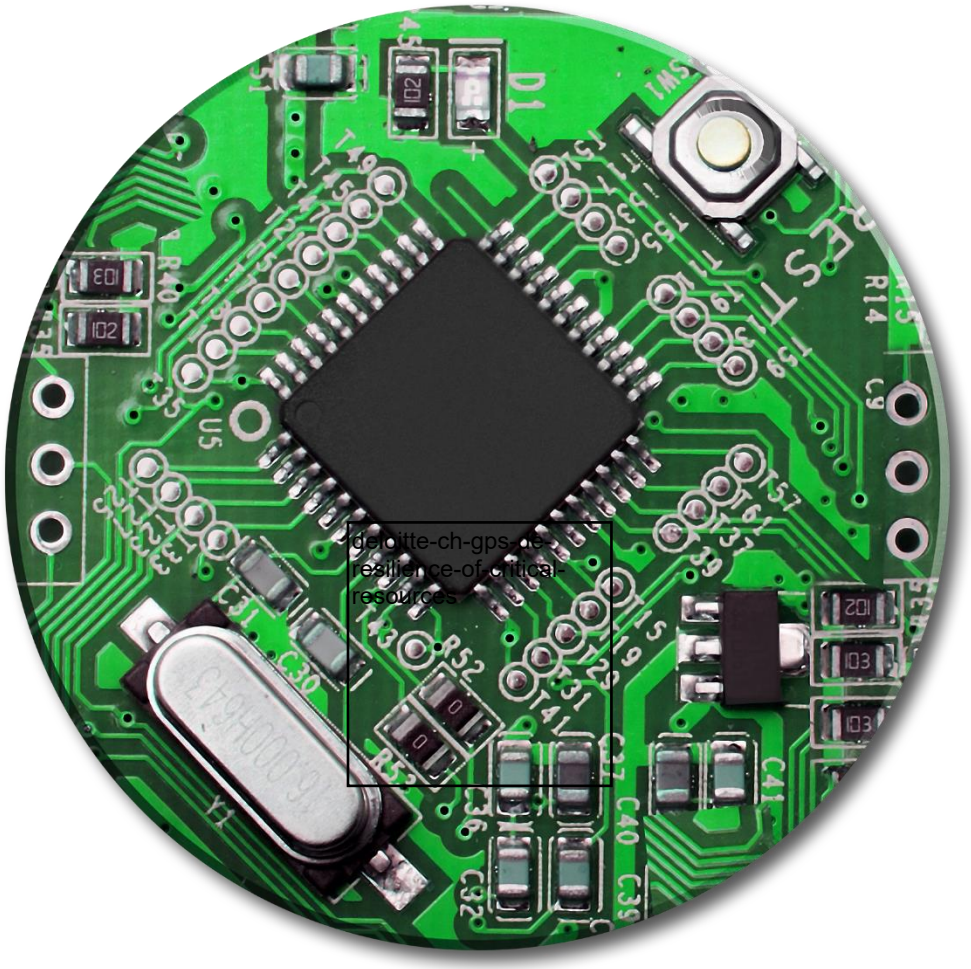
Deloitte.



Resilience of critical resources

How crisis-proof is the key semiconductor/microchip sector in Switzerland?

Contents

Introduction

Last year, the Deloitte Resilience Barometer 2022 analysed how crisis-proof key areas of the Swiss economy are. The study revealed that **resilience in the area of availability of critical resources/electronics** plays a particularly important role. Electronic components (especially semiconductors and microchips) are widely used in a variety of sectors and, due to digitalisation, have developed into a systemically important branch of the economy in Switzerland as well.

In recent years, the availability of semiconductors/microchips has been heavily affected by the COVID-19 pandemic and geopolitical tensions. The combination of rising demand and production bottlenecks led to supply shortages.

Bottlenecks also resulted from the increased demand for advanced technologies and solar cells, as well as the changes in the microchip market brought about by the pandemic (including a downturn in the automotive industry and higher demand for computers and smartphones). Further shortages occurred as a result of restrictions on production during large-scale lockdowns in China. In addition, the trade conflict between China and the US and the consolidation in the semiconductor industry meant that European countries – including Switzerland – began to focus more on the issues of independence and risk distribution.

Against this backdrop, we interviewed experts in an attempt to assess the potential future risk to the Swiss economy of a shortage of semiconductors/microchips and develop recommendations for companies, industries and authorities on how to improve resilience in this key area.

Statements by experts who did not wish to be named or quoted were incorporated into the study in anonymised form.

