Policy Brief

The semiconductor industry in Europe: between geopolitics and tech race

IndustriAll Europe

Semiconductors: the industry of industries

Semiconductors serve as the backbone of modern technology, powering everything from smartphones and computers to automotive systems and advanced manufacturing devices. The global demand for semiconductors has surged in recent years, driven by the rapid proliferation of digitalisation, artificial intelligence, and the Internet of Things (IoT). The semiconductor market has been worth almost USD 600 billion in recent years. It is experiencing a high rate of growth, which could see it reach USD 1,000 billion by the end of the decade.

To navigate this complex landscape, industriAll Europe has commissioned Syndex[1] to carry out a comprehensive study . This study aims to gain a deeper understanding of the challenges and opportunities underlying the semiconductor sector, laying the groundwork for policy demands towards policymakers and companies.

The current policy brief summarises the main findings of the Syndex study and identifies several key priorities for the sector that should be addressed in the years to come.

The EU Chip Act

In view of the growing, strategic importance of semiconductors, their market expansion, and in the aftermath of COVID-19, the European Union (EU) has set its sights on strengthening its position within the semiconductor industry. The first step was to recognise the strategic importance of semiconductor production for economic competitiveness and technological sovereignty. With that in mind, the EU adopted the EU Chips Act. The EU Chips Act aims to improve the EU's security of supply, resilience and technological sovereignty in the field by reaching at least 20% of the market share by 2030 with the mobilisation of EUR 6.2 billion of public and private investment.

The semiconductor supply chain is highly globalised, with different stages taking place in various regions around the world. Chip design may occur in the US, wafer fabrication in Taiwan or South Korea, assembly

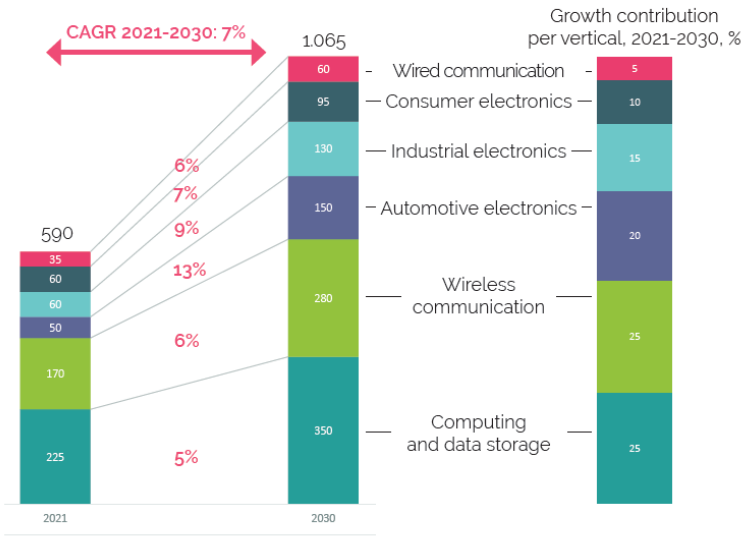
[1] https://www.syndex.eu/

in China or Southeast Asia, and integration into products worldwide. Moreover, no company or country is autonomous or dominating the market in every step of the value chain. Thus, chip production relies on collaboration and trade between the major semiconductor-producing regions. On the other hand, the global nature of the supply chain can lead to vulnerabilities, such as disruptions caused by geopolitical tensions, natural disasters, pandemics, or sudden shifts in demand. This became evident with the global pandemic, during which chip shortages had an impact on other industries, such as health care or automotive, when several factories had to shut down due to a lack of components, and workers had to pay the price. This underscored the need for resilience and strategic planning across all stages of semiconductor production and distribution.

Global situation in the semiconductor industry

The semiconductor industry is undergoing significant expansion. Over the past two decades, from 1990 to 2010, the industry has witnessed a growth rate of approximately 7.5%. Remarkably, within nine years (2021-2030), projections now indicate that the industry is expected to achieve an almost identical growth. This acceleration underscores the rapid pace of technological advancement and the increasing demand for semiconductor products across various sectors. The demand for semiconductors in the automotive industry is forecast to grow by 300% by 2030, while the industrial electronic sector's needs for chips are expected to double by 2030, fuelled by a number of major trends, such as the high-end production technologies of Industry 4.0.

