OECD countries.[19] Switzerland has also been recognised as the most innovative country for 13 consecutive years by the Global Innovation Index.[20]

As Ha-Joon Chang has pointed out, Switzerland is often cited by advocates of the post-industrial society as an example of a nation specialising in services while maintaining a high living standard because of its renowned finance and high-end tourism sectors.[21] However, as this author has highlighted and we discuss in this paper, Switzerland's success is actually a story of a robust and high-tech manufacturing sector with roots dating back to the mid-16th century.

In this paper we contribute to the debate about the role of manufacturing in advanced economies by examining Switzerland's economic structure and performance between 2012 and 2021. Our focus is on the manufacturing sector and the knowledge-intensive services.

We explore two industries that play a key role in Switzerland's economy: pharmaceuticals and the mechanical, electrical, and metal (MEM) industry. Pharmaceutical manufacturing, the most productive and fastest-growing Swiss industry, contributed 14.3% to the country's economic growth between 2012 and 2019. In comparison, the emblematic MEM industry, Switzerland's largest industrial employer, has struggled to remain competitive since the 2008 global financial crisis, despite once accounting for one-fifth of the country's economic growth.[22]

The paper is structured as follows:

- **Section 1** provides an overview of Switzerland's economy, highlighting its global leadership and the factors that enable this.
- **Section 2** describes the contribution of medium and high-tech manufacturing and knowledge-intensive services to Switzerland's economy.
- **Section 3** examines the role of the pharmaceutical industry in Switzerland's economy and how it compares internationally.
- **Section 4** focuses on the mechanical, electrical and metal industry, describing the key industries that form this sector and their recent performance.
- **Section 5** concludes by discussing the key characteristics of Swiss economic and innovation leadership, recent challenges and how the Swiss federal government is responding to these challenges.

[18] World Bank (2024). *World Development Indicators*.
[19] Trésor-economics (2019). *What lessons can be drawn from Switzerland's high standard of living?* No. 246.
[20] WIPO. *Global Innovation Index.*
[21] Chang, H. J. (2022). *Edible economics: a hungry economist explains the world*. Random House.
[22] Average annual contribution to economic growth between 1998 and 2007.

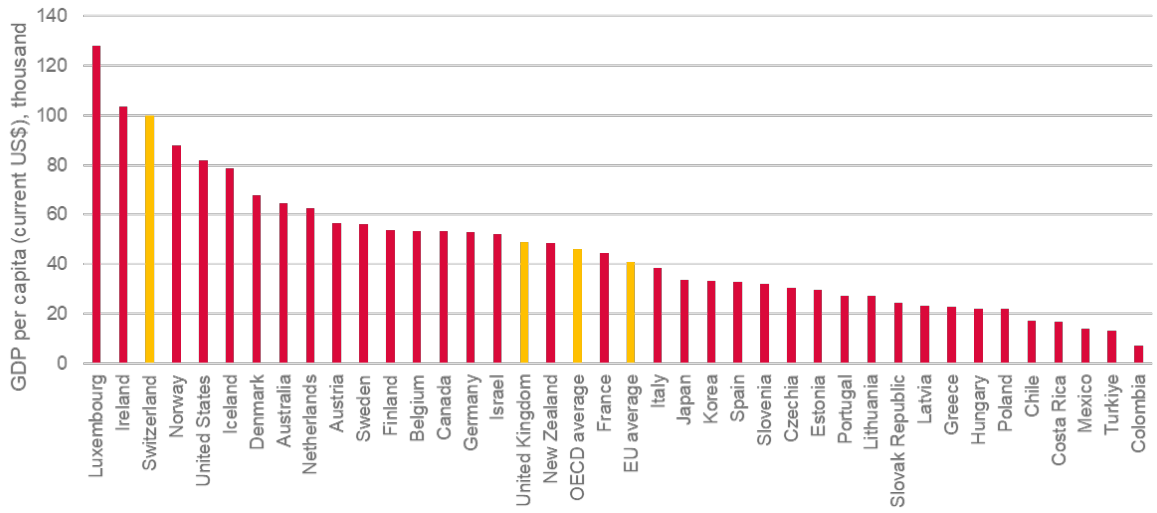
1. Overview of Switzerland's economy

- *In 2023 Switzerland had the third-highest GDP per capita among OECD countries.*
- *Services, both labour- and knowledge-intensive, and medium/high-tech manufacturing are the sectors with the largest participation in Switzerland's economy.*
- *Switzerland is one of the most industrialised advanced economies. Manufacturing accounts for 22.5% of the value added and 17.5% of the employment.*
- *Innovation is one of the main drivers of Switzerland's prosperity. Switzerland has been recognised as the most innovative country for 13 consecutive years by the Global Innovation Index.*

Switzerland is one of the wealthiest countries in the world

In 2023 Switzerland had the third-highest GDP per capita among OECD countries, accounting for nearly US$100,000, just behind Luxembourg and Ireland (Figure 1). In 2022 Switzerland's labour productivity, measured as GDP per employee, was US$116,600, compared to the OECD average of US$89,100. In the same year, unemployment rate in Switzerland was 4.3%, lower than the OECD average of 5.6%.[23]

FIGURE 1. OECD COUNTRIES: GDP PER CAPITA, 2023



Source: World Bank (2024). *World Development Indicators.*

Services, both labour- and knowledge-intensive, and medium/high-tech manufacturing are the sectors with the largest participation in Switzerland's economy. In 2019 these sector groups accounted for 83% of the value added and 78% of the jobs (Table 1).[24] Key economic sectors include: the pharmaceutical industry, the financial sector, the mechanical, electrical engineering and metal industry, the information and telecommunication industry, wholesale and retail trade, and human health activities.[25]

[23] OECD (2023). *Economic Policy Reforms 2023: Going for Growth*, OECD Publishing.
[24] Full-time equivalent.
[25] Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*.

Because of its high productivity levels and fast growth, medium/high-tech manufacturing and knowledge-intensive services were the sector groups that contributed the most to economic growth in 2019. However, between 2012 and 2019 labour-intensive services made the largest contribution to economic growth (41.8% on average), followed by knowledge-intensive services (29.2%) and medium/high-tech manufacturing (17.2%) (Table 1). Human health activities are the labour-intensive sector with the largest contribution to Switzerland's economic growth, averaging 12.4% between 2012 and 2019, just behind the manufacture of pharmaceutical products.

