



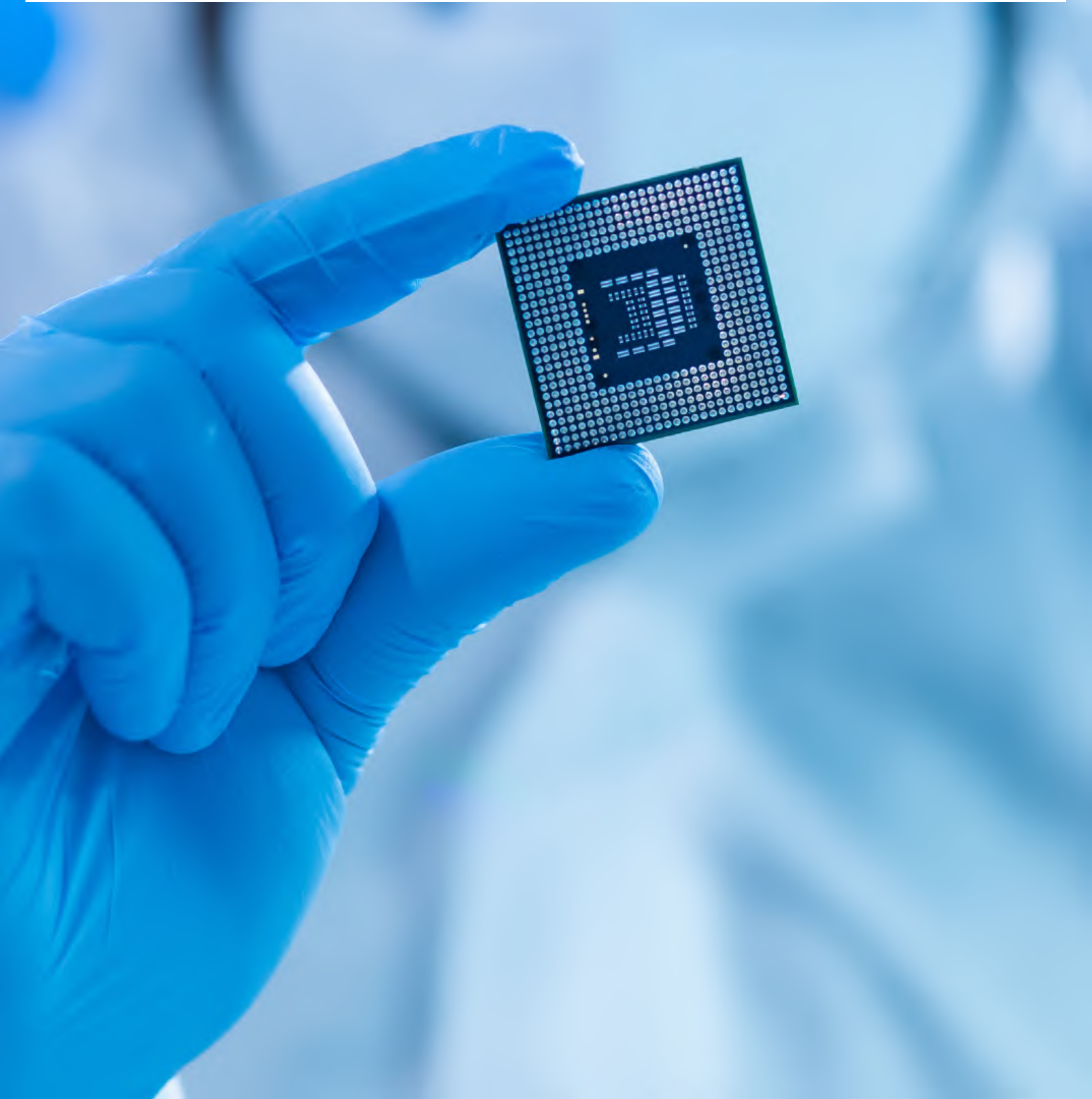
Federal Ministry
of Research, Technology
and Space

Federal Ministry
for Economic Affairs
and Energy

Hightech
Agenda
DEUTSCHLAND

Microelectronics Strategy of the German Federal Government

Research, Skilled Workforce and Manufacturing for the
Microelectronics-Ecosystem in Germany



Content

Abstract	2
Why microelectronics?	5
Global competition	6
What challenges does Germany face?	8
Objectives of this strategy	10
The approach in six fields of action	13
Field of action 1: Expanding chip design capabilities	14
Field of action 2: Transfer “from lab to fab”	16
Field of action 3: Skilled workers – increasing numbers	18
Field of action 4: Skilled workers – improving quality.....	21
Field of action 5: Stimulating investment.....	23
Field of action 6: European and international cooperation.....	25
Framework conditions	27
Concerted action and national coordination	30
Impressum	32



Abstract

With this strategy, the German Federal Government has created a framework to implement targeted and consistent measures in the field of microelectronics, therefore making a significant contribution to the Federal Government's High-Tech Agenda for Germany as well as taking advantage of the opportunities offered by the European Chips Act (ECA)¹. Europe's position in the microelectronics sector has a broad impact on Germany's innovative and economic strength and thus on its ability to remain sovereign in the face of geopolitical tensions. The systematic development of the microelectronics sector in Germany and Europe is, therefore, of great interest to the Federal Government. Together with its European partners, Germany is in a promising position to strengthen its innovative capacity and to secure its technological sovereignty² and resilience in the field of microelectronics. Research and development, a skilled workforce, and investment in industrial pilot projects and innovative manufacturing form the basis of international competitiveness and sustainable value creation. Promoting and expanding the existing

microelectronics research landscape in Germany lays the foundation for supporting the achievement of further goals of the German High-Tech Agenda, particularly in the key technologies of artificial intelligence (AI), quantum technology, and energy generation.

Germany is the largest microelectronics hub in the EU. On the one hand, it makes a significant contribution to European semiconductor manufacturing, accounting for around 30% of wafer capacity. On the other, with its high share of value added in the industrial sector, it is heavily dependent on innovative microelectronics. Microelectronics contributes about 4% directly and about 15% indirectly to Germany's gross domestic product. Germany can only compete in the international microelectronics market by working together with its European partners. The European Chips Act promotes coordinated action in a key technology within the European Union.

1 Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023 [\[Link\]](#)

2 Technological sovereignty is the ability to guarantee the development, use, and further development of key technologies that are required to implement societal priorities and needs at any time; see also here [\[Link\]](#)



The microelectronics industry enjoys a particularly high economic dynamism along with a high level of research expenditure, while, at the same time, being at the centre of geopolitical disputes. Careful attention must be paid to ensuring that government measures are only applied where market forces cannot develop, e.g. due to distortions of competition (such as non-market policies and practices by third countries), or where there is a need to safeguard technological sovereignty in a challenging geopolitical context, as well as the resilience and trustworthiness of essential supply chains,³ and where these goals cannot be achieved by private-sector solutions. With this in mind, the Federal Government is focusing on the critical success factors of research, skilled workers, and manufacturing:

- **Research:** Comprehensive “chip design capabilities” and the transfer “from lab to fab” with a focus on advanced packaging are key elements of the strategy. The Research Fab Microelectronics Germany (FMD) plays a pivotal role in transferring new knowledge into applications, while universities are developing the expertise for the next generation of technology. Chip design and advanced packaging offer significant potential for technological sovereignty, which can be driven by government funding for research and development.
- **Skilled workers:** One new feature is the promotion of a skilled workforce specifically in the field of microelectronics; this is linked to research and investment measures and reinforces the Federal Government’s general measures aimed at securing skilled employees in specific sectors. In view of the high growth in demand in the microelectronics sector that is expected, this approach is justified. It is designed to work in synergy with the training and recruitment efforts of the business community to attract more and better-trained skilled workers, while, at the same time, increasing the attractiveness of Germany as a place to work in for international skilled personnel. It is also a prerequisite for successful investment.