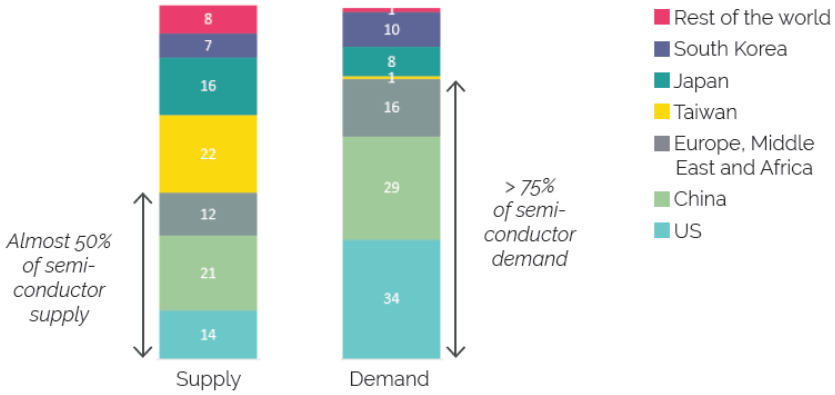
Global semiconductor market value by vertical, indicative $ billion



Source: The semiconductor decade a trillion-dollar industry. McKinsey. April 2022.

However, despite their universal presence in everyday life, semiconductor production remains heavily concentrated in a few key regions, notably Asia and the United States. Regionally, semiconductor supply and demand is imbalanced: both Europe and the United States have become much less important in terms of production. European production fell from 30% in 1990 to 12% in 2019. US production has declined from 37% to 14% in the meantime.

Semiconductor supply and demand, by region in 2021, % share



Source: Semiconductor fabs: Construction challenges in the US. McKinsey & Company. January 2023.