During the COVID-19 pandemic (2020–21), knowledge-intensive services was the sector group with the largest contribution to economic growth. Sectors supporting this strong performance included insurance, professional, scientific and technical activities, and education.

TABLE 1. SWITZERLAND: ECONOMIC STRUCTURE, 2019

Sector group[1/]	Value added shares, 2019	Employment shares (FTE[2/]), 2019	Contribution to economic growth[3/]			
			2019	2012–19	2020	2021
Labour-intensive services	40.7%	48.2%	19.8%	41.8%	-151.7%	48.3%
Knowledge-intensive services	27.4%	21.2%	20.5%	29.2%	51.3%	10.8%
Medium/high-tech manufacturing	14.7%	8.3%	25.5%	17.2%	-18.8%	37.7%
Low/medium-tech manufacturing	7.8%	9.2%	19.9%	2.6%	-1.7%	5.7%
Other production	7.0%	11.9%	7.7%	6.9%	16.1%	3.5%
Utilities	2.3%	1.2%	6.6%	2.3%	4.9%	-5.9%
Total absolute values	CHF571 billion (~US$575 billion)	3.6 million FTE jobs	100%	100%	(-)100%	100%

Note: [1/]A description of the sector group classification is available from the appendix. [2/]FTE, full-time equivalent jobs. [3/]Contribution computed based on the method used by Zhao and Tang (2018). The table presents the result of the sum of the quantity effect and the price effect as a percentage of the total growth rate of the economy.

Source: Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*.

Switzerland is one of the most industrialised countries in the world

Switzerland is one of the most industrialised countries in the world in terms of manufacturing value added per capita.[26] Manufacturing accounts for 22.5% of the value added of the Swiss economy and 17.5% of the employment. This is above the EU and OECD averages, as shown in Table 2, and more than twice the participation of manufacturing in the UK economy. Switzerland also shows higher productivity levels in both the manufacturing sector and the total economy. This is explained by the dynamism and large size of medium/high-tech manufacturing industries, such as pharmaceuticals and the mechanical, electrical engineering and metal industry.

The manufacturing sector is not only crucial for maintaining Switzerland's high living standard but also serves as a seedbed for Switzerland's high-productivity services, including finance, transport, and business and professional services, such as research and development (R&D), engineering,

[26] UNECE. *Manufacturing value added per capita, constant 2010 United States dollars*.

design and management consulting.[27] In 2017 every ₣1 produced by the manufacturing sector generated an additional 24 centimes in knowledge-intensive services. This relationship works both ways, as for every ₣1 produced by scientific research and development activities, an additional 39 centimes were generated in manufacturing, and for every ₣1 produced in IT and other information services 23 centimes were created in the manufacturing sector.[28]

TABLE 2. PARTICIPATION OF MANUFACTURING IN SELECTED COUNTRIES AND REGIONS, 2019

Country / region	Manufacturing			Total economy
	Value added shares	Employment shares	Labour productivity[3/]	Labour productivity[3/]
Switzerland	22.5%	17.5%	196,813	137,491
UK	9.8%	7.8%	98,688	77,676
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Note: [1/]OECD members excluding Australia, Chile, Israel, Japan, Korea and Turkey because of data unavailability. [2/]EU (27 countries from 01/02/2020). [3/]Value added in current US$ per worker based on OECD data.

Source: Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*; OECD (2024). *OECD Data explorer*; OECD (2024). *OECD Exchange rates*.

[27] Chang, H. J. (2022). Op. cit.
[28] Simple multipliers calculated based on Swiss Input-Output table 2017 published by the Federal Statistical Office (2023).

Innovation is one of the main drivers of Switzerland's prosperity

Innovation is one of the main drivers of Switzerland's prosperity. Switzerland has been recognised as the most innovative country for 13 consecutive years by the Global Innovation Index (GII), published by the World Intellectual Property Organization (WIPO).[29]

The presence of renowned R&D institutions equips Switzerland with the capacity to conduct frontier research domestically. Switzerland is one of the largest investors in R&D. In 2019 its share of gross domestic expenditure on R&D, as a percentage of GDP, was 3.2%, higher than the OECD average of 2.5%, ranking sixth in the world. The private sector contributes nearly two-thirds of R&D expenditure in Switzerland, being home to many world-class private research centres, including IBM, Google, Disney, ABB, Hyundai, Oracle, HP and Biogen.[30] In 2022 Swiss applicants filed 51,445 patents globally, making Switzerland the ninth leading country of patent origin. When adjusted for population, Switzerland ranked third worldwide in patent applications per million residents, with 1,168 patents. This placed Switzerland behind Korea, which had 3,559 patents per million residents, and Japan, with 1,749 patents.[31]

The comprehensive innovation services available in Switzerland facilitate knowledge transfer and technology commercialisation. For example, Innosuisse, the Swiss Innovation Agency, specialises in promoting collaboration and technology transfer between industry and universities in applied R&D projects. Additionally, Switzerland boasts an extensive range of intellectual property (IP) specialists who provide IP commercialisation services such as licensing, patent transactions or strategic partnerships.[32]

Well-equipped technology parks and experienced industrial clusters across Switzerland also support innovation by lowering the cost for businesses to access the facilities and services necessary for developing, producing and marketing new products and services. For instance, Switzerland Innovation is a network of six innovation parks that foster collaboration between companies, start-ups and universities. Additionally, a "precision cluster" derived from the successfully Swiss watch industry has recently expanded to include manufacturing technologies for robotics, medical technology and additive manufacturing.[33]

[29] WIPO. *Global Innovation Index.*
[30] Switzerland Global Enterprise. *Swiss Innovation.*
[31] WIPO. *IP Statistics Data Center.*
[32] Ibid.
[33] Switzerland Global Enterprise. *Advanced manufacturing in Switzerland.*

2. Medium/high-tech manufacturing and knowledge-intensive services[34]

- *Switzerland's medium/high-tech manufacturing sector group accounts for 14.7% of value added, 8.3% of jobs and 58% of goods exports.*
- *Three main industries drive the strong performance of Switzerland's medium/high-tech manufacturing: pharmaceuticals; computer, electronic and optical products, watches and clocks; and chemicals.*
- *These are industries that have productivity levels above the national average, fast productivity growth and relatively large shares of value added and employment.*
- *Switzerland's knowledge-intensive services account for 27.4%% of value added, 21.2% of jobs and 65% of service exports.*
- *The labour productivity of Switzerland's knowledge-intensive services is 1.2 times larger than the OECD average, 1.7 times larger than the EU average and 1.5 times larger than the UK average.*
- *The main industries driving the growth of the knowledge-intensive sector include: IT and other information services, professional services, insurance, financial services, architectural and engineering activities, and scientific research and development.*

2.1 Medium/high-tech manufacturing

In 2019 Switzerland's medium/high-tech manufacturing sector group accounted for 14.7% of value added and 8.3% of jobs in the total economy. This sector contributed 25.5% of Switzerland's economic growth that year (Table 1).