³ Supply chain resilience refers to the ability of a supply chain to withstand disruptions (robustness), to adapt to them (agility), and to recover from them in order to maintain normal business operations.

- **Manufacturing:** One key element of the strategy is providing incentives for establishing and further developing innovative microelectronics production in Germany: semiconductor manufacturing, advanced packaging, along with materials, production equipment and its components. The “lab to fab” transfer is to be systematically pursued. In view of the market growth and the simultaneous intensification of a global subsidy race, the focus is on increasing the attractiveness of Germany as a place in which to create sovereign added value for critical semiconductors (and the relevant technology nodes, right down to the nanometre range) and components. Strengthening local demand from chip user industries as well as developing their design capabilities and system expertise also contributes towards this goal.

Research, skilled workers, and manufacturing must be considered together more closely than before, and measures must be coordinated from the perspective of economic innovation. In doing so, the current and future needs of existing industries in Germany and Europe must be taken into consideration, and fields of new potential value creation – from AI and data centres to quantum computers and trustworthy electronics for secure infrastructures and defence – must be specifically developed technologically and exploited economically. The realisation of the inherent growth potential in this area is a crucial contribution to securing our long-term prosperity. Only by doing so can Germany become an attractive destination for investors and the best talent. And only by doing so can the state’s resources be used efficiently and effectively.

The strategy unites measures and concepts that dictate the direction of future action in order to form a consistent overall picture. It further develops and expands the Federal Government’s ongoing measures. The strategy aims to bolster Germany’s microelectronics ecosystem as a driver of innovation for the entire economy. At the same time, it takes into account the improvement of overarching site factors and international networking as well as research and economic security. The strategy thus contributes to technological and geopolitical sovereignty, to securing prosperity and employment, and to the economic resilience of Germany and Europe.

On the basis of this strategy, all the relevant national stakeholders are called upon to align and expand their measures in a synergistic manner. Alongside the Federal Ministry of Research, Technology and Space (BMFTR) and Federal Ministry for Economic Affairs and Energy (BMWE) as the central federal ministries in this area, companies, research institutions, educational institutions, associations, clusters and networks, as well as the federal states, also have a responsibility to get involved.



Why microelectronics?

Everyday life and the world of work are permeated by the advancing digitalisation of microelectronics. Microelectronic elements are not only found in mobile phones, tablets and computers. They also regulate the energy supply, control medical technology and data flows for the internet, and enable secure, networked, automated mobility. Innovative microelectronics forms the basis for secure communication as well as for AI applications. It is also an essential foundation for the “twin transition” towards sustainability and digitalisation.

With global sales of over €580 billion⁴, the semiconductor industry forms the basis for sales in the electronics user industries that are again many times higher in value (> factor 10). In Germany, these include, primarily, the automotive industry, mechanical engineering as well as energy and medical technology. Microelectronics is a key technology for industry in two respects: on the one hand, products such as cars, medical devices and machines, or the use of AI, would be inconceivable without it. And on the other hand, the manufacture of numerous products is only economically viable with automation, which would not function without electronics. Only those who develop advanced microelectronics can tap into significant gains in performance in a wide range of application areas or even break into new value

creation in the first place. As a rule, microelectronics cannot be replaced by other technologies. In this respect, microelectronics is a strategic resource for Germany and Europe. Access to innovative electronics is a core prerequisite for ensuring our country's economic strength and security and is, therefore, of particular national interest. If it is not sufficiently available, e.g. due to supply bottlenecks or dedicated changes to supply chains or the electronics themselves, then there is a very real risk of “chip crises”⁵. As a value multiplier, its absence can bring entire industries to a standstill for months; this, in turn, can jeopardise the prosperity and security of Germany and Europe. This is all the more true now that geopolitical challenges have brought supply and cyber security into sharp focus. Finally, the trustworthiness of microelectronics plays a major role: only by using trustworthy microelectronics can it be ensured that a product's guaranteed functionality is maintained in the long term and that knowledge and intellectual property are not leaked via malicious components.

Conclusion: Microelectronics is a key technology, and boosting our microelectronics sector is thus of crucial importance for the industrial competitiveness, technological sovereignty and economic resilience of Germany and Europe.

⁴ In 2024; 2024 Factbook, Semiconductor Industry Association [\[Link\]](#)

⁵ In a study commissioned by the ZVEI, the economic costs in Germany of the 2021–23 chip crisis were estimated to be approx. € 100 billion. [\[Link\]](#).



Global competition

Microelectronics is a highly internationalised industry with complex supply chains whose susceptibility to disruption during the COVID-19 pandemic and beyond has already led to supply bottlenecks in Germany and Europe. Due to their geographical concentration in Asia, natural disasters such as earthquakes also pose a substantial risk to supply security. Moreover, semiconductors are already the subject of geopolitical tensions and trade conflicts. Therefore, renewed and even very sudden disruptions to global supply chains cannot be completely ruled out. This makes reinforcing the resilience of supply chains in the microelectronics sector a highly relevant issue.

Microelectronics is widely regarded as a key technology and a necessary component of a country's economic and military strength. As a result, it is also the subject of geopolitical tension. The USA and Asian countries, particularly China, are pursuing a policy of drastically expanding their production capacities and research.⁶ With the CHIPS and Science Act, the USA has offered high subsidies for industry on the one hand, while on the other, research is also being significantly boosted and new research infrastructures established. The leaders in technology, Taiwan and South Korea, are investing heavily in production capacity and research programmes. Like Europe, Japan has fallen behind in the production of semicon-

ductors. It is striving to catch up with high levels of investment and is seeking to work together with the USA and Taiwan. India, which has not had a major microelectronics industry to date, is positioning itself as a new production location by providing high subsidies.

China is also striving to achieve technological leadership and to dominate the market in the field of microelectronics: on the one hand, through massive investment in the research and development of its own technological solutions, and on the other, through a strategic industrial policy that also involves high levels of public subsidies (including the China Integrated Circuit Industry Investment Fund, which is worth billions). The People's Republic is thus continuing its decades-long strategy of self-sufficiency and sees itself vindicated in doing so by the tightened export restrictions imposed by the USA. At present, there is no end in sight to this dynamic. Besides pursuing its own paths to producing the latest generation of chips, China is also seeking to massively increase its market share in established chip generations by significantly expanding national capacity. China already produces almost 30% of the world's chips in the larger technology nodes, which are particularly relevant for industrial applications in Germany. This raises concerns about distortions of