Background information on the semiconductor market

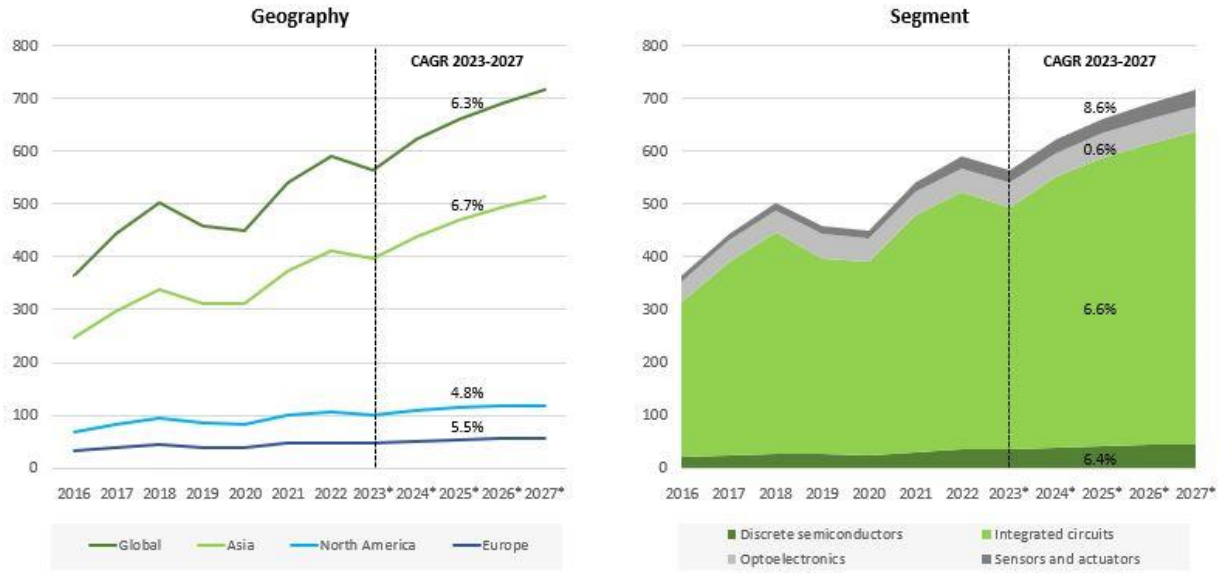
Global significance and outlook

Semiconductors are widely used in a variety of sectors. They are employed in microchip and solar cell production, for example, and are key components of computers, smartphones, household devices and consumer electronics products. Semiconductors/microchips are installed in vehicle control systems and are used in electronically controlled industrial machines, factory automation and intelligent infrastructures. The energy, utilities and medical technology industries are also heavily dependent on semiconductors/microchips.

Now virtually omnipresent in our daily lives, these tiny components guarantee the smooth functioning of everything from mobile phones, TVs, fridges and washing machines to credit cards, coffee machines, toasters and even children's toys. An average modern car contains hundreds of microchips, which are responsible for things such as assistance systems, airbags, lights, engine functions and exhaust systems. Electric cars require almost twice as many semiconductors.

In 2023, turnover in the global semiconductor market will amount to approximately CHF 563.10 billion. This figure is expected to grow by 6.3% annually (CAGR 2023-2027), leading to a forecast market volume of CHF 718.00 billion by 2027 (see Figure 1).

Fig. 1: Turnover in the global semiconductor market, outlook by geography and segment
[Turnover in CHF billion, 2016-2027]



Source: Statista; * Outlook

Geographically, the largest share of turnover and growth is expected to be generated in Asia, particularly in China. With a forecast market volume of CHF 458.90 billion, integrated circuits[i] (e.g. DRAM, microprocessors, analogue-to-digital converters) are the largest segment in the market in 2023 and are experiencing higher annual growth rates than discrete semiconductors[ii] (e.g. diodes, transistors, resistors, capacitors, inductors) and optoelectronics[iii] (e.g. displays, light-emitting diodes, optical switches). Only the market for sensors and actuators[iv] is growing faster, albeit from a lower volume.

The majority of semiconductors/microchips are produced by Asian or US manufacturers. In terms of production for the semiconductor industry, the world's most important regions are Taiwan and South Korea, while chip design work predominantly takes place in the US. Semiconductor manufacturing is highly complex and a large number of companies and countries are involved in the production process – from design to wafer fabrication to assembly, testing and packaging.[v]

TSMC (Taiwan Semiconductor Manufacturing Company) is the world's largest contract manufacturer for semiconductor products (foundry) and the third-largest semiconductor manufacturer after Intel and Samsung. TSMC mainly produces in Taiwan, but it also has factories and a design centre in the US. Its largest customer is Apple (see Figure 2).[vi]

Fig. 2: Country locations of the top three manufacturers
[Design/R&D; wafer fabrication; foundry; assembly, testing and packaging]

Source: TSMC, Intel, Samsung websites; * Planned

Intel produces in the US, Europe and China and is also active in the foundry business – however, most of its assembly and test sites are located in Asia.[vii] Samsung mainly produces in South Korea, but it also has factories in the US which make customised chips for major customers such as Qualcomm and Tesla.[viii] Other important global manufacturers include Micron (US), SK Hynix (South Korea) and SMIC (China). The largest manufacturers in Europe are NXP Semiconductors (Netherlands), Infineon and Bosch (Germany), and STMicroelectronics (Switzerland).

The semiconductor industry has consolidated considerably in recent years, and certain products can only be manufactured by a small number of companies in Taiwan, South Korea, etc. This has led to a situation in which end-customers are heavily dependent on individual companies or production countries, with resilience on the output side sometimes coming under pressure as a result. There are also dependencies on the input side with regard to key raw materials and upstream products – particularly on China, the world's largest producer of silicon, which is essential for wafer fabrication.[ix]

To boost supply chain resilience and become less dependent on Asian production countries (particularly China), the US and the EU are trying to establish and/or increase their support for their own semiconductor industries.

The 2022 CHIPS for America Act[x] has made USD 52 billion of funding available to boost semiconductor research, design and manufacturing in the US. The focus is on the promotion of modern, highly advanced microchips – an area in which the US has relatively little capacity. The European Chips Act[xi] of 2022 aims to bolster Europe's competitiveness and resilience in the field of semiconductors by 2030, mobilising EUR 43 billion of public and private investments and thus complementing existing programmes such as Horizon Europe and Digital Europe. Here, too, the focus is primarily on the design and production of the next generation of very small microchips.

"The subsidy race for semiconductors in the US and the EU is purely geostrategic in nature, raising the question of whether tax money isn't being wasted to build up overcapacities. Furthermore, the focus of the capacity expansion is on prestigious, very small microchips and not on the traditional chips and circuit boards required by many mechanical engineering companies for their machines and by the automotive industry."