In 2023 the medium/high-tech manufacturing sector group exported products[35] valued at over US$245 billion, accounting for 58% of the total value of goods exported by Switzerland. In comparison, in the same year the UK exported medium/high-tech manufactured products valued at US$270 billion, accounting for 52% of the total UK's exported goods.[36]

Three industries are mainly driving the strong performance of Switzerland's medium/high-tech manufacturing: pharmaceuticals; computer, electronic and optical products, watches and clocks; and chemicals. These are industries that have productivity levels above the national average,[37] fast productivity growth and relatively large shares of value added and employment (Table 3).

For instance, the pharmaceutical industry shows productivity levels almost five times the average of the Swiss economy, and between 2012 and 2019 it experienced an average annual productivity growth rate of 9.4%. Because of its relatively large value-added shares (5.8%) and fast growth, this industry contributed, on average, 14.3% of the overall growth of Switzerland's economy between 2012 and 2019.

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[34] Appendix A describes the economic activities included within these sector groups.
[35] Medium/high-tech manufactured products refer to the exported goods with HS codes 28–38 (chemicals, including pharmaceutical products, and organic chemicals), 84–85 (mechanical and electrical apparatus, machinery and equipment), 86–89 (transportation), 90 (optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus) and 91 (clocks and watches and parts thereof).
[36] UN Comtrade.
[37] Relative productivity above 1, where 1 is the average productivity level of the Swiss economy.

2.2 Knowledge-intensive services

Switzerland's knowledge-intensive services accounted for 27.4% of value added and 21.2% of jobs in the total economy in 2019. Following the medium/high-tech manufacturing sector group, knowledge-intensive services contributed 20.5% to Switzerland's economic growth in 2019 (Table 1). In 2023 Switzerland earned US$252 billion from the export of knowledge-intensive services, accounting for 65% of total services exported.[38]

By international comparison, Switzerland's knowledge-intensive services sector group is slightly larger than the averages of the OECD and the EU in terms of both value added (25.1% for the OECD and 21% for the EU) and employment shares (19.5% for the OECD and 17.9% for the EU). Switzerland's knowledge-intensive services also feature higher productivity. In 2019 the value added per worker per year in Switzerland's knowledge-intensive services was US$133,541, higher than the OECD level of US$110,581 and the EU level of US$78,548.[39]

The knowledge-intensive services sector in the UK contributed similar proportions to the economy in terms of value added (27.8%), employment (24.1%) and the share of knowledge-intensive services exported (67%).[40,41] Nonetheless, the UK's value added per worker per year in its knowledge-intensive services was US$89,584 in 2019, behind the Switzerland and OECD average.[42]

Within Switzerland's knowledge-intensive services, the industries that made the largest contributions to economic growth between 2012 and 2019 include: IT and other information services (6.5%), professional services (5.5%), insurance (4.3%), financial services (4.1%), architectural and engineering activities (3.6%), and scientific research and development (2.9%). Of these industries, insurance services, scientific research and development, financial services, and IT and other information services have among the highest productivity levels, all above the national economy average (Table 3).

Switzerland is one of the hub countries globally exporting knowledge-intensive services. Between 1995 and 2011, Switzerland advanced its hub position in the export of financial services, IT services, R&D and other professional business services. This is particularly notable, as many advanced countries such as the US, the UK and France lost their centralised positions to Asian countries such as China and Korea during the same period. More importantly, Switzerland's increasingly centralised role in exporting these services enhanced its manufacturing competitiveness in the global market.[43]

[38] WTO, Trade in services by mode of supply data set.
[39] OECD Data explorer, OECD Exchange rates.
[40] Ibid.
[41] WTO, Trade in services by mode of supply data set.
[42] OECD Data explorer, OECD Exchange rates.
[43] Blázquez, L., Díaz-Mora, C. and González-Díaz, B. (2020). *The role of services content for manufacturing competitiveness: A network analysis*. Plos one, 15(1), e0226411.

TABLE 3. SWITZERLAND: CONTRIBUTION OF MEDIUM/HIGH-TECH MANUFACTURING AND KNOWLEDGE-INTENSIVE SERVICES

Higher productivity - Lower productivity

Sector	Value-added shares, 2019	Employment shares, 2019[1/]	Contribution to growth[2/] (average 2012–19)	Relative productivity,[3/] 2019	Productivity growth (average 2012–19)
Manufacture of pharmaceutical products	5.8%	1.3%	14.3%	4.62	9.4%
Insurance	5.4%	2.1%	4.3%	2.60	3.3%
Scientific research and development	1.2%	0.5%	2.9%	2.30	3.0%
Telecommunications	1.5%	0.7%	0.6%	2.15	1.5%
Manufacture of coke, chemicals and chemical products	1.5%	0.8%	2.5%	1.91	4.1%
Financial service activities	6.7%	4.0%	4.1%	1.67	2.0%
Manufacture of computer, electronic and optical products; watches and clocks	4.1%	2.9%	1.9%	1.41	0.3%
IT and other information services	3.5%	2.9%	6.5%	1.20	0.3%
Legal and accounting services; services of head offices; management consulting services	4.3%	4.0%	5.5%	1.08	0.0%
Manufacture of electrical equipment	0.8%	0.8%	-0.9%	1.06	-0.4%
Manufacture of machinery and equipment n.e.c.	2.0%	2.1%	-0.6%	0.98	-0.5%
Manufacture of motor vehicles, trailers and semi-trailers	0.1%	0.1%	-0.2%	0.92	-4.9%
Manufacture of other transport equipment	0.3%	0.4%	0.2%	0.90	-2.3%
Architectural and engineering activities	2.7%	3.1%	3.6%	0.87	-0.6%
Advertising and market research	0.4%	0.5%	0.2%	0.77	1.5%
Publishing activities	0.3%	0.4%	-0.1%	0.74	-5.9%
Motion picture, video and television-programme production services, sound recording and music publishing; programming and broadcasting services	0.3%	0.4%	0.0%	0.64	-2.3%
Other professional, scientific and technical services; veterinary services	0.5%	0.8%	0.8%	0.63	-1.5%
Education	0.8%	1.8%	0.9%	0.41	-3.0%