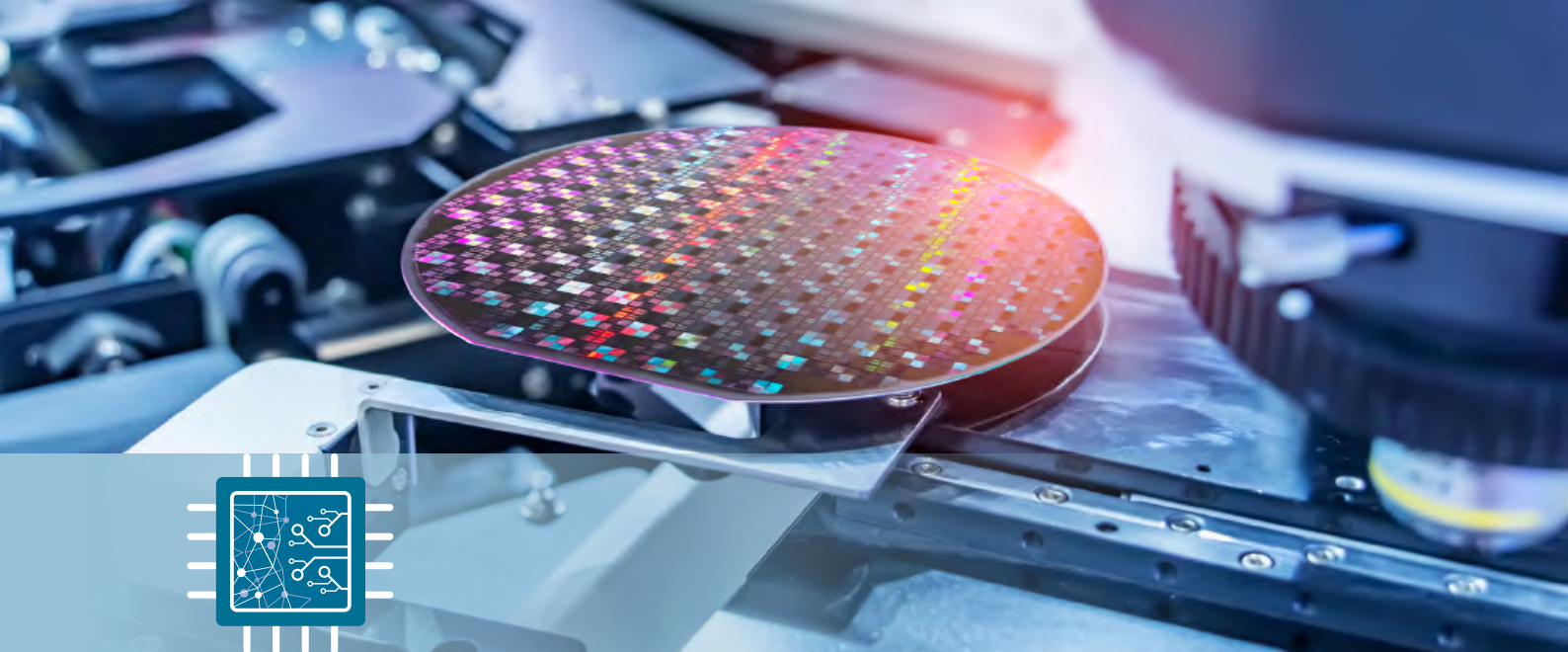
⁶ The Competitive Etch: Addressing the talent gap in the semiconductor industry, 2022, Accenture [\[Link\]](#); Localizing the global semiconductor value chain, 2024, Arthur D. Little [\[Link\]](#)

competition and overcapacity similar to those in the photovoltaic sector. A general renunciation of subsidies would put all countries in a better position. However, subsidies in third countries put European exporting companies that compete with subsidised companies from third countries at a disadvantage. It can lead to European companies being forced out of the market, creating new dependencies on (companies in) third countries.⁷

There is also intense global competition for technological advances in the fields of research, development and industrialisation, because they form the basis for dependencies and geopolitical bargaining power. This is currently evident in the case of AI chips. In light of the expected economic and strategic relevance of AI, safeguarding the supply of microelectronics to AI users – potentially all industries and almost everyone in Germany – is crucial for maintaining geopolitical room for manoeuvre and leveraging growth potential. This also applies to the electronic components necessary for decarbonisation and to security-related microelectronics in critical infrastructures or the defence sector.

Europe, and thus also Germany, has positioned itself within this global competition with the EU Chips Act: this Act boosts research, development, and transfer, makes it easier for the government to support industrial projects, and sets up a monitoring mechanism to prevent supply bottlenecks. Although a subsidy race is undesirable from a general economic perspective, targeted investment promotion in the field of microelectronics is, nevertheless, justified on account of the importance of the sector as a critical technology and the resulting need to prevent third countries from gaining an unassailable technological advantage through non-market policies and practices, and to maintain and expand our own capabilities. The effects are already becoming apparent. For example, the Federal Government is assisting a pilot line for advanced packaging at the FMD and the establishment of production capacities for well-known chip manufacturers in Dresden. These activities are being supported by the respective federal states. The faster and better the individual projects are integrated into the microelectronics ecosystem, the more sustainable the desired positive impact on technological sovereignty, resilience and economic growth will be.

⁷ Industriepolitik in Europa (“Industrial Policy in Europe”), 2025, expert opinion of the Scientific Advisory Board at the Federal Ministry for Economic Affairs and Energy [[Link](#) (in German)]



What challenges does Germany face?

In view of the high levels of investment in microelectronics by global competitors and the huge importance of the industry as an enabler of numerous products and services in application-driven economic sectors, Germany and Europe are called on to safeguard technological sovereignty, reduce unilateral dependencies and place a stronger focus on economic security, while, at the same time, remaining open to investment. Against this background, issues relating to export controls, the unwanted drain of expertise, the dual civil-military use of research, and the ensuring of the trustworthiness of electronics and research security must also be taken into consideration in the strategy at hand.

According to forecasts, the global semiconductor market is expected to see significant growth by 2030.⁸ Major trends such as electrification, digitalisation and the advent of AI applications in ever more economic segments are also creating new and changing demands. The key challenge is keeping pace with the rapid succession of new generations of microelectronics, helping to shape them and, while doing so, establishing and expanding technological sovereignty in critical areas. Opportunities are also opening up technologically: whereas miniaturisation of chip structures has been the prevailing path of innovation

to date, greater diversity in chip technologies and innovations is now emerging. Approaches that combine different chip technologies in a single housing (heterogeneous integration/advanced packaging) play a special role in this context.

Microelectronics is research-intensive, requires high investment and highly qualified specialists:

- In Europe, semiconductor companies spend around 14 % of their turnover on research and development (R&D).⁹ In the German electrical and digital industry, expenditure on R&D totals over € 21 billion per annum.¹⁰ With its strong industrial and competence clusters, Germany is the driving force behind microelectronics in Europe. Sensors, microcontrollers and power semiconductor devices for the automotive industry and energy technology, security devices for the Internet of Things, and equipment for manufacturing semiconductors (especially components for extreme ultraviolet lithography, needed to produce all modern high-performance computing and memory chips) and substrates for elemental and compound semiconductors are the assets of a vital ecosystem of research and industry in Germany – a significant advantage for the location. Since other regions of

⁸ The semiconductor decade: A trillion-dollar industry, 2022, McKinsey&Company [\[Link\]](#)

⁹ 2024 Factbook, Semiconductor Industry Association [\[Link\]](#)

¹⁰ Investitionen der Elektro- und Digitalindustrie ("Investment of the Electro- and Digital Industry"), 2023, ZVEI [\[Link\]](#) (in German)



the world are stepping up their R&D activities and since, at the same time, there is a need for new technologies to be developed on an ongoing basis, R&D activity in Germany must also be stepped up. This applies both to areas where Germany already has particular strengths as well as to new technologies where comparative advantages must be developed through R&D.

- While there were around 330,000 people working in the European semiconductor industry in 2023, forecasts predict that this figure will grow to over 500,000 by 2030.¹¹ The dynamic interplay of the three megatrends of digitalisation, demographic change (and the resulting increased pressure to automate) and decarbonisation poses complex challenges for meeting the demand for skilled employees in Germany. This applies to the demand for skilled workers in STEM professions (science, technology, engineering and mathematics) as a whole. This situation is becoming increasingly acute in the microelectronics sector: expansion of capacity and strong market growth are further fuelling demand for suitable skilled personnel in this sector.

- Europe's share of semiconductor production and the global electrical and digital industry has fallen steadily in recent decades and currently stands at around 13%.¹² Although the foundations for a trend reversal have been laid with state funding in the Europe-wide "Important Project of Common European Interest" (IPCEI) Microelectronics (IPCEI ME) since 2018 and IPCEI Microelectronics and Communication Technologies (IPCEI ME/CT) since 2023, as well as major investments under the European Chips Act, sufficient scaling has, however, not yet taken place to keep pace with the strong growth in other global regions. At the same time, the focus on expanding capacity alone, as set out in the European Chips Act to date, is insufficient. Rather, in future, funding should be focused on critical or particularly promising economic segments on the basis of strategic considerations, taking into account the diversity of local demands. Demand from microelectronics application industries is also crucial for the utilization of existing production capacities, their expansion and for attracting new investments.