Stefan Brupbacher
Director, Swissmem

In Germany, for instance, the federal government is providing EUR 4 billion of funding, distributed across 31 semiconductor projects.[xii] Additional private investments of more than EUR 10 billion in innovative production facilities, manufacturing sites and microchip development will further boost the semiconductor industry in Germany. Among other things, Infineon is making the largest individual investment in the company's history to further expand its production site in Dresden.[xiii] In addition, the Taiwanese contract manufacturer TSMC has announced that it will open its first European semiconductor plant in Germany – to this end, a special joint venture called the European Semiconductor Manufacturing Company (ESMC) will be founded together with Bosch, Infineon and NXP Semiconductors.[xiv]

"Policymakers and governments could help to improve locational factors by promoting both specific research and the expansion of production capacities, for example. At present, Switzerland isn't on a level with Asia, the US or the rest of Europe in this regard. The fact that Switzerland can no longer participate in research programmes such as Horizon Europe is one example."

Rainer Käsmaier
Managing Director Semiconductors,
Hitachi Energy

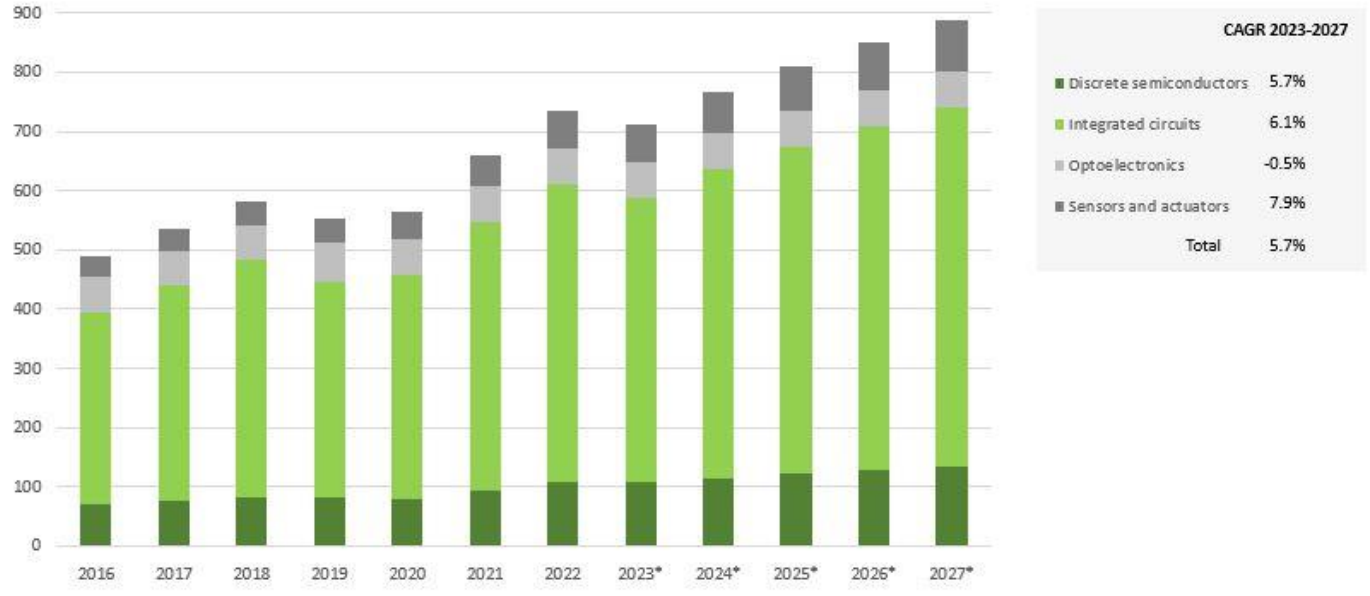
A key sector for Switzerland

With the increasing digitalisation of the economy and our daily lives, the semiconductor industry – like in other countries – has become a systemically important branch of the Swiss economy on which other sectors depend.

It is necessary to distinguish between suppliers of the global semiconductor industry and actual manufacturers of semiconductors/microchips in Switzerland itself. The former include the VAT Group and the Comet Group, which produce vacuum technology for semiconductor manufacturing, and Inficon Holding, which makes sensors for process monitoring in the processing, production, inspection and packaging of wafers.[xv] The main Swiss semiconductor manufacturers include Hitachi Energy, which took over ABB Switzerland's semiconductor production in Switzerland, and STMicroelectronics, which is headquartered in Switzerland and has production sites in France and Italy.[xvi]

Turnover in Switzerland's semiconductor market will amount to around CHF 712.70 million in 2023, with integrated circuits/microchips accounting for the largest share of the market (CHF 478.20 million) – followed by discrete semiconductors (CHF 108.60 million), sensors and actuators (CHF 63.79 million) and optoelectronics (CHF 62.10 million) (see Figure 3).

Fig. 3: Turnover in the Swiss semiconductor market, outlook by segment [Turnover in CHF million, 2016-2027]