Note: [1/]FTE, full-time equivalent jobs. [2/]Contribution computed based on the method used by Zhao and Tang (2018). The table presents the result of the sum of the quantity effect and the price effects as a percentage of the total growth rate of the economy. [3/]Labour productivity measured as value added per FTE. Relative productivity is computed as a ratio of the productivity level of the total economy.
Source: Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*.

3. The pharmaceutical industry

- *The pharmaceutical industry is the sector with the highest labour productivity in the Swiss economy, nearly five times the national average.*
- *Between 2012 and 2019, it experienced a stronger economic performance than in the pre-financial crisis period (1998–2007).*
- *Switzerland's pharmaceuticals industry shows higher productivity levels than many advanced economies, being 3.5 times higher than the OECD average and more than twice the UK average in 2019.*
- *In 2023 Switzerland was the second largest exporter of pharmaceutical products globally, behind Germany.*
- *Pharmaceutical products were the second-largest Swiss export by value and showed the largest trade surplus among all Swiss export goods, with a value of US$41 billion in 2023.*
- *The private sector invests more than ₣7 billion (~US$8 billion) every year in R&D, representing almost half of Switzerland's business-enterprise R&D expenditure.*
-

The Swiss pharmaceutical industry employs 47,500 people and accounted for 9.3% of Switzerland's value added in 2019.[44] Various sectors benefit from the buoyant pharmaceutical industry. In 2020 for every Swiss franc generated in the pharmaceutical industry, an additional 70 centimes were created in other Swiss sectors. In the same year, around 209,200 people were indirectly involved in the pharmaceutical value chain. These employees came from diverse sectors, including chemicals, consumer and investment goods, energy, construction, transport, finance, ICT, consulting, cleaning and security, among others.[45]

Pharmaceuticals is the industry with the highest labour productivity level across all Swiss industries. In 2019 this industry had a productivity level that was nearly five times the national average. This is also the industry that makes the largest contribution to economic growth, on average 14.3% between 2012 and 2019.

The Swiss pharmaceutical industry traces its roots to the 19th-century chemical industry. During this period, manufacturers in the textile industry discovered that their dyes possessed pharmaceutical properties. Recognising this potential, they began marketing these products for medicinal use, laying the foundations for Switzerland's pharmaceutical sector.[46] Today, over 250 pharmaceutical companies are based in Switzerland, including start-ups, SMEs and multinational corporations such as Roche and Novartis.[47,48]

As Figure 2 shows, the pharmaceutical industry outperforms the rest of the Swiss economy, experiencing faster value added, employment and productivity growth than the national average. Between 2012 and 2019, value added grew in the pharmaceutical industry at an average rate of

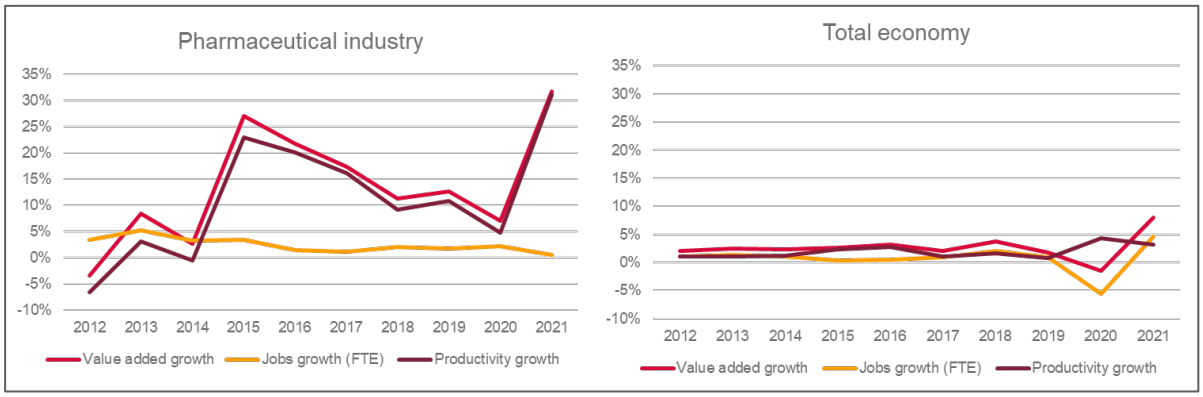
[44] Switzerland Global Enterprise (2020). *Switzerland as a Pharma Hub.*
[45] Interpharma/BAK Economics AG (2021). *Importance of the Pharmaceutical Industry for Switzerland*. Basel. Interpharma.
[46] Swiss government. Chemical and pharmaceutical industry.
[47] Switzerland Global Enterprise (2020). Op. cit.
[48] Pharmaceutical Technology (2018). A formula for success: inside Swiss pharma.

12.3%, compared to the total economy's average rate of 2.5%. This growth exceeded the pre-financial crisis period's (1998–2007) average rate of 11.4%.

In terms of productivity, the pharmaceutical industry grew at an average rate of 9.4% between 2012 and 2019, nearly three times the overall productivity growth of 3.2% during the same period, and above the productivity growth rate observed in the pre-crisis period (1998–2007) of 7.0%.

During the COVID-19 pandemic, although the pharmaceutical industry experienced slower value-added growth, it sustained positive growth rates and expanded its number of jobs. In contrast, the total economy saw contractions in both value added and the number of jobs.

FIGURE 2. SWITZERLAND: PERFORMANCE OF THE PHARMACEUTICAL INDUSTRY AND THE TOTAL ECONOMY, 2012–2021 (GROWTH RATES)



Note: FTE, full-time equivalent jobs.