As diverse as the areas of application in German user industries are, so too are the requirements for the underlying chips. This goes hand in hand with the need for more innovation, design capabilities and production capacities for chips with different technology nodes and technological approaches – ideally covered by the European ecosystem. Where this is not possible or not economically viable, supply chains must become more resilient. Measures that focus on core positions in the global semiconductor value chain (from chip design to manufacturing) and reduce dependencies in key sectors (automotive, communications, digitalisation, medical technology, AI, defence) make a decisive contribution here. The geopolitical challenges that Germany and Europe face can be most effectively addressed through coordinated action – both within Germany and in the European Union or in international fora such as the G7 or the OECD.

¹¹ Long-term Action Plan, METIS Project [\[Link\]](#)

¹² Globale Elektro- und Digitalindustrie – Daten, Zahlen und Fakten ("Global electrical and digital industry – facts, figures and data"), September 2024, ZVEI [\[Link\]](#) (in German)); Commission Staff Working Document "A Chips Act for Europe", 2022, European Commission [\[Link\]](#)



Objectives of this strategy

With this comprehensive strategy, the German Federal Government aims to increase Germany's attractiveness as a microelectronics hub and boost the technological sovereignty and resilience of Germany and Europe. To this end, we intend to develop both European instruments (a new version of the European Chips Act and further IPCEIs) and national measures, taking into account the following guiding principles:

1. The development and expansion of existing economic and technological strengths. This should be done, in particular, where European capabilities are indispensable in the global semiconductor value chain. This will reduce unilateral dependencies, thereby improving the geopolitical negotiating position and strengthening existing customer industries.
2. Developing new microelectronics technologies on the basis of the existing pilot lines of the European Chips Act and on the basis of research aimed at filling the pipeline for the next and subsequent chip generations and commercially exploiting new microelectronics applications. The focus should be on areas where there is potential future demand from European chip user industries and where there is significant economic potential.

3. Strengthening the resilience and trustworthiness of existing supply chains by means of targeted measures based on security and risk analysis, along with the targeted development of analytical capabilities. This must go beyond a mere focus on capacity building or market share. The relevance of microelectronics for defence and security, as well as for new basic technologies such as AI or quantum technologies, must also be taken into consideration.

Here, simplifying and speeding up processes and ensuring the smooth interaction of various instruments of government action are vital for implementing measures more quickly and in a more focused manner.

Last but not least, concerted action should be taken to exploit synergies by means of measures taken by the scientific community, industry, associations, educational institutions and the federal states; and cooperation with European and international institutions and partners who share the same values should also be intensified.

This Microelectronics Strategy is a key measure of the Federal Government's High-Tech Agenda for Germany. The research framework programme "Microelectronics. Trustworthy and sustainable. For Germany and Europe", extended until 2026, serves as the technical basis for the R&D elements of the Microelectronics Strategy. With this strategy, Germany is also

making its contribution towards the goals of the European policy programme for the digital decade¹³. It also serves the European Green Deal and the European Strategy for Economic Security.

Where do we want to be in 10 years' time?

1. Foundations for innovative chips laid: We have broad capabilities to develop, design and manufacture upcoming innovative chip technologies in Germany. This applies in particular to AI chips and chips for the user industries in Europe, based on a strong foundation in chip design at universities, research institutions and industry, and the development of new materials and computing technologies.
2. New capabilities in the leading-edge sector: Germany has succeeded in establishing manufacturing in the field of leading-edge technologies, with a corresponding local ecosystem of suppliers and research partners. This leads to the establishment of an even closer innovation cycle with local manufacturers of production and analysis equipment, companies that design chips and systems, and user industries. Chip design for small technology nodes and heterointegrated systems is well established in Germany in the spheres of research and industry, with innovative start-ups also contributing to this.
3. Supplying user industries with innovative microelectronics: The demand for microelectronics for local user industries (e.g. automotive, medical technology, energy technology, etc.) is increasingly being met by German and European development, production, packaging and testing. Close cooperation between research and industry ensures continuous innovation. The growth of innovative user industries guarantees a sustained demand for locally produced secure chips. Therefore, Germany has also succeeded in expanding its own production capacities for the relevant semiconductor technologies in technology nodes larger than 22 nanometres.
4. Strengths in the supplier sector remain: The strong position of suppliers in extreme UV, materials, tools and analytics has been further expanded and complemented by excellence in other technology areas and value-chain segments, which have been developed and industrialised through R&D collaboration between research institutions and companies. This secures influential leverage in geopolitical competition.
5. Sufficient skilled workers: The high demand for suitably qualified skilled workers can be met through targeted training and further education measures. We have also taken advantage of the opportunities offered by transformative processes in the economy.
6. Successful concerted action: We have worked closely with industry and stakeholders on the organic development of a functioning microelectronics ecosystem: new businesses and research capacities have been integrated into a growing ecosystem of suppliers, users, research institutions, start-ups and scale-ups in new technology areas. Geographically, they are developed on the basis of local strengths (in R&D, skilled employees, business networks, etc.) and receive support from the relevant federal states and regions. Local production satisfies industry's needs and strengthens resilience in application sectors, supporting innovation and sustainable growth. Coordination within the Federal Government ensures consistent action, while institutionalised exchange formats with stakeholders form the basis for agile action.

On the basis of this target vision, fields of action with specific measures are derived as follows. The measures identified are to be constantly developed in close consultation with stakeholders (see also Concerted Action and National Coordination).

13 Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030 [\[Link\]](#)