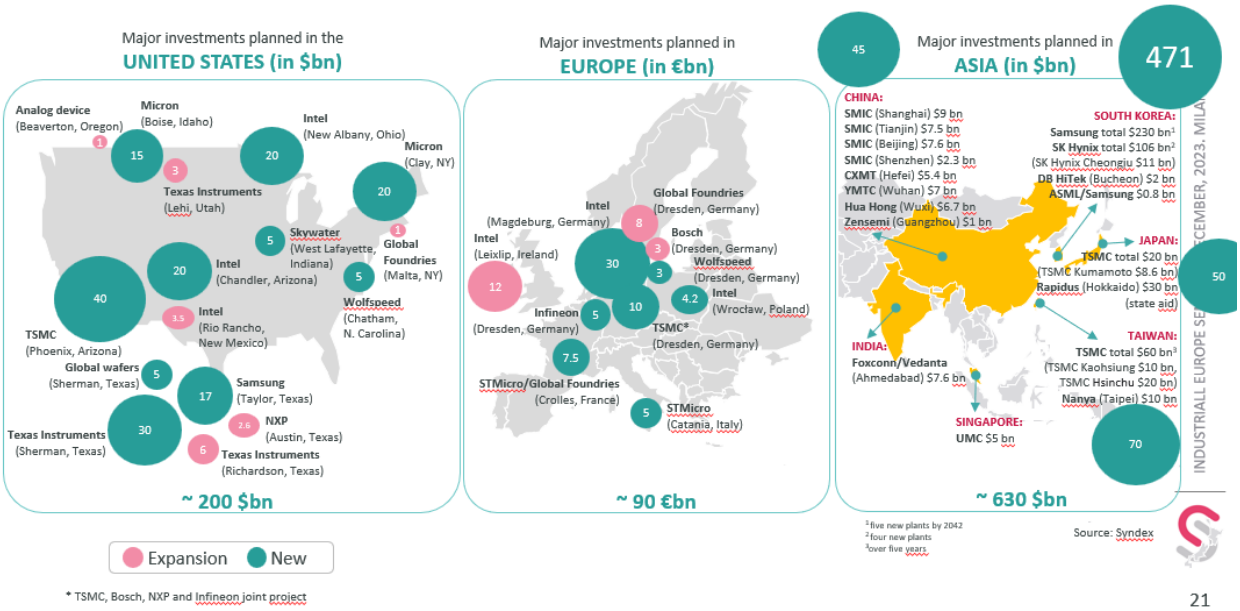
European position

Europe, despite its technological prowess and industrial strength, lags behind in semiconductor production, relying heavily on imports to meet its domestic demand. This overreliance on external sources poses significant risks, particularly in the face of escalating geopolitical tensions and disruptions in global supply chains. Recent events, such as trade disputes, export restrictions, and geopolitical rivalries, have underscored the vulnerability of Europe's semiconductor supply chain, prompting calls for greater self-sufficiency and strategic autonomy in critical technologies.

The EU industry is less represented in a number of important end-markets for semiconductors, such as cloud and data storage, personal computing, wireless communications (smartphones) and consumer devices (gaming). Furthermore, with only 50 semiconductor fabrication plants (fabs) on EU soil, the manufacturing base is rather low. The EU cannot produce chips with feature sizes below 22nm and has a weak position in design and design automation tools. As a result, the EU had a trade deficit of EUR 19.5 billion in semiconductors in 2021 (EUR 51 billion of imports compared with EUR 31.5 billion of exports). Only four European companies are found in the top 20 semiconductor related companies in the world.

Rank	Company	Country	Revenues - M$	Employees
7	ASML	Netherlands	27 424	37 704
15	STMicroelectronics	France/Italy	17 318	51 370
16	Infineon	Germany	17 240	57 217
19	NXP Semiconductors	Netherlands	13 177	34 500
39	ASM International	Netherlands	2 877	4 258
45	AT&S	Austria	2 026	14 403
46	Siltronic	Germany	1 851	4 500
60	Soitec	France	963	1 986
62	Melexis NV	Belgium	923	1 900
70	X-FAB	Belgium	769	4 200
79	BE Semiconductor	Netherlands	635	1 682
80	Technoprobe	Italy	588	2 120
87	Aixtron	Germany	475	974
91	Magnachip	Luxembourg	338	897

Europe has been trailing behind in the manufacturing, and partly also in the design of cutting-edge chips. This is somewhat due to management decisions of the last years and decades, but also due to the simple fact that European companies often could not keep pace with American, Korean or Taiwanese competitors.



This is due both to the lack of a comprehensive industrial strategy, with often short-sighted management decisions and the realisation of short-term profits, and the lack of decisive State aid. In Taiwan, for example, the government covers up to 40% of the set-up costs of a fully equipped cutting-edge plant. A **level playing field** is needed without further delay. It is therefore positive that the European Commission, the vast majority of the Member States, and most of the major semiconductor manufacturing companies, have decided to actively invest in the future of the industry in Europe and to start closing the gap to the global competitors.