Source: Statista; * Outlook

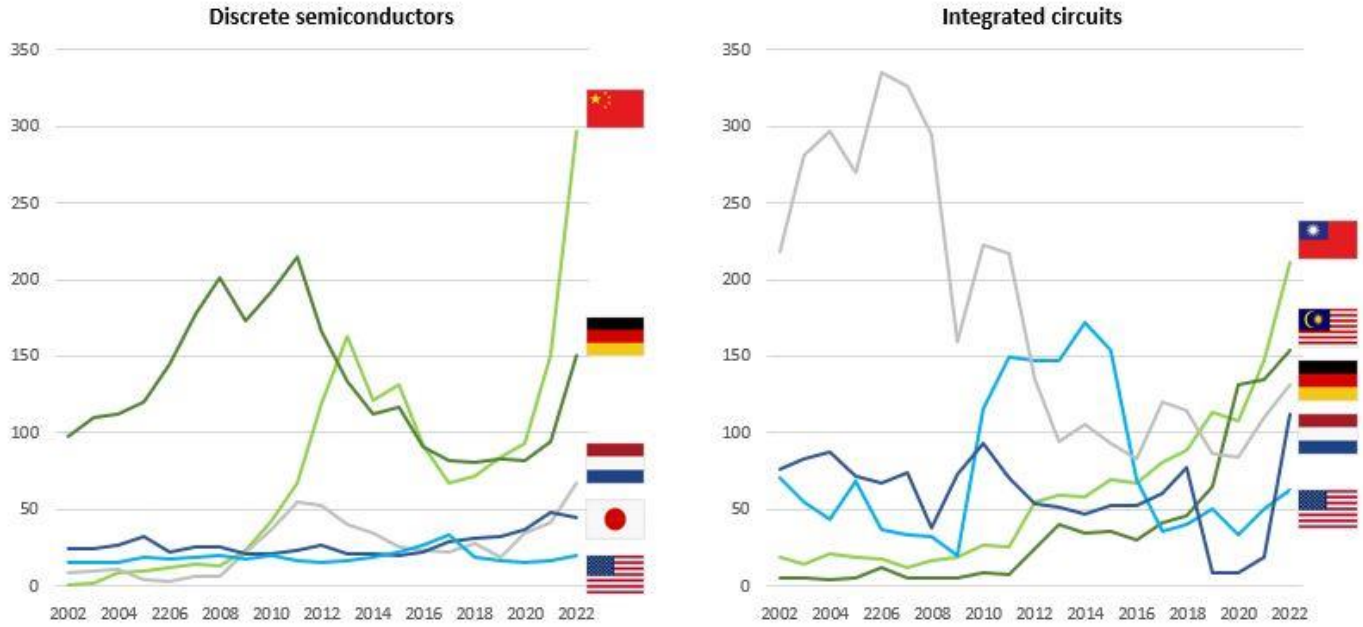
This figure is expected to grow in line with the global trend by 5.7% annually (CAGR 2023-2027), leading to a forecast market volume of CHF 888.10 million by 2027.

Swiss imports of discrete semiconductors and integrated circuits have increased significantly over the last ten years, especially since the COVID-19 pandemic in 2019/20 (see Figure 4).

"The composition of the Swiss semiconductor industry is very heterogeneous. Today, there are at least 100 companies with around 15,000 employees which are all globally leading niche players and often make vital products as suppliers to the global semiconductor industry or manufacture their own semiconductors. This ecosystem has become more important in recent years and benefits from the proximity to excellent universities and universities of applied sciences."

Stefan Brupbacher
Director, Swissmem

Fig. 4: Swiss imports of discrete semiconductors and integrated circuits by country of origin
[Value in CHF million, top five countries, 2002-2022]



Source: Federal Office for Customs and Border Security (FOCBS)

However, there are strong dependencies on a small number of countries of origin. In the discrete semiconductor market, Switzerland has been heavily reliant on imports from China, Germany, the Netherlands, Japan and the US in recent years (68% of total imports in the period 2002-2022). For integrated circuits, the countries of origin were Taiwan, Malaysia, Germany, the Netherlands and the US (58% of total imports in the period 2002-2022). Over the last ten years, there has also been a steady decline in imports of semiconductors/microchips from Western countries such as Germany and the US, coupled with a strong increase in imports from Asian countries like China, Taiwan and Malaysia.

In the future, however, new pandemics, extreme climatic events and worsening geopolitical tensions or conflicts in these regions could put pressure on the resilience of Switzerland's key semiconductor/microchip sector and lead to procurement difficulties in individual countries of origin.

Assessment of the potential future risk to the Swiss economy

Causes of semiconductor/microchip shortages

There are many possible causes of semiconductor/microchip shortages. As explained at the beginning, the recent semiconductor shortage was caused by the pandemic, geopolitical tensions and supply bottlenecks, among other things.

Bottlenecks were brought about by the general rise in demand for advanced technologies as part of the digitalisation trend (e.g. smartphones, solar cells, smart meters) and by the changes in the microchip market that resulted from the COVID-19 pandemic in 2019/20, when demand for semiconductors declined in the automotive industry and increased for products such as tablets, computers, printers and consumer electronics items. However, car sales are now on the rise again and the automotive industry is lagging behind.

The logistics industry also ground to a halt at some points during the COVID-19 pandemic. One incident that exacerbated supply problems was the obstruction of the Suez Canal by the container ship Ever Given in 2021, which paralysed global logistics for weeks and led to supply bottlenecks at raw materials suppliers.[xvii]

The prolonged lockdown in China in 2022 under the country's zero-COVID policy was another factor that significantly reduced production.[xviii] Deliveries of raw materials (including silicon) from China were also disrupted by natural disasters.[xix] The Fukushima earthquake already caused major disruption to the supply of semiconductors in 2011, highlighting the need to improve supply chain resilience.[xx] Various unusual weather events in recent years – including snow in Texas, fires in Japan and drought in Taiwan – have repeatedly underlined the vulnerability of the highly diversified, global semiconductor industry.[xxi]

"Shortages were particularly noticeable during the Covid pandemic because the restrictions lasted for so long. Furthermore, they were exacerbated by other events such as the Suez Canal obstruction. In addition, a number of industrial segments such as the car industry had not adequately adapted their supply chain management in light of insights gained from earlier crises, such as after the Japanese tsunami in 2011. The need for improved supply chain set-ups and business continuity plans is now undisputed."

Rainer Käsmaier
Managing Director Semiconductors, Hitachi Energy

The trade conflict between China and the US, which has been escalating since 2019, has further accentuated this topic's significance. The US has used trade blacklists and export restrictions to cut China off from key technology components and semiconductors/microchips.[xxii] For its part, China recently restricted exports of key metals and rare earths – including germanium and gallium – which play a crucial role in semiconductor/microchip manufacturing.[xxiii]

In addition, the war in Ukraine has further exacerbated the global chip crisis because, prior to the outbreak of war, Ukraine was one of the main suppliers of industry-grade neon and argon, noble gases which are used in microchip manufacturing in combination with lasers.[xxiv]

As a result of these events, the issues of dependence and risk distribution are increasingly in the spotlight in European countries too, especially Switzerland.