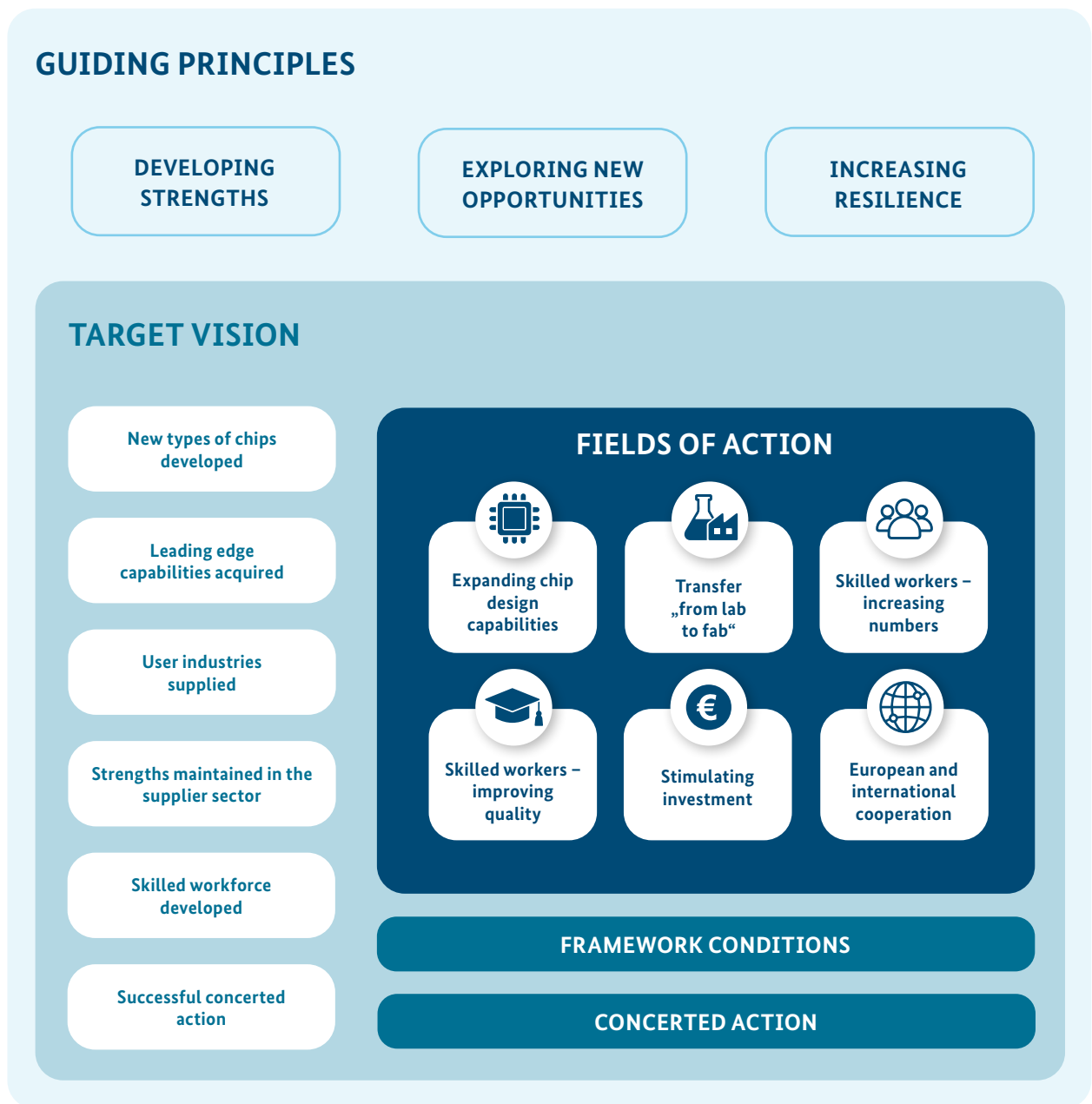


Figure 1: Overview of the Microelectronics Strategy



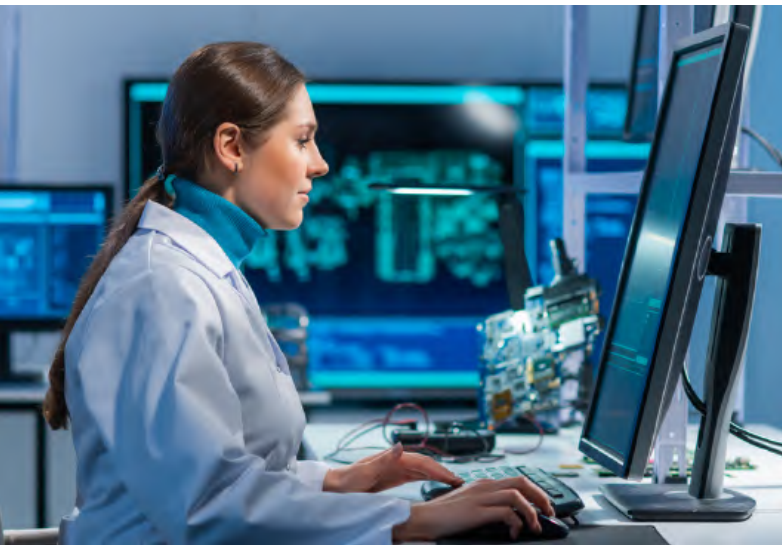
The approach in six fields of action

The Microelectronics Strategy utilises the instruments introduced by the EU Chips Act and supplements them with national measures in six fields of action (Figure 1): “Chip design” and transfer “from lab to fab” for better research and innovation foundations, as well as the closely related quantitative and qualitative expansion of the skilled workforce. In the “Stimulating investment” field of action, the Federal Government is bundling measures relating to IPCEIs and capacity building in line with Pillar II of the EU Chips Act. In the “European and international cooperation” field of action, the Federal Government is ensuring that strong networking and partnerships within and outside Europe contribute to strengthening the resilience of global microelectronics supply chains. In the “Framework Conditions” field of action, consideration is given to improving horizontal and sector-specific location factors as well as research and economic security. With the “Concerted Action and National Coordination” field of action, the Federal Government will ensure that the measures are conceived holistically and are closely networked.

The Federal Government has underpinned these six fields of action for the further development of the microelectronics ecosystem with measures that also take into consideration the activities of stakeholders, the EU, the German federal states and other actors. The strategy identifies measures that are already underway and those that are in the pipeline. This is designed to increase transparency about existing

measures while, at the same time, pointing the way to the future.

Many of the measures mentioned in the national Microelectronics Strategy are already being put into action by the Federal Government and are included in both the current federal budget and the current economic plan of the Climate and Transformation Fund (KTF). Corresponding measures are also envisaged in the current drafts for the federal budget for 2025 and 2026, as well as in the draft economic plans for the KTF (2025) and the Special Fund for Infrastructure and Climate Neutrality (SVIK, from 2026 onwards) along with the financial planning up to 2029. Any measures that go beyond this are conditional on funding. Neither current nor future budget negotiations will be prejudged by the Microelectronics Strategy. The division of responsibilities between the Federal Government and the federal states as laid down in the Constitution will be taken into account. The strategy will also not be prejudicial to changes or adjustments to the social security systems.



Field of action 1: Expanding chip design capabilities

A significant portion of the expertise and up to 50%¹⁴ of the value added in microelectronics lies in the way chips and electronic systems are designed. Chip design plays a central role in the process: from the initial idea to the finished chip in the end device. It translates user requirements into functionalities and shapes product innovations. New possibilities in semiconductor production and advanced packaging (e. g. heterointegration) also facilitate novel designs. As a consequence, some chip users are increasingly striving to develop their own individual chip designs. A wide range of applications requires powerful, partly customised chip designs with increasing functionality, secure-by-design, which, at the same time, must become increasingly energy-efficient. Furthermore, trustworthiness is an increasingly important feature of microelectronics. When designing new chips, the integration of security technologies and secure trust anchors should, therefore, be taken into account from the outset, especially with regard to expanding existing capabilities.

To operationalise this field of action, the Federal Government is devising a Design Initiative. Alongside the nationwide integration of the ecosystem, the focus

is on expanding chip design expertise through research, especially with regard to open source, secure-by-design and AI tools, as well as on the issues of heterointegration, chiplets, and smart and energy-efficient AI chips. A chip design competence centre is intended to significantly expand the possibilities for chip design in Germany.

In line with the measures taken by the Federal Government, the federal states are also committed to expanding design capabilities. The Bavarian Chip-Design-Center (BCDC) promotes cooperation between the spheres of science and industry. Similar efforts are being pursued by the Advanced Chip Design Accelerator (ACDA) of imec Germany in the federal state of Baden-Württemberg.

Next-generation chip design

Germany can boast a high level of expertise in the field of established chip generations and when it comes to designing heterogeneous systems; however, the country still lacks the expertise to design the next-generation of chips. For the smallest chip structures, design capabilities are to be expanded, initially in individual targeted projects, and primarily within a European framework. The development of smart and energy-efficient AI chips will be encouraged and applied in key industries. A flagship project for the “Supercomputer im Auto” will start as early as 2025. Moreover, alternative new chip architectures such as neuromorphic, AI-adapted designs or quantum chips with research focused on edge computing will be promoted. The ongoing processor initiative fosters research into improving processor performance and efficiency. This is supported by ongoing measures such as “ZuSE” (Sustainable Special Processors and Development Platforms), the joint project “NEUROTEC”, research structures for neuromorphic computing at the FMD, and the SPRIND “New Computing Concepts” challenge. For the design tools themselves, AI offers new possibilities for high-quality and efficient chip design.

Lowering barriers for research and start-ups

Incentives for R&D in chip design for start-ups and small and medium-sized enterprises are to be expand-

14 Strengthening the global semiconductor supply chain in an uncertain era, Boston Consulting Group / Semiconductor Industry Association, 2021 [\[Link\]](#)

ed through a European design platform. The platform will be co-funded by the EU Chips Act and integrated with national initiatives. This will improve access to chip design tools and components and the requisite infrastructure. This platform will also facilitate test series, known as multi-project wafer runs. The use of AI can accelerate and simplify the chip design process. Research and development into such methods and tools, including in European networks, offer opportunities to achieve this.