Source: Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*.

In an international comparison, Switzerland's pharmaceutical industry shows higher productivity levels than many advanced economies. In 2019 value added per worker per year in Switzerland's pharmaceutical industry was US$747,000, which is 3.5 times higher than the OECD average of US$213,826 and more than twice the UK's US$361,600.

Comparing the size of the pharmaceutical industry in Switzerland and the UK, we find significant differences. In Switzerland the pharmaceutical industry contributed 26% to manufacturing value added and 7% to manufacturing employment. In contrast, in the UK the industry contributed 7% to manufacturing value added and 2% to manufacturing employment.[49]

Switzerland's pharmaceutical sector is exported-oriented. In 2023 Switzerland was the second-largest exporter of pharmaceutical products[50] globally, accounting for 12% of the global export market, with exports valued at US$99 billion. Germany led the market with an export value of US$121 billion.

Pharmaceutical products were the second-largest Swiss export by value, behind luxury pearls, stones, metals and jewellery, which totalled US$127 billion. Additionally, pharmaceutical products

[49] OECD Data explorer.
[50] HS code 30: Pharmaceutical products.

had the largest trade surplus among all Swiss export goods, with a value of US$41 billion, making Switzerland one of the countries with the largest export surplus of pharmaceutical products worldwide.[51,52]

A key factor supporting the strong growth of the pharmaceutical industry is the intensity of research and innovation. The private sector invests more than ₣7 billion (~US$8 billion) every year in the research and development of new medicines and therapies.[53] This represents almost half of Switzerland's business-enterprise R&D expenditure.[54] As a result, among 35 technology fields identified by the WIPO,[55] medical technology and pharmaceuticals are the 2 technology areas where Swiss patent applicants file the most patents. In 2022 Swiss applicants published a total of 9,754 patents in these two areas, ranking Switzerland sixth in the world, behind China, the US, Japan, Korea and Germany.[56]

[51] UN Comtrade.
[52] Switzerland Global Enterprise (2020). *Switzerland as a Pharma Hub.*
[53] Interpharma/BAK Economics AG (2021). *Importance of the Pharmaceutical Industry for Switzerland*. Basel. Interpharma.
[54] OECD (2024). *OECD Data Explorer. Business enterprise R&D expenditure by industry*.
[55] WIPO (2008). Concept of a Technology Classification for Country Comparisons.
[56] WIPO. *IP Statistics Data Center.*

4. The mechanical, electrical and metal industry

- *The Swiss mechanical, electrical and metal (MEM) industry employs more than 320,000 people and accounted for 7% of Switzerland's value added in 2019.*
- *Within the MEM industry, the manufacture of computer, electronic and optical products, watches and clocks, and the manufacture of machinery and equipment, account for more than half of the value added and employment.*
- *Switzerland has leveraged the know-how of the watchmaking industry to develop new industries, such as precision manufacturing.*
- *Nearly 80% of MEM products made in Switzerland are exported, positioning Switzerland as the second-highest country in the world by per-capita machinery exports.*
- *Despite its sustained contribution to economic growth, exports and innovation, the MEM industry has faced slower growth over the last decade.*

The machinery, electrical and metal (MEM) industry is a term used by the Swiss government to refer to a combination of sub-sectors including: computer, electronic and optical products; watches and clocks; machinery and equipment; metals; and transport equipment.[57] These sub-sectors are also organised within the trade association Swissmem.[58]

The MEM industry is Switzerland's largest industrial employer. It employs more than 320,000 people and accounted for 7% of Switzerland's value added in 2019.[59] Most of Switzerland's 10,000 MEM businesses are SMEs employing fewer than 250 workers.[60]

Although the MEM industry contributed one-fifth of Switzerland's economic growth between 1998 and 2007, its impact has diminished in recent years. Between 2012 and 2019, it accounted for only 1.0% of the country's growth. However, the industry showed strong resilience during the COVID-19 pandemic, contributing 31.2% to economic growth.

The manufacture of computer, electronic and optical products, watches and clocks, and the manufacture of machinery and equipment, account for more than half of the value added and employment of the MEM industry.

The manufacture of computer, electronic and optical products, watches and clocks is the most productive sub-sector within the MEM industry, with labour productivity 1.4 times the national average in 2019 (Table 3). It also made the largest contribution to Switzerland's economic growth within the MEM industry between 2012 and 2019 (1.9%) (Table 4). However, this sector has been highly volatile over the past decade, contributing as much as 16.4% to Swiss economic growth in 2020, while showing a negative contribution of -17.7% in 2015.

[57] Kantonschwyz (2016). *Swiss Mechanical, Electrical and Metal Industry*
[58] https://www.swissmem.ch/en/index.html
[59] Switzerland Global Enterprise. *Swiss Mechanical, Electrical and Metal Industry*
[60] Swiss Confederation (2023). *Machinery, electrical engineering and metals industry*.

TABLE 4. SWITZERLAND: CONTRIBUTION TO THE GROWTH OF THE MECHANICAL, ELECTRICAL AND METAL INDUSTRY

Economic activity	Value-added shares in MEM, 2019	Employment shares in MEM, 2019[1/]	Contribution to growth (annual average)	
			2012–19	2020–21
Manufacture of computer, electronic and optical products; watches and clocks	41.9%	32.3%	1.9%	14.4%
Manufacture of machinery and equipment n.e.c.	20.7%	22.2%	-0.6%	7.0%
Manufacture of fabricated metal products, except machinery and equipment	18.6%	23.7%	0.4%	5.5%
Manufacture of electrical equipment	8.4%	8.2%	-0.9%	1.0%
Repair and installation of machinery and equipment	3.4%	5.6%	0.5%	0.1%
Manufacture of other transport equipment	3.2%	3.2%	0.2%	2.5%
Manufacture of basic metals	2.7%	3.6%	-0.4%	0.8%
Manufacture of motor vehicles, trailers and semi-trailers	1.1%	1.2%	-0.2%	-0.1%
Total mechanical, electrical and metal (MEM) industry	56,038 million	322,518	1.0%	31.2%

Note: 1/FTE, full-time equivalent jobs.

Source: Federal Statistical Office of Switzerland. *Industries production account (59 industries)*.