"During the COVID-19 pandemic, we experienced certain shortages of electronic components such as controls and inverters. Even though we have European suppliers for controls, these still need components produced in China. We needed to introduce more flexibility into the supply chain by changing from single sourcing to dual sourcing. For our critical components, we already have or plan to build-up a second source."

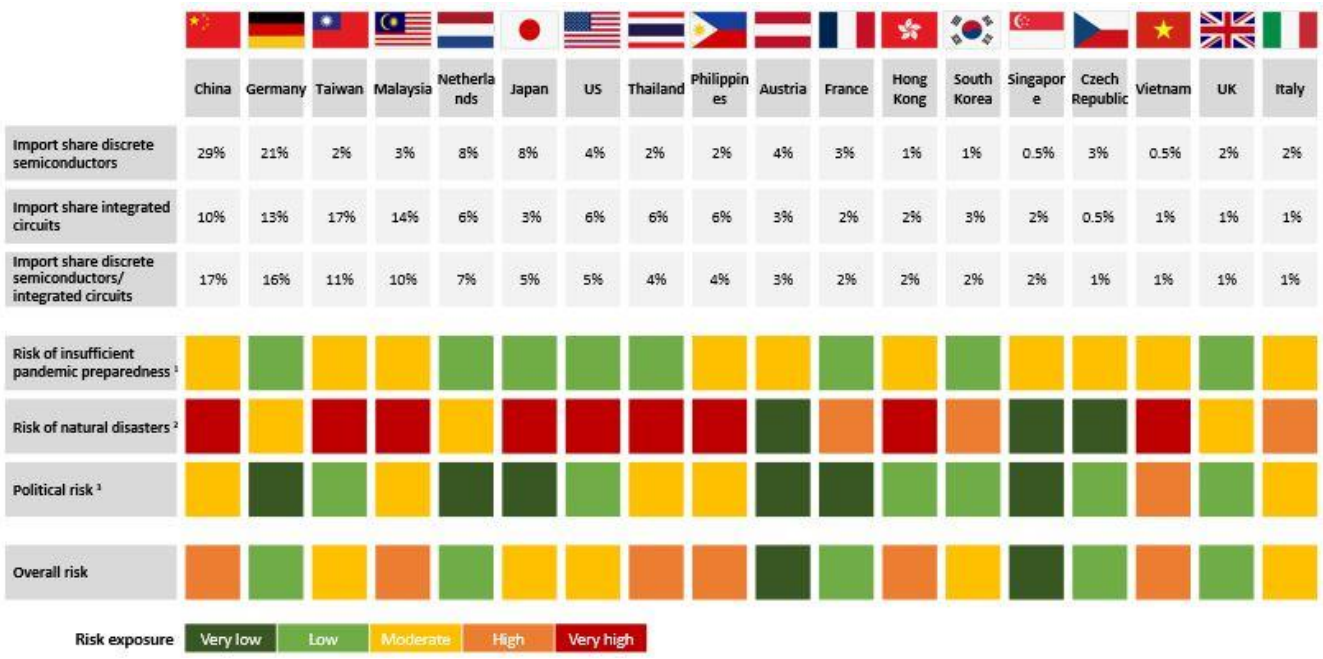
Kurt Ledermann
CFO, Rieter Management AG

Potential risk exposure in the Swiss economy

Against this backdrop, it makes sense to assess the Swiss economy's potential risk exposure in relation to the availability of semiconductors/microchips both in the individual risk scenarios – new pandemics, extreme weather events and geopolitical tensions – and overall.

The first step in this process was to rate the most important countries of origin of Swiss discrete semiconductor and integrated circuit imports in recent years in terms of their risk exposure in the individual dimensions and overall on a scale ranging from "very low" to "very high" (see Figure 5).

Fig. 5: Risk matrix – countries of origin
[Import share by country as a %, 2018-2022; EIU Political Risk Score; Natural Disaster Risk Index; Global Health Security Index]



Source: Federal Office for Customs and Border Security (FOCBS); [1] Global Health Security Index 2021; [2] Natural Disaster Risk Index WorldRiskReport 2022; [3] EIU Political Risk Score, average 2018-2022