Strengthening open-source design

In many cases, chip design can only be done using established design modules that require a licence and the corresponding software. This can hinder training, exploratory research and widespread adoption by chip users. Open source and the free instruction set architecture RISC-V are consequently gaining in importance. Such open approaches should be widely supported in order to make processor development in Germany more independent. Moreover, a challenge relating to open-source tools, among other things, will promote a vibrant and sovereign design ecosystem, one that facilitates access to chip design, particularly for universities but also for SMEs, and that makes it more appealing for students, for example, to engage with it. The aim is to expand chip design expertise and reduce existing dependencies.

More chip design at higher education institutions

Although many universities and colleges offer courses in chip design, they vary greatly in terms of content. Collaborative activities between higher education institutions and research facilities is intended to enhance the appeal and quality of chip design education across the board. The nationwide network “Chipdesign Germany”, established in 2024, creates a comprehensive cooperation platform that is also becoming more visible internationally.

Trustworthy chips “Made in Germany”

Chips developed and produced in this country, especially those for critical applications, should be labelled “secure by design”. This will also allow us to create the hardware requirements for digital sovereignty. This means that we will be protected against cyber attacks, which is a competitive advantage in terms of European values and regulatory requirements.

Approaches for uniform manufacturer certification and harmonised procurement criteria for trustworthy chips are being discussed in European and, where appropriate, in international fora.

Analysis capacities in industry, research and administration are also being established and expanded. The ability to perform analyses of chips in black-box scenarios (chip reverse engineering) enables a reliable risk assessment of chips and electronic products from potentially untrustworthy sources to be performed. This allows broader supply chains to be tapped into and greater resilience to be achieved.

Security research in the field of microelectronics and chip design increases the cyber security of IT systems. The Agentur für Innovation in der Cybersicherheit GmbH (“Agency for Innovation in Cyber Security GmbH”) also known as the Cyberagentur (“Cyberagency”), jointly founded by the Federal Ministry of Defence and the Federal Ministry of the Interior, supports this development with selected research projects, thus fostering the corresponding ecosystem.

Processes from design to the manufacturing, validation and certification from the flagship initiative “Trustworthy Electronics” should also contribute to the creation of new standards and norms, such as a hardware bill of materials. The aim is for these standards to be drawn up in line with local values and requirements so that they can be subsequently incorporated into trustworthy and secure electronic components and systems, thereby enabling trustworthy chips along the entire global value chain, especially those “Made in Germany”. For this purpose, besides the functional aspects, it is necessary for chip development to consider cybersecurity in terms of the resilience of IT systems. The EU Chips Act specifically incorporates protection against cybersecurity risks as one of its objectives.

Field of action 2: Transfer “from lab to fab”

Microelectronics is research-intensive and is characterised by the rapid succession of new generations of technology. Furthermore, trends such as “more than Moore” or heterointegration offer a broader spectrum for functional and performance enhancements. The rapid transfer of new knowledge from the laboratory to the factory, i.e. “from lab to fab”, is an essential factor for success. Short distances between basic research and application are particularly important, since the miniaturisation of chip structures can no longer be continued indefinitely. Universities and research institutions are offering solutions that go beyond the traditional approaches. They form a key component of the innovation ecosystem, not least because of the technology available in the “microelectronics research laboratories”. At the same time, German firms have already built up a strong R&D base that can be built upon. As a cooperative network of leading Fraunhofer and Leibniz institutes, the FMD offers easy access to the entire microelectronics value chain from a single source: from technology development to the production of pilots. Apart from further miniaturisation, the field of advanced packaging, in

particular heterointegration, offers great opportunities for Germany to increase performance and functionality. These terms describe combining chip components with different functions or materials. Such combined chips pave the way for customised solutions that meet the future needs of user industries in Germany and Europe.

The federal states are also contributing to strengthening the transfer “from lab to fab”, e.g. Saxony with its funding of the Centre for Advanced CMOS & Heterointegration Saxony at several FMD locations.

Expanding the research factory in the EU Chips Act

The FMD will be significantly expanded through a European pilot line. The BMFTR, the participating federal states and the EU (via the Chips Joint Undertaking) are funding this expansion with more than € 700 million. The FMD’s capacities in the field of advanced packaging, particularly heterointegration and chiplet technology, will be significantly expanded. The requisite technologies are to be developed in collaboration with industrial partners. Additionally, highly specialised chips can be manufactured in pilot series. The BMFTR and the federal states are support-



ing this expansion. In addition, the FMD will establish close cooperation with two further pilot lines in Belgium and France. This will provide Germany with an even broader range of R&D opportunities. The expertise developed at the FMD, especially in the field of heterointegration, will be backed up by a range of modules, which will then be disseminated by the Microtec Academy through appropriate educational channels.

Industry-backed basic principles

Co-funding academic basic research projects gives companies access to early insights into preliminary developments. In turn, this allows them to draw faster and more informed conclusions for their own research and innovation. Such projects at universities are funded by the BMFTR's ForMikro 2.0 initiative, which covers up to 80% of the costs. The projects develop concrete potential applications for new approaches and creative ideas from knowledge-oriented research.

From research and development to industrial application

Research and innovation always need to interact with industry in order to create sustainable growth and prosperity in Germany and Europe. Large industry-driven research projects along the value chain, carried out in close cooperation with research institutions, have long been at the heart of the Federal Government's microelectronics research programme. With the EU Chips Act, co-financing for such projects is being expanded through the European Chips Joint Undertaking partnership. This involves not just semiconductor technologies and their applications, but also the further development of chip manufacturing equipment. The federal states of Baden-Württemberg, Saxony and Thuringia are funding these projects, together with the BMFTR. A lab-to-fab accelerator is intended to support the next step of the EU Chips Act pilot line at the FMD in 2026. This will give businesses easy access to cutting-edge technologies such as advanced packaging and chiplets. Innovative SMEs in particular can also benefit from small-batch production for new fields of application.

IPCEI Microelectronics and Communication Technologies

IPCEI projects also play a major role, enabling large-scale investment in pan-European, highly innovative R&D projects in the semiconductor industry, extending to initial commercial use. These projects form a link between R&D on the one hand and industrial production on the other, stimulating the innovative strength of the enterprises receiving funding and accelerating the transfer of developments into industrial production. With the IPCEI ME/CT, the BMW, along with 13 EU Member States, is promoting the development of new microelectronic products and services. The aim is to establish a stronger semiconductor ecosystem along Europe's entire value chain, thereby reducing strategic dependencies and improving supply security.

To date, 28 projects along the entire value chain have been funded in Germany as part of the IPCEI ME/CT. The BMW, together with the federal states, is investing around €4 billion in this initiative. In the medium term, this will lead to the realisation of technological innovations: from high-performance electronics with new compound semiconductors to "leading-edge" communication and AI applications via microsystem technology in mature technology nodes. At the same time, a total of 3,200 jobs will be created in Germany, along with more than 8,000 in Europe.

The Federal Government is actively involved in shaping the further development of the IPCEI instrument and is constructively contributing to the discourse on accelerating and simplifying procedures and future thematic orientation within the framework of the Joint European Forum for IPCEI (JEF-IPCEI). In coordination with France and the Netherlands, a possible further IPCEI in microelectronics is also being set up with the IPCEI Advanced Semiconductor Technologies (AST), with the state aid process at the European Commission scheduled to start in 2026.

Smart funding and financing

Microelectronics, and the semiconductor industry in particular, tends to be unattractive to investors on account of its high capital intensity, technically complex projects and long return on investment periods. To develop chip start-ups and SMEs, there needs to be easier access to support, funding and

investment opportunities. The FMD, for example, offers a specific service for start-ups with its “QNC Space”. The possibility of producing pilot and small series in the research factory lowers barriers. The Federal Agency for Breakthrough Innovation SPRIND also uses its instruments to support highly innovative start-ups in the field of microelectronics.