The watchmaking industry is a key element of the success of the MEM industry. The watchmaking industry traces its roots back to the mid-16th century and the Reformation in Geneva. When Jean Calvin forbade the wearing of jewellery, goldsmiths and jewellers working in the region turned their attention and talents to watchmaking. There are around 700 watchmaking firms in Switzerland, most of which are based in Geneva and the Jura region, mainly specialising in the luxury segment.[61]

Switzerland has leveraged the know-how of the watchmaking industry to develop new industries. The Swiss watchmaking cluster has gradually evolved into a "precision cluster", attracting manufacturers from outside the watchmaking industry who require similar technologies and skills for their production. The "precision cluster" features medical and production technologies such as robotics and additive manufacturing.[62]

Nearly 80% of MEM products made in Switzerland are exported, positioning Switzerland as the second-highest country in the world by per-capita machinery exports.[63] In 2023 exports of machinery and electronics, optical products, and watches and clocks[64] added up to US$90.3 billion,

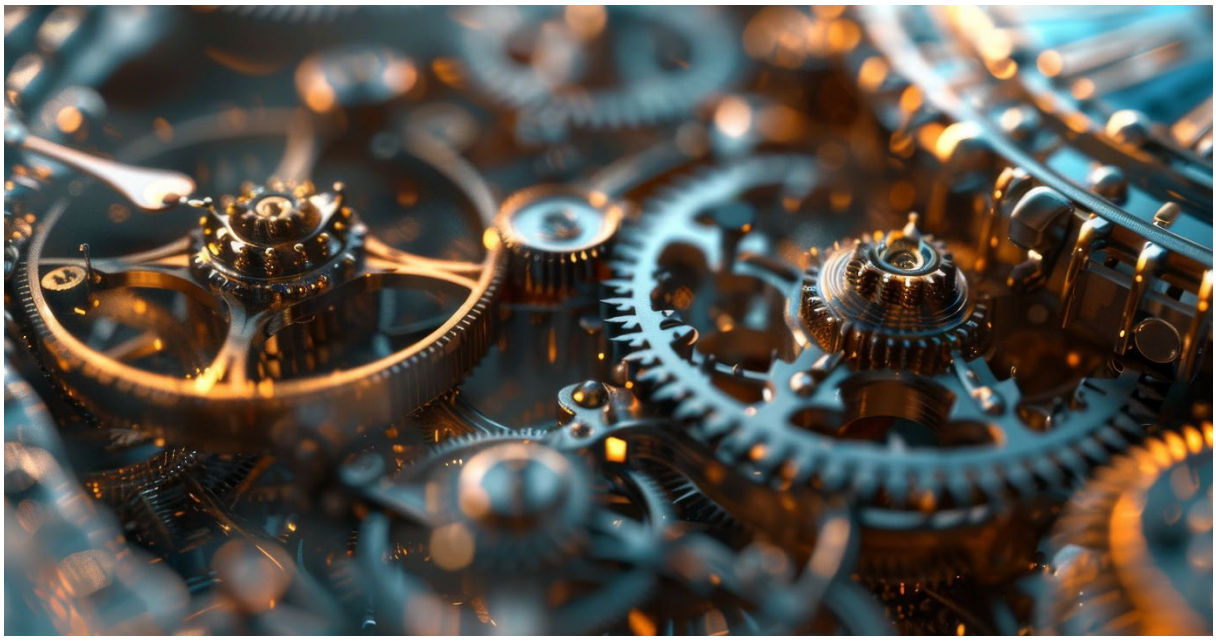
[61] Swiss Confederation (2023). *Watchmaking industry*.
[62] Switzerland Global Enterprise. *Economic Structure*
[63] Switzerland Global Enterprise. *Swiss Mechanical, Electrical and Metal Industry*
[64] HS Code for 84 (machinery and mechanical appliances, boilers, nuclear reactors; parts thereof), 85 (electrical machinery and equipment and parts thereof; sound recorders and reproducers; television image and sound recorders and reproducers, parts and accessories of such articles), 90 (optical, photographic, cinematographic, measuring, checking, medical or surgical instruments and apparatus; parts and accessories), and 91 (clocks and watches and parts thereof).

accounting for 21.5% of Swiss goods exports. Switzerland is the 15th-largest exporter in these product categories, holding 1.6% of the global export market.

Among MEM products, watches and clocks represent the largest export category, generating US$29.8 billion in 2023. This accounted for 7.1% of Switzerland's total goods exports and represented the third-largest trade surplus among the country's export goods, amounting to US$26 billion in the same year.[65] Switzerland is the largest exporter of watches and clocks in the world, accounting for 50.2% of global exports of these products in 2023.[66]

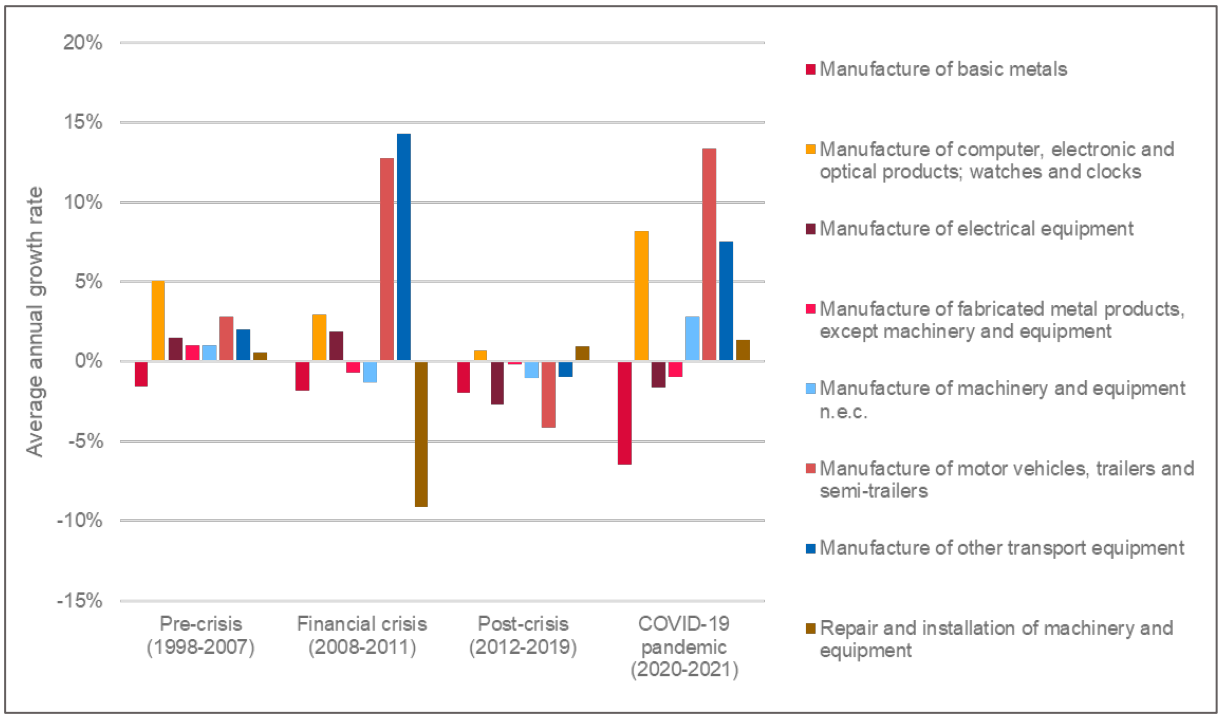
Significant investment in innovation and R&D underpins the success of Switzerland's MEM industry, which provided nearly 20% of the R&D positions and attracted 14% of business R&D expenditure in Switzerland in 2019.[67] Within the MEM industry, measurement and electrical machinery were the top two technology fields for patenting among Swiss businesses in 2022, positioning Switzerland among the top 10 countries globally by patent origin.[68]