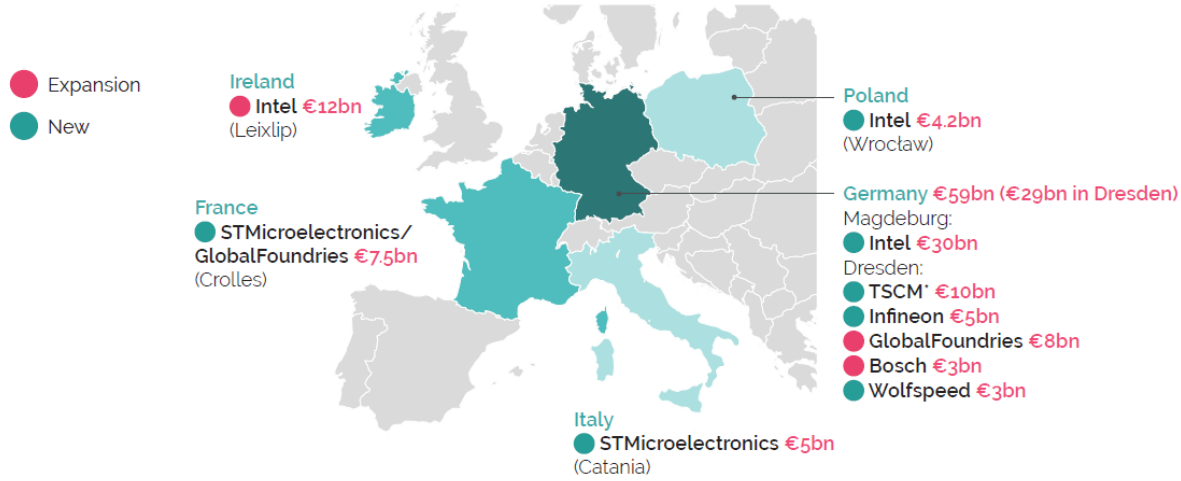
While the EU Chips Act aims at increasing EU autonomy, we are sceptical about the objectives. Indeed, the EU plan aims to produce the next generation of leading-edge chips by 2030 by targeting production below 5-nanometers down to 2-nanometers. This is a market segment that will only constitute a minor share of the overall market for the next decade and ignores the current realities of the industry, in particular the automotive sector and customers' requirements. The demand for these new types of chips is growing, but will not replace the demand for the older ones. This was the case in the automotive sector during COVID-19, when the shortages were related to the 40-180 nanometre chips that are used also in medical devices and industrial machinery. In the current European markets, the majority of fabs produce at nodes on 150 mm and 200 mm wafers, whereas only a limited number of fabs process 300 mm wafers.

Regional imbalance

We have concerns about the risk of a geographic imbalance between countries in terms of resource allocations, as only the largest Member States with significant financial availability could benefit from the EU Chips Fund. We already see that investment in the production of chips has been concentrated in the

few countries that have been able to attract foreign direct investment (FDI) mobilising a massive amount of public subsidies.

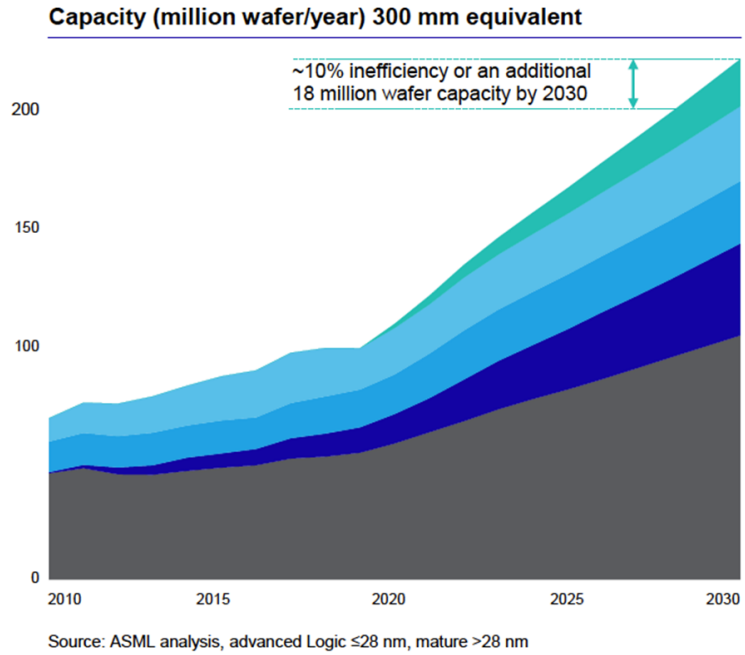
The bulk of planned investments in Europe so far remains concentrated in a handful of markets, led by Germany. The remaining major projects are located in Ireland, France, Poland and Italy.



* TSMC, Bosch, NXP and Infineon joint project. Source: Syndex.

There is a risk of Member States fighting with each other for a larger share of the Chips Act funding. It is therefore essential that the overall industrial strategy takes into account the regional dimension as well as the social and territorial cohesion of the European Union. Particular attention should be paid to ensure that investments benefit all countries and not just the larger Member States with more financial resources, as the Commission will also need to approve State aid.