The EU Chips Act also established a “Chips Fund” specifically for start-ups, scale-ups, and SMEs in the semiconductor value chain. The European Innovation Council, the InvestEU Fund and the European Investment Bank are all enabling access to various grants, financing instruments and loans specifically for semiconductor companies.

The Federal Government will also take steps to better integrate support programmes and financing, particularly to give SMEs easier and faster access to capital. We will investigate linking support in the form of grants with elements of financing (such as guarantees or repayable loans) when further developing funding concepts.

The BMWV and the BMFTR are striving to ensure that future funding programmes are compatible with research and investment funding. At the same time, the Federal Government is examining ways of streamlining the procedures relating to funding law.

Microelectronics for quantum chips

The Federal Government considers quantum technologies – which include quantum computing, quantum sensing and quantum communication – to be potentially very relevant for the economy. It is assumed that, in the future, they will complement conventional microchips in these fields and, in certain applications – the extent of which cannot yet be predicted – replace them. This is why they are also relevant to the Federal Government’s Microelectronics Strategy.

This is why synergies with the national Microelectronics Strategy should be kept in mind, such as with

regard to the integration of quantum technologies into classic microelectronics systems and the relevance of modern microelectronics process technology for the manufacture of quantum systems. The first step involves establishing pilot lines for quantum chips, which the BMFTR intends to set up together with the European partnership Chips Joint Undertaking.

Field of action 3:

Skilled workers – increasing numbers

The number of skilled workers that Germany, as a microelectronics hub, will require will continue to grow steadily in the coming years, partly due to the establishment and expansion of new chip production facilities: from 2027 onwards, the industry expects to have a demand for 20,000 to 30,000 additional technically trained workers.¹⁵ According to the skilled labour monitoring report for the Federal Ministry of Labour and Social Affairs, the sector relating to the electrical engineering occupational group, including microelectronics, is one of the “focus occupations with shortages” in the medium-term forecast up to 2028.¹⁶

The particularly high degree of technology and specialisation in the microelectronics sector leads to increased demands concerning the qualifications of individual employees. Attracting a large number of well-qualified specialists in a short period of time thus requires the right conditions.

The Federal Government is responding to these challenges with cross-sectoral and sector-specific measures that target the entire education chain. Cross-sector measures include, for example, initiatives to generate greater enthusiasm for STEM subjects as well as measures to improve the integration of foreign skilled workers. Sector-specific measures are designed to make career paths in microelectronics more attractive.

15 This includes direct and indirect new jobs and is based on estimates for announced or planned investments gleaned from press releases. New direct jobs are expected from new settlements planned throughout Germany (e.g. ESMC) or expansions of existing production facilities, including those with IPCEI funding. Indirect jobs also include additional jobs created at companies in the local area, in the rest of the value chain and at suppliers.

16 Fachkräftemonitoring für das BMAS – Mittelfristprognose bis 2028 (“Skilled labour monitoring for the BMAS – medium-term forecast until 2028”), 2024, IAB/bibb/GWS [[Link](#)] (in German)]



Nevertheless, a sustainable increase in the skilled labour pool can only be achieved if all the relevant stakeholders are involved. This includes enterprises and businesses, federal states and local authorities, social partners, education and training providers, and the Federal Government. As a general rule, the measures outlined in this strategy do not replace the responsibilities of businesses with regard to securing and recruiting skilled workers. However, with this strategy, the Federal Government aims to further improve the framework conditions in Germany's microelectronics ecosystem so that all the stakeholders will be encouraged to intensify or launch new activities within their respective areas of responsibility.

Ongoing task: sparking enthusiasm for STEM subjects

If we manage to spark enthusiasm for STEM careers at an early age, this will also expand the pool of skilled labour and young talent for the electronics industry of the future. With their STEM Action Plan, the BMFTR and BMBFSFJ are bundling STEM measures along the entire education chain. For example, the nationwide STEM clusters and the #MINTmagie ("STEM magic") communication campaign are helping to increase the pool of skilled employees in the microelectronics sector by providing low-threshold access to STEM

subjects. The #empowerGirl internship initiative specifically provides STEM internships for girls. Measures established by specific federal states also make important contributions; they include measures such as the "THE NERD LÄND!" initiative to make STEM subjects at degree level more attractive in Baden-Württemberg, the Fabmobil in Saxony, and approaches taken by firms and foundations, e.g. the "Schulewirtschaft" (School-Business) network and the "Wissensfabrik" (Knowledge Factory) to promote STEM education.

Highlighting career paths in microelectronics

Career paths in the field of microelectronics are currently less visible than those in more well-known industries when it comes to choosing training and study programmes, and are considered to be less attractive. This results in low numbers of trainees and students, which is why it is important to get pupils excited about microelectronics. Competitions sponsored by the BMFTR, such as "INVENT A CHIP" and "Labs for Chips", give pupils a vivid impression of microelectronics. These formats should be continued and continuously improved (among other things, to achieve a broader impact). Career paths in microelectronics should, therefore, be taken into due consideration when giving career guidance at schools.

Attracting and retaining more students

In the BMFTR-sponsored “COSIMA” competition, students can test new applications for microsystems. In the future, a new competition will invite students to design and test their own chips using open-source chip design. The BMFTR will promote student academies related to current social issues at the FMD, among other places. The objective is also to appeal to talented individuals outside of traditional degree programmes and to highlight the relevance of microelectronics in everyday life. At state level, what can also attract additional institutions is the introduction of specific new degree programmes, such as the Master’s programme in Advanced Semiconductor Nanotechnologies in Saxony-Anhalt in 2023, or integration into European activities, such as the participation of the Technical University of Munich in “Edu4Chip”. With the expansion of the “Semiconductor Talent Incubation Programme Taiwan” (STIPT) from Saxony to all 16 federal states, students now have a unique opportunity to gain insight into semiconductor manufacturing in Taiwan.

Empowering young scientists

The promotion of junior research groups in microelectronics – for example in strategic areas such as chip design – is intended to make careers in microelectronics at German universities and research institutions more attractive. The aim is to retain talented microelectronics specialists in Germany and attract new talent to the country.

Getting women into microelectronics

Increasing the proportion of women among those employed in the field of microelectronics (and, accordingly, among trainees and students) offers great potential. To encourage more women to study STEM subjects, the BMFTR is committed to overcoming existing gender stereotypes. With its funding guideline “MissionMINT – Frauen gestalten Zukunft” (“MissionSTEM – Women Shape the Future”), the BMFTR is supporting young women transitioning from school to STEM studies and from university to a STEM career¹⁷. Further examples at state level include the “MINT to be” STEM initiative with a “MINTor network”, or network of STEM mentors, in Saxony,

“intoMINTgoesLSA” and the STEM mentoring and coaching programme for female students and graduates called “MeCoSa MINT Career” (both in Saxony-Anhalt).

Recruiting international professionals

With regard to international skilled staff, the focus is on reducing bureaucratic entry barriers and ensuring that integration is successful. The law and the ordinance on the further development of skilled labour immigration have noticeably simplified matters in this regard. To make it easier for foreign skilled employees to find work, the Federal Government will also set up a digital Federal Agency for Immigration (“Work and Stay Agency”). State and university initiatives for local integration are also making important contributions. The “Internationalisation of the Higher Education Institutions in Germany: Strategy of the Federal and Länder Ministers of Science (2024–2034)” also aims to improve the legal and structural framework conditions for international students in Germany. The recruitment and retention of international students and researchers should also be taken into account with regard to microelectronics-specific BMFTR research funding measures in the future.