Despite its sustained contribution to economic growth, exports and innovation, the MEM industry has faced slower growth over the last decade than in the pre-crisis period (1998–2007). The manufacture of computer, electronic and optical products, watches and clocks is the sole segment within the MEM industry that experienced positive value-added growth from 2012 to 2019. However, even this sector saw an average growth rate of just 0.7% between 2012 and 2019, a significant decline from the 5% growth rate during the pre-crisis period (1998–2007) (Figure 3).



[65] UN Comtrade.
[66] Ibid.
[67] Switzerland Global Enterprise. *Swiss Mechanical, Electrical and Metal Industry.*
[68] WIPO. *IP Statistics Data Center*.

FIGURE 3. SWITZERLAND: VALUE-ADDED GROWTH OF THE MEM INDUSTRY, 1998–2021



Source: Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries)*.

Because of its strong export orientation, the MEM industry has been impacted by slower global demand, trade barriers, a strong Swiss franc, talent shortages and increasing competition from emerging economies.[69] The lower activity also reflects the diversification of production sites to emerging economies, such as India, South Africa and China.[70] As early as 2015, nearly half of Swiss MEM manufacturers considered relocating or developing new business abroad because of the appreciation of the Swiss franc.[71] This issue remains a significant challenge for the Swiss MEM industry, alongside difficulties in electricity and gas supply and geopolitical tensions.[72]

[69] Deloitte (2013). *White paper on Swiss manufacturing industry. Challenges and prospects in global competition*.
[70] Ibid.
[71] Deloitte (2015). *Growth opportunities strategies for Swiss manufacturing companies.*
[72] SWISSMEM (2023). *The downturn has now reached the industrial sector.*

5. Final reflections

Switzerland is renowned for being one of the most innovative and competitive countries globally. Several factors contribute to this success, including its robust high-tech manufacturing base, innovation-driven industries, highly skilled professionals and strong export orientation.

Knowledge-intensive services and manufacturing play a key role in Switzerland's economy. Unlike many other advanced economies, Switzerland is highly industrialised, with manufacturing accounting for 22.5% of the value added and 17.5% of the employment.[73]

The pharmaceutical and mechanical, electrical and metal (MEM) industries are among the most successful Swiss sectors. Most of these industries exhibit productivity levels surpassing the national average, rapid growth, strong export orientation and substantial investments in research and development. The success of these sectors is underpinned by a long-standing tradition of collaboration between firms and research institutions, world-renowned research centres, the availability of skilled personnel and the "Made in Switzerland" reputation for high quality and reliability.[74,75,76]

However, increasing competition and a decline in innovation pose challenges to Swiss leadership, particularly in the MEM industry.[77,78] Although Switzerland remains one of the most innovative countries in the world, there is a growing trend among companies towards incremental rather than radical innovation, and an increase in R&D outsourcing.[79] Additionally, there is a noticeable relocation of R&D-intensive companies abroad. Swiss private R&D expenditure in foreign locations rose from ₣9.8 billion (~US$11 billion) in 2000 to ₣15.9 billion (~US$18 billion) in 2021.[80]

Nonetheless, the Swiss federal government is responding to these challenges by, among other measures, expanding its industrial technology-transfer infrastructure, with a focus on emerging technologies.[81] In 2019 the government announced plans to establish a network of 12 technology-transfer centres – Advanced Manufacturing Technology Transfer Centers (AM-TTC) – in areas including 3D printing for medtech, robotics and photonics.[82,83]

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[73] Federal Statistical Office of Switzerland (2024). *Industries production account (59 industries).*
[74] Switzerland Global Enterprise. *Advanced manufacturing in Switzerland*
[75] Switzerland Global Enterprise (2021). *Swiss innovation*.
[76] Donzé, P. (2018). The Swiss Watch Industry. *Oxford Research Encyclopedia of Business and Management*. Retrieved 30 Jul. 2024, from https://oxfordre.com/business/view/10.1093/acrefore/9780190224851.001.0001/acrefore-9780190224851-e-94.
[77] Gersbach, H. and Wörter, M. (2024). *Challenges for the Swiss Innovation System*. No. 177. KOF Studien, 2024.
[78] Barjak, F., Foray, D. and Wörter, M. (2023). *Mastering multiple complexities – a rising challenge for Swiss innovation models.*
[79] Gersbach, H. and Wörter, M. (2024). Op. cit.
[80] Ibid.
[81] Swiss Federal Council (2023). *Funding approved: Two more technology transfer centers for Switzerland.*
[82] Greater Zurich Area (2019). *Technology transfer centers receive funding*.
[83] Swiss Federal Council (2023). Op. cit.