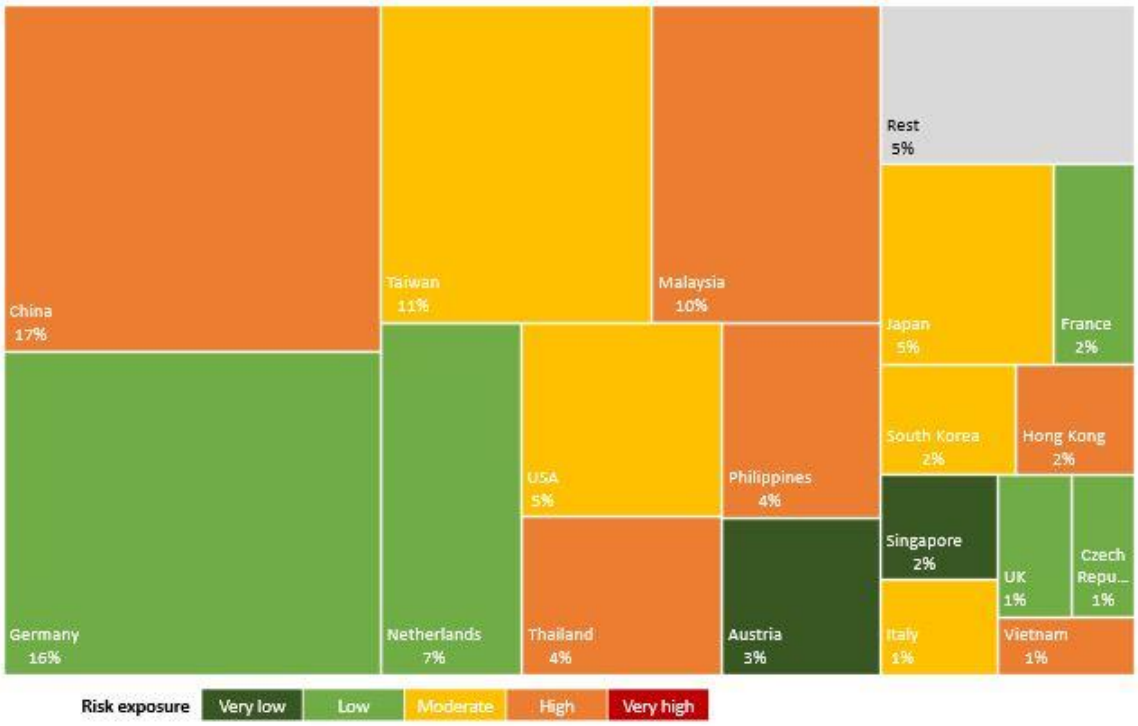
Although it is very difficult to assess the risk of new pandemics breaking out in individual countries of origin, what can be estimated is the individual countries' pandemic preparedness. Data from the 2021 Global Health Security Index[xxv] was used to determine the risk of insufficient pandemic preparedness and the countries were then rated in terms of their preparedness for and resilience against new pandemics on the basis of this information. In almost all countries of origin, the risk exposure in this dimension is rated either "low" or "moderate", meaning that they are more or less prepared for this scenario.

The risk of natural disasters in the individual countries of origin was assessed using the Natural Disaster Risk Index from the WorldRiskReport 2022.[xxvi] This rates the risk of extreme events (including earthquakes, tsunamis, flooding, cyclones, droughts and sea-level rises) as "very high" for almost all Asian countries of origin and the US and as "high" for France, South Korea and Italy.

The political risk for the individual countries of origin is primarily based on the average EIU Political Risk Score[xxvii] of the last few years. The political risk is only "high" for Vietnam. For most other Asian countries of origin, the risk is rated as "moderate". By contrast, almost all Western countries of origin of Swiss semiconductor/microchip imports score either "very low" or "low".

From an overall perspective, the risk is judged to be “high” for the countries of origin of China, Malaysia, Thailand, the Philippines, Hong Kong and Vietnam. As a result, the potential risk exposure of the Swiss economy can be rated as quite high, as these countries of origin accounted for 38% of all Swiss imports of discrete semiconductors and integrated circuits between 2018 and 2022 (see Figure 6).

Fig. 6: Risk exposure of discrete semiconductors/integrated circuits
[Import share by country in %, 2018-2022; overall risk]



Source: Federal Office for Customs and Border Security (FOCBS); Global Health Security Index 2021; Natural Disaster Risk Index WorldRiskReport 2022; EIU Political Risk Score, average 2018-2022.

By contrast, countries of origin with a “very low” or “low” overall risk made up only 32% of imports during the same period.

This picture illustrates the need for companies, industry and the authorities to develop more targeted resilience measures in order to make Switzerland’s key semiconductor/microchip sector more crisis-proof. It is particularly important to bear in mind that the average risk for 2018-2022 may no longer adequately reflect the current risk. One example in this regard is Taiwan, where the political risk has been rated as “low” in recent years while the country is preparing for an armed conflict with China.

Necessary resilience measures

Recommended actions for individual companies

Perform ongoing risk monitoring

- Monitor geopolitical tensions, pandemic outbreaks and extreme climatic events on an ongoing basis to be able to react in an emergency.
- Evaluate alternative supplier countries and production sites.
- Revise existing business continuity plans.
- Improve risk distribution along the entire value chain.

Do supply chain due diligence

- Comply with all regulatory requirements in order to minimise financial and reputational risks.
- Continuously review supply chains in order to identify gaps and new risks (e.g. digital network, conformity of monitoring systems, data exchange).
- Clearly communicate expectations to suppliers in order to minimise risks.
- Train employees in supply chain due diligence requirements.

Adapt sourcing strategies

- Rethink strategies involving just-in-time production and low stock levels and create redundancies (e.g. stocks of upstream products, expansion of storage capacities).
- Engage in modular sourcing, i.e. instead of buying individual components on the market (e.g. semiconductors), purchase complete, finished modules or assemblies with a large range of functions from an established electronics producer (e.g. microchips).
- Sign long-term framework agreements with suppliers (e.g. binding volume commitments).

"Supply chain replication and greater localisation could help to reduce dependence on just a small number of providers. Nowadays, the establishment of a second supply source is often dictated by end-customers. However, even with steps like this, raw material shortages cannot be completely avoided or controlled."

Rainer Käsmaier
Managing Director Semiconductors, Hitachi Energy

"Multi-sourcing is back in fashion in our industry, after a long period where everybody was introducing single sourcing to reduce cost. We have even insourced some critical components, like software for the controls to decrease the dependency."

Kurt Ledermann
CFO, Rieter Management AG

Use regional suppliers/friendshoring

- Focus on stronger localisation and on using regional rather than international suppliers.
- Engage in friendshoring – procurement from countries that are geopolitical allies and/or have comparable values – so as not to be dependent on individual suppliers in geopolitically unstable regions.
- Use supply chain replication/different sources if possible (e.g. dual/multiple sourcing).

Adapt make-or-buy strategy

- Establish own competencies in the area of semiconductors/microchips.
- Include relevant industries in the security-relevant technology and industry base (STIB).
- Develop microchips together with semiconductor manufacturers and contract foundries to manufacture microchips.