The semiconductor industry is also witnessing a significant increase in investments globally, driven by the growing demand for chips across various sectors. However, these massive investments could lead to the risk of **overcapacity in the industry**. A subsidy race must be avoided, and funds have to be spent efficiently without creating overcapacities and market distortions.



It is already clear that the EU strategy will not pay off in the short term. In the long run, it is likely to strengthen the chip value chain and foster European strategic autonomy, in particular if Europe is capable of capitalising on its strong points, such as leading-edge, technical skills and research laboratories, and leadership in equipment production. It is essential that the investment promised not only goes into new facilities, but also **training**. In the long run, having production capacities restored, with quality workplaces and a skilled workforce ready to take up the challenges ahead, will be decisive for the industrial strategy of the EU chips industry.

Skills shortages

The shortage of chip supplies goes hand in hand with a shortage of ICT professionals. The demand for ICT professionals has increased over the past years, while the number of ICT professionals available has decreased, resulting in a gap which is growing at an alarming rate. The Deloitte report[2] outlines the 50% increase needed between now and 2030 to support the announced investments and the ambition to reach the trillion-dollar mark in the semiconductor market: the number of workers in the sector would rise from 2 to 3 million worldwide.

The question of skills appears to be crucial and even a prerequisite for the success of capacity investments in the semiconductor industry. It takes at least two years for a new fab to go into production, whereas setting up training programmes takes at least five years before any structural effects are produced. This shows that an efficient training strategy is an essential prerequisite for the success of an ambitious semiconductor plan. The United States seems to have understood the importance of training programmes, as the Inflation Reduction Act (IRA) directly ties tax incentives for companies with training obligations and the creation of quality apprenticeships. Meanwhile, despite several European initiatives, such as the European Skills Agenda, the EU lags behind. Furthermore, the funds available for semiconductor companies do not come with conditionalities in terms of investment in training and/or apprenticeships.

[2] Deloitte report, "*The Global Semiconductors talent shortage*" (2022)

The European Chips Skills 2030 Academy, which is an integral part of the EU Chips Act, intends to set up an industry-university network and resources to support training and reskilling in the industry and manage coordination with competence centres. However, the dedicated resources risk being spread too thinly across the number of micro-competence centres for them to be effective. Furthermore, the initiative is at too early stage, and it is still unclear how it will work concretely.

Social and employment conditions

A massive amount of public money is being poured into industries to attract investments in the chip sector. This can be highly questionable when there are no conditionalities. The main point missing from the EU Chips Act compared to the US CHIPS and SCIENCE ACT is the social conditions attached to it. The US Act includes numerous workforce-related terms and conditions that are lacking in the EU Chips Act. The conditionality of public aid appears to be limited in general within the EU, or more specifically for schemes dedicated to semiconductors.

Interesting avenues to explore in terms of aid conditionality, which could ultimately align the interests of all stakeholders, can be found below:

Employment Conditions

- Introduce a stability or growth term for the workforce within the EU, with a duration to be set according to the duration of the investment, in order to create positive and quality employment in Europe for European workers
- The introduction or improvement of value-sharing mechanisms for the benefit of workers is a factor to attract and retain workers

Conditions for profit-sharing

- Compliance clause: an obligation to provide total or partial reimbursement of public aid in the event of non-compliance with the conditions initially set out
- Better sharing of added value: obligation to set up or improve profit-sharing mechanisms
- Clause requiring profits to be reinvested within Europe (particularly for R&D)

Social and environmental conditions

- Emissions reduction clause
- Water use commitments
- Inclusion clauses

The responsibility of companies also appears to be strongly engaged. The attractiveness of semiconductor companies is a major issue for which a great deal of effort needs to be focused in the short/medium term, particularly in the areas of working conditions, competitive salary conditions and values issues (diversity and ESG). The responsibility of companies must be engaged in three different areas:

Working Conditions

It is imperative that companies in the sector take a proactive approach to the issue of working conditions and communicate on the subject **in order to counterbalance an unattractive image** in this area (e.g. working hours, work from home, paid family leave…).

Competitive Salary Conditions

Semiconductor companies are facing **increasingly head-on competition from sectors offering significantly higher levels of remuneration** for the same level of qualification. In this context, firms need to think about the **packages** they offer. The introduction or improvement of **value-sharing mechanisms** for the benefit of employees is a factor to attract and retain employees and lends credibility to the "joint project" often put forward by top management.