Appendix A

Table A1. Sector classification by national economic activities of Switzerland

Classification of sectors based on the industrial classification for national economic activities					
Classification	**National code**	**Sector**	**Classification**	**National code**	**Sector**
Low/medium-tech manufacturing	10–12	Manufacture of food and tobacco products	Other production	1–3	Agriculture, forestry and fishing
	13–15	Manufacture of textiles and apparel		41–43	Construction
	16	Manufacture of wood and of products of wood and cork, except furniture		5-9	Mining and quarrying
	17	Manufacture of paper and paper products			
	18	Printing and reproduction of recorded media			
	22	Manufacture of rubber and plastic products			
	23	Manufacture of other non-metallic mineral products	Utility	35	Electricity, gas, steam and air conditioning supply
	24	Manufacture of basic metals		36	Water collection, treatment and supply
	25	Manufacture of fabricated metal products, except machinery and equipment		37–39	Sewerage services; sewage sludge; waste collection, treatment and disposal services; materials recovery; remediation services and other waste management services
	31–32	Furniture; other manufactured goods	Labour-intensive services	45	Trade and repair of motor vehicles and motorcycles
	33	Repair and installation of machinery and equipment		46	Wholesale trade
Medium/high-tech manufacturing	19–20	Manufacture of coke, chemicals and chemical products		47	Retail trade
	21	Manufacture of pharmaceutical products		49	Land transport and transport via pipelines
	26	Manufacture of computer, electronic and optical products; watches and clocks		50–51	Water transport and air transport
	27	Manufacture of electrical equipment		52	Warehousing and support activities for transportation
	28	Manufacture of machinery and equipment n.e.c.		53	Postal and courier activities
	29	Manufacture of motor vehicles, trailers and semi-trailers		55	Accommodation
	30	Manufacture of other transport equipment		56	Food and beverage service activities
Knowledge-intensive services	61	Telecommunications		68	Real estate activities
	62–63	IT and other information services		77	Rental and leasing activities
	64	Financial service activities		78	Employment activities
	65	Insurance		79	Travel agency, tour operator reservation service and related activities
	69–70	Legal and accounting services; services of head offices; management consulting services		80–82	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
	71	Architectural and engineering activities		86	Human health activities
	72	Scientific research and development		87–88	Residential care and social work activities
	73	Advertising and market research		90–92	Creative, arts and entertainment services; library, archive, museum and other cultural services; gambling and betting services
	74–75	Other professional, scientific and technical services; veterinary services		93	Sports activities and amusement and recreation activities
	85	Education		94	Activities of membership organisations
	58	Publishing activities		95	Repair of computers and personal and household goods
	59-60	Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services		96	Other personal service activities

Table A2. Sector classification by ISIC

Classification of sectors based on Revision 4 of the International Standard Industrial Classification of All Economic Activities (ISIC)							
Classification	**Section**	**Division**	**Description**	**Classification**	**Section**	**Division**	**Description**
Low/medium-tech manufacturing	C	10–12	Food products, beverages and tobacco	**Knowledge-intensive services**	J	58–63	Information and communication
	C	13–15	Textiles, wearing apparel, leather and related products		K	64–66	Financial and insurance activities
	C	16–18	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials; paper and paper products; printing and reproduction of recorded media		M	69–82	Professional, scientific and technical activities
	C	19	Coke and refined petroleum products		P	85	Education
	C	22–23	Rubber and plastics products, and other non-metallic mineral products	**Labour-intensive services**	G	45–47	Wholesale and retail trade, repair of motor vehicles and motorcycles
	C	24–25	Basic metals and fabricated metal products, except machinery and equipment		H	49–53	Transportation and storage
	C	31–33	Furniture; jewellery, musical instruments, toys, etc.; repair and installation of machinery and equipment		I	55–56	Accommodation and food service activities
Medium/high-tech manufacturing	C	20	Chemicals and chemical products		L	68	Real estate activities
	C	21	Basic pharmaceutical products and pharmaceutical preparations		N	77–82	Administrative and support service activities
	C	26	Computer, electronic and optical products		O	84	Public administration and defence; compulsory social security
	C	27	Electrical equipment		Q	86–88	Human health and social work activities
	C	28	Machinery and equipment n.e.c.		R	90–93	Arts, entertainment and recreation
	C	29	Motor vehicles, trailers and semi-trailers		S	94–96	Other service activities
	C	30	Other transport equipment		T	97	Activities of households as employers; undifferentiated activities of households for own use
Other production	A	01–03	Agriculture, hunting, forestry and fishing	**Utilities**	D	35	Electricity, gas, steam and air conditioning supply
	B	05–09	Mining and quarrying		E	36–39	Water supply; sewerage, waste management and remediation activities
	F	41–43	Construction				

Table A3. Classification and correspondence table between ISIC and EBOPS codes for service export

Classification of sectors based on Extended Balance of Payments Services Classification (EBOPS) and Revision 4 of the International Standard Industrial Classification of All Economic Activities (ISIC)				
Classification	**EBOPS CODE**	**EBOPS description**	**ISIC CODE**	**ISIC description**
Labour-intensive services exported	SA	Manufacturing services on physical inputs owned by others		
	SB	Maintenance and repair services not included elsewhere		
	SC	Transport	H	Transport and storage
	SDB1SK21	Health services	Q	Human health and social work activities
	SDASDB3	Tourism and business travel	I	Accommodation and food service activities
	SE	Construction	F	Construction
	SK23	Heritage and recreational services	R	Arts, entertainment and recreation
	SK24	Other personal services	S	Other service activities
	SWSJ34	Trade-related services (distribution)	G	Wholesale and retail trade; repair of motor vehicle. and motorcycle.
	SJ32+SJ33+SJ34	Other business services (excluding trade-related)	L+N	Real estate; administrative and support service activities.
Knowledge-intensive services exported	SJ1+SJ2+SJ31	Professional, scientific and technical activities	M	Professional, scientific and technical activities
	SFSG	Insurance and financial services	K	Financial and insurance activities
	SISK1	Telecommunications, computer, information and audiovisual services	J	Information and communication
	SDB2SK22	Education services	P	Education
	SH	Charges for the use of intellectual property n.i.e.		

Source: WTO (2020). Trade in services by GATS mode of supply: The WTO TiSMoS dataset

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