Introduce resilience by design

- Already integrate modularity at the product design level.
- Facilitate the exchange of individual modules/assemblies across the entire life cycle in order to enable flexibility with regard to new market requirements, changing customer needs and supply bottlenecks.

Recommended actions for industry/associations

Integrate cooperation into the purchasing process

- Form buying groups to guarantee the availability of critical resources/electronic components.
- Strengthen collaboration with logistics providers to make transport routes more resilient.
- Bolster alliances not just between competitors but also between different sectors (e.g. automotive industry, telecommunications, consumer goods).

Engage in research partnerships

- Engage in cooperation/joint ventures with other companies, start-ups and semiconductor clusters in order to develop more resilient products.
- Strengthen the collaboration and transfer of knowledge between business, universities and R&D institutions.
- Promote interdisciplinary and international research cooperation.

Intensify educational and public relations work

- Raise awareness in society and among politicians of the importance of the semiconductor industry.
- Increase policymakers' and governments' commitment to ensuring good framework conditions (e.g. improve funding instruments, boost relevant research).
- Set up and use industrial platforms for exchange and information.

"A strategy of verticalisation can help to strengthen resilience. In Switzerland, Hitachi Energy has the option to manufacture semiconductors for its own products, for various sectors in the country and for the country itself. For a verticalisation process like this to become a locational advantage for a whole industry, however, a good ecosystem of research partnerships and cooperation agreements between companies is also required."

Rainer Käsmaier
Managing Director Semiconductors, Hitachi Energy

Recommended actions for authorities

Strengthen the economic framework

- Improve the general conditions in Switzerland (e.g. modernise the infrastructure, revitalise the dual education system, adhere to the expenditure and debt brake, liberalise the labour market, reform domestic financial transfers and the tax system).
- Rethink access to «Horizon Europe» and strengthen international R&D exchange.
- Simplify access to specialists, especially from third countries, and give university graduates from third countries equal rights with regard to taking up work in Switzerland (i.e. no prioritisation of Swiss residents).[xxviii]
- Test security of supply in relevant areas on the basis of scenarios and enhance it in collaboration with industry (STIB).

Refresh relations with the EU

- Target participation in European initiatives and contribute key Swiss qualifications/talent/skills to the EU.
- Maintain a dialogue with EU countries that subsidise and are building up their own/European semiconductor production.
- Strengthen research cooperation with selected EU countries that have a relevant semiconductor industry (e.g. Germany with Infineon, the Netherlands with ASML).

Boost free trade

- Sign additional free trade agreements with countries that have a relevant semiconductor industry (e.g. Malaysia, Thailand, Vietnam).
- Boost research cooperation with key third countries that occupy a leading position in the international semiconductor industry, such as the US, Japan or Taiwan.

Promote technology neutrality

- Offer attractive framework conditions for private ecosystems for innovation and clusters in the area of digital technologies (e.g. by ensuring a liberal labour market, minimal bureaucracy, low tax burden).

"The debt brake means that Switzerland cannot join in the subsidy race. This makes it all the more important for companies operating here to benefit from the best possible conditions. The promotion of education, research and innovation is one of Switzerland's strengths – more resources are needed here, and in the future, innovation funding should also flow directly to companies and not just to universities. Access to "Horizon Europe" needs to be restored as quickly as possible and access to specialists, particularly from third countries, should be simplified."

Stefan Brupbacher
Director, Swissmem

Develop resilience strategies

- Perform a comprehensive risk assessment and hold open discussions on the subject of risk, i.e. what risk is Switzerland and its economy willing to tolerate?
- Develop resilience strategies to reduce the Swiss economy's dependencies and guarantee security of supply (e.g. agreements with geopolitically allied countries that produce semiconductors and semiconductor components or have reserves of rare earths (e.g. Sweden)).
- Expand monitoring to include not just essential goods but also strategically critical goods (such as semiconductors).

"The strategy towards China should focus on the indispensability firstly of our products and secondly of diplomatic initiatives. This will enable us to stay under the radar of the international powers for as long as possible. We also need to adopt a modest attitude when it comes to foreign policy. Switzerland isn't going to heal the world – we don't need to teach other countries anything. With this in mind, we expect the federal government to demonstrate a high level of commitment to the goals of concluding free trade agreements with Vietnam, Thailand, Malaysia, India and the Mercosur countries. An agreement with Taiwan isn't very realistic at the moment. In addition, greater research cooperation is required with third countries such as the US and Japan."