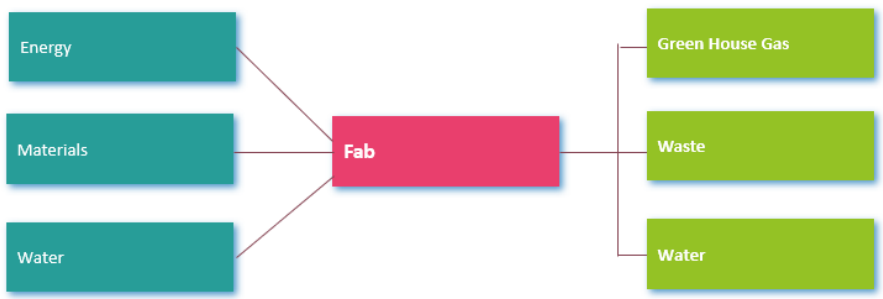
Value Issues

Companies in the sector need to pay particular attention to a number of aspects, as employees' expectations have changed significantly:

- the question of **shared values** is essential to give meaning to work and joint effort
- the issue of **diversity**, which is also a weak point in the sector
- **environmental issues**, which need to be taken seriously in view of the sector's impact, particularly in terms of water use

Sustainable conditions

To be sustainable, fabs need to minimise the emission of greenhouse gas (GHG), waste and water usage.



In a typical semiconductor fab, the emissions are distributed[3] as:

- 35% of emissions coming directly from fabs
- 45% from purchased electricity, steam, heating, and cooling
- 30% from transport & suppliers (raw materials, etc.)

Semiconductor manufacturing has its own environmental footprint. According to Mc Kinsey's article, only a very ambitious scenario would allow the sector to comply with a 1.5° trajectory by 2030.

Together with social and employment conditions, funding should also be linked to sustainability clauses and conditions. The EU Chips Act only considers the environmental impact based on the final product's performance and manufacturing process. When deciding on EU Funds and State aid, the Commission should ensure coherence with EU sustainability goals. Applying the **circular economy**[4] model, where possible, to the semiconductor industry, could facilitate the cutting of greenhouse gas emissions, reducing the demand for raw materials and feeding the industrial production system with parts of existing materials and products.

Another path to reach is to have a clear and stronger strategy for raw materials to move towards greater independence through the sustainable exploitation of the resources, as well as security of supply through a joint and fair external agenda.

Conclusion

Europe is clearly lagging behind in the chips race. Chip giants are not European and European investment remains limited compared to other regions of the globe. The EU might not be able to reach its 20% target of the world's production in 2030.

However, the EU has become aware of its de-industrialisation and the fact that many countries around the world have introduced industrial policies. The European strategy is taking shape, but more efforts have to be made including on skills, working conditions and environmental issues.

Building a future-proof chip industry requires a strategy that resists any unexpected shocks that the value chain may face. Setting Industry 5.0 (human centricity, sustainability and resilience) as the compass of the EU strategy will not only align with ethical and societal expectations, but also ensure long-term viability, competitiveness, and success in an increasingly complex and uncertain value chain.

While industrial policy is increasingly meddling with geopolitics, we should make sure that the technological race does not become a chip war. We should learn from past mistakes and leverage the benefits that **cooperation** with strategic partners can have. Indeed, the collaboration between companies, both domestically and internationally, can help optimise production capacity and reduce the risk of overcapacity. Strategic partnerships and supply chain alliances could enable manufacturers to share resources, leverage complementary capabilities, and better respond to market fluctuations.

[3] From 2022, McKinsey, "*Keeping the semiconductor industry on the path to net zero*"
[4] Our position on circular economy

We run the risk of an instrumentalisation of the chip supply chains for political gains. This could reignite the pandemic-era chip shortages, but also start a larger trade war, which would then escalate to other critical materials. This would be detrimental to the economy, the green and digital transition and the population globally. The shift away from the existing interconnected global supply chains could also have very negative political consequences.