Stefan Brupbacher
Director, Swissmem

List of footnotes

[i] Integrated circuits are semiconductors consisting of multiple connected components that provide the same functionality more efficiently and at a lower cost than discrete components.
[ii] Discrete semiconductors are basic semiconductors that are often made of a single component and perform elementary electronic functions.
[iii] Optoelectronic devices are semiconductors whose functionality is related to light.
[iv] Sensors and actuators are semiconductors which capture factors from the real world or move and control other devices.
[v] New York Times, Your Car, Toaster, Even Washing Machine, Can't Work Without Them. And There's a Global Shortage, 14.5.2022. https://www.nytimes.com/2021/05/14/opinion/semicondctor-shortage-biden-ford.html.
[vi] New York Times, Inside Taiwanese Chip Giant, a U.S. Expansion Stokes Tensions, 22.2.2023. https://www.nytimes.com/2023/02/22/technology/tsmc-arizona-factory-tensions.html.
[vii] Intel Website, How Many Manufacturing Fabs Does Intel Have? Last Reviewed, 3.2.2022. https://www.intel.com/content/www/us/en/support/articles/000089875/programs/intel-corporation.html.
[viii] CNBC Website, How Samsung became the world's No. 2 advanced chipmaker and set the stage for a U.S. manufacturing boom, 11.6.2023. https://www.cnbc.com/2023/06/09/samsungs-plans-to-catch-tsmc-in-semiconductor-manufacturing.html.
[ix] Berliner Zeitung, Kobalt, Silizium, Lithium: Experten warnen vor Chinas Macht, 7.7.2022. https://www.berliner-zeitung.de/news/ifo-institut-china-dominiert-den-mineralien-markt-li.244289.
[x] The White House, Factsheet: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China, 9.8.2022. https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/09/fact-sheet-chips-and-science-act-will-lower-costs-create-jobs-strengthen-supply-chains-and-counter-china/.
[xi] European Commission, European Chips Act: Factsheet, 8.2.2022. https://digital-strategy.ec.europa.eu/en/library/european-chips-act-factsheet.
[xii] Manager Magazin, Förderung für 31 Projekte in Deutschland – EU genehmigt Milliardenhilfen für die Chipindustrie, 8.6.2023. https://www.manager-magazin.de/unternehmen/tech/eu-genehmigt-milliardenhilfen-fuer-die-chipindustrie-a-a3318b2a-4427-40b4-9a90-b954a47b1eaa.
[xiii] Süddeutsche Zeitung, Startschuss: Ausbau des Halbleiterwerks Infineon in Dresden, 2.5.2023. https://www.sueddeutsche.de/wirtschaft/computer-dresden-startschuss-ausbau-des-halbleiterwerks-infineon-in-dresden-dpa.urn-newsml-dpa-com-20090101-230502-99-530703.
[xiv] Heise online, TSMC kommt als ESMC nach Deutschland, 8.8.2023. https://www.heise.de/news/TSMC-kommt-als-ESMC-nach-Deutschland-9237991.html.
[xv] Swissmem, Halbleiterindustrie in der Schweiz – bedeutend, aber wenig sichtbar, 20.2.2023. https://www.swissmem.ch/de/aktuelles/detailansicht/halbleiterindustrie-in-der-schweiz-bedeutend-aber-wenig-sichtbar.html#:~:text=Swissmem%20hat%20den%20Industriesektor%20Semiconductors,Funktionieren%20vieler%20Produkte%20und%20Maschinen.
[xvi] Luzerner Zeitung, Halbleiterproduktion – Die Japaner greifen nach ABB-Teil, 14.12.2018. https://www.luzernerzeitung.ch/wirtschaft/die-japaner-greifen-nach-abb-teil-geht-dem-stromkanton-bald-der-schnauf-aus-ld.1297671.
[xvii] The Wall Street Journal, Ship Stuck in Suez Canal and Chip Shortages: What Global Supply-Chain Problems Mean for You, 26.3.2021. https://www.wsj.com/articles/whats-wrong-with-global-supply-chains-and-how-it-affects-you-11616763749.
[xviii] Manager Magazin, Shanghai-Lockdown verschärft Lieferprobleme, 27.5.2022. https://www.manager-magazin.de/unternehmen/verschaerfte-lieferprobleme-shanghai-lockdown-schlaegt-durch-a-c5e9d2ec-5329-40cf-91b5-ccb31b0bfb22.
[xix] Rohstoff Website, Hitzewelle in China führt zu Stromknappheit und Produktionsausfall, 17.8.2022. https://rohstoff.net/china-hitzewelle-fuehrt-zu-stromknappheit-und-produktionsausfall/

[xx] Elektronik Praxis, Beben vor Fukushima führt zu Aussetzern in Halbleiterproduktion, 18.3.2022. https://www.elektronikpraxis.de/beben-vor-fukushima-fuehrt-zu-aussetzern-in-halbleiterproduktion-a-ceda7933ca71666ddfad9d9b92455057/.
[xxi] Handelsblatt, Erst Schnee in Texas, dann Brände in Japan – nun bedroht eine Dürre in Taiwan die Lieferkette für Halbleiter, 25.3.2021. https://www.handelsblatt.com/technik/it-internet/chipindustrie-erst-schnee-in-texas-dann-braende-in-japan-nun-bedroht-eine-duerre-in-taiwan-die-lieferkette-fuer-halbleiter/27040744.html.
[xxii] CNBC, What are Gallium and Germanium? China curbs exports of metals critical to chips and other tech., 4.7.2023. https://www.cnbc.com/2023/07/04/what-are-gallium-and-germanium-china-curbs-exports-of-metals-for-tech.html.
[xxiii] Manager Magazin, China weitet Handelsstreit auf wichtige Chip-Rohstoffe aus, 4.7.2023. https://www.manager-magazin.de/politik/weltwirtschaft/china-will-export-von-metallen-zur-chipherstellung-kontrollieren-a-02c6c79d-ff41-422e-96ca-c2813cb2a1f2.
[xxiv] Der Standard, Neon-Knappheit: Der Ukraine-Krieg verschärft die globale Chipkrise, 16.3.2022. https://www.derstandard.de/story/2000134119153/neon-knappheit-krieg-ukraine-globale-chipkrise.
[xxv] GHS Index Website, Global Health Security Index 2021. https://www.ghsindex.org.
[xxvi] World Risk Report website, WorldRiskReport 2022. https://weltrisikobericht.de/weltrisikobericht-2022-e/
[xxvii] The Economist Intelligence Unit, EIU Political Risk Score, 2018-2022.
[xxviii] Deloitte/Swiss-American Chamber of Commerce, “Switzerland needs global talent”, 2022. https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/tax/deloitte-ch-tax-switzerland-needs-global-talent-en.pdf.

The analyses and publication were carried out with the support of Philipp Merkofer from Kimosabe Consulting.

Your contacts

Ralph Wyss
Partner
Defense, Security & Justice Sector Lead
Mobile + 41 58 279 7060
Email: rwyss@deloitte.ch

Dr. Michael Grampp
Research Director & Chief Economist
Mobile + 41 58 279 6817
Email: mgrampp@deloitte.ch