Promoting lateral entry into microelectronics

Transformation processes are freeing up employees, who are increasingly being recruited as career changers for the microelectronics industry. To this end, the BMFTR intends to open up specific further education and training opportunities in microelectronics.

Securing skilled labour for businesses

As part of the plan to establish large-scale facilities, the companies receiving funding are obliged to carry out measures to secure skilled workers within their own companies. Thus, the BMWF is helping them meet the demand for skilled labour in the newly established production facilities.

In the medium term, further measures will be explored to determine whether they can counteract the shortage of skilled personnel in microelectronics, such as support for in-house training.

¹⁷ Part of the BMFTR STEM Action Plan, as well as the “Alliance for Women in STEM Professions”, including the #empowerGirl internship initiative.

Field of action 4: Skilled workers – improving quality

What we require for the microelectronics ecosystem in Germany is not only a sufficient number of employees, but also highly qualified ones. When we talk about improving quality, we are referring to vocational training, academic qualifications, targeted professional development for permanent staff and training measures for those changing their career. Access to virtual or real production facilities, clean rooms and lab equipment must be guaranteed, even during training. Teaching content and materials must be geared towards practical requirements. Well-trained and motivated teachers are essential if the complex manufacturing techniques are to be learned. For this reason, and because of the rapid progress made in semiconductor technology, measures specifically targeted at microelectronics are required, in addition to the cross-sectoral measures taken by the Federal Government.

The EU, some federal states and companies are also contributing to the quality of skilled worker training in microelectronics by carrying out their own measures. On the part of the Federal Government, we have set ourselves the target of creating transparency regarding existing measures, making better use of synergies between the various initiatives and, where required, adding complementary measures.

National Academy of Education for Microelectronics and Microsystems Technology

The BMFTR has consolidated ongoing activities to improve education and training in microelectronics and allocated additional funds to this area. The aim is to expand the “Microtec Academy”, which has previously focused on vocational training, into a national education academy for microelectronics and microsystems technology through the nationwide flagship project “skills4chips”. Among other things, this will pick up on the content developed at the FMD’s Microelectronics Academy (MEA) for academic further education and bundle tailor-made qualification paths for more and better-trained specialists in

microelectronics. Appropriate, high-quality educational formats that are tailored to specific needs will be made available to the relevant target groups. In light of the diversity of existing regional initiatives, the “Microtec Academy” and “skills4chips” not only provide newly developed content themselves, but also refer to proven courses offered by others, such as the vocational training centre for electrical engineering in Dresden. Implementation can only succeed if all the relevant stakeholders work closely together.¹⁸

Companies promoting skilled workers

The expansion of production capacities in Germany is a key factor in the growing demand for a skilled workforce. At the same time, this opens up new opportunities for enhancing education and training. The companies involved in the IPCEI projects funded by the BMW and the federal states will make additional contributions to training and further education: the German enterprises involved in the projects plan to directly fund at least 20 university professorships, over 200 doctoral theses and almost 300 master’s theses across Europe. Companies whose relocation projects are supported must, among other things, help to expand the pool of skilled employees in Germany by means of training and qualification measures. Furthermore, spillover effects resulting, for example, from cooperating with European universities and research institutions are another prerequisite for funding under the EU Chips Act. In addition, the federal states are considering regional training and further education initiatives to support the establishment of new businesses.

Making more efficient use of the infrastructure

Training and further education in microelectronics is expensive and complex, not least because of the limited availability of the necessary infrastructure. At the same time, hands-on training on the appropriate machines is a key prerequisite for many firms. Not every training location (whether academic or commercial) can or must cover the entire range of the equipment itself. The BMFTR will support stakeholders in using existing capacities (such as labs, clean rooms and grey rooms) more efficiently and in a more

¹⁸ This refers, in particular, to chip and electronics manufacturers, regional vocational schools, vocational training centres, private education providers, research institutions (including the FMD), universities and networks such as “Chipdesign Germany” and “ForLab-Natalie”. The aim is to establish close links with existing, non-sector-specific education portals such as “hoch&weit”, the continuing education portal for universities, and “mein NOW” (focus on continuing vocational education).



targeted manner for training and further education purposes. One new approach is virtual clean rooms, for example the pilot project within the ForLab-NataliE project. A national clean room training strategy in microelectronics could make an important contribution. The specific characteristics of each federal state and stakeholder must be taken into consideration.

Integrating training into research projects

Research funding and skilled labour training can benefit from each other. Training and continuing education formats such as learning modules, summer schools and practical seminars are eligible for funding by the BMFTR as part of its research funding programme, both at universities and research institutions and at companies. To date, however, this has rarely been taken advantage of. In future, the BMFTR intends to provide targeted incentives for training and further education formats as part of research projects.

Supporting teachers in microelectronics

Good training can only succeed if teachers are motivated, well prepared if they know what is needed in practice, and if they teach with enthusiasm. The new portal for training and examination staff, “leando”, funded by the Federal Ministry for Education, Family Affairs, Senior Citizens, Women and Youth (BMBFSFJ), and the “Netzwerk Q” network for the further training of vocational training staff can contribute towards this. Closely linked to existing offers, the “Microtec Academy” will design and offer training courses and workshops for those responsible for training and human resources, as well as teachers (“train-the-trainer”). In close cooperation and exchange with the BMBFSFJ and the federal states, the BMFTR also intends to examine whether and how incentives for job shadowing at companies, for example, can be created to give teachers a stronger practical focus.

Field of action 5: Stimulating investment

The European Chips Act aims to increase the EU's share of the global semiconductor production market from less than 10% today to up to 20% by 2030. With this regulation, the European Union has, among other things, laid down the conditions for large-scale funding for so-called "integrated production facilities" and "open EU manufacturing facilities" that are new ("first-of-a-kind") in the EU and contribute to supply security and a resilient semiconductor ecosystem. Such investments are flagship projects that also attract investment from other (supplier) companies within Germany and the EU; as a result, significant positive spillover effects that are desirable from an industrial policy perspective can be expected beyond the mere expansion of capacity. These range from cluster formation, employment effects and knowledge spillover to cooperation partners and suppliers to a closer innovation process with local consumer industries.

The focus of the support is not confined to the development of ever smaller process nodes. Rather, innovations in the microelectronics sector are being achieved in various technology nodes and across all stages of the value chain, from the manufacture of raw wafers and wafer processing to the construction of modules and systems. These innovations are being shaped in particular by the needs of downstream industries and the use cases defined by them. When selecting topics, Germany also focuses its funding on consolidating the current strengths of the semiconductor industry so as to expand its global leadership in strategic technology areas and catch up in specific areas where it is currently lagging behind.

Major investments

By promoting individual major investments in semiconductor manufacturing facilities, the Federal Government is pursuing the goal of establishing new, first-of-a-kind manufacturing capacities in Germany as well as further expanding existing factories to state-of-the-art standards; here, too, the aim is to realise innovative production capacities for the first time, as set out in the Chips Act. This will introduce innovative manufacturing technologies into the

European semiconductor ecosystem, which, in the medium term, will drive the further development and qualification of the German and European value chain, downstream industries and supplier industries. At the same time, international semiconductor manufacturers based in the region are being integrated into the European ecosystem, thus serving as an anchor point for international networking and cooperation. Furthermore, the arrival of international semiconductor manufacturers reduces the dependency of German and European downstream industries on non-European production sites and on technologies not yet available in Germany; this thus makes a substantial contribution to ensuring resilient and trustworthy supply chains for microelectronic products. The Federal Government will continue to work to ensure that Germany and Europe are in a position to serve a range of relevant technology nodes, including small nodes, from their own production, so as to reliably cover user industries with all relevant technology areas and to promote a broad microelectronics ecosystem of suppliers, developers, infrastructure providers and users.

The funding of large-scale projects is being carried out with due regard for the efficient use of public funds in keeping with the principles of goal- and impact-oriented budget management. Scientific evaluations are key to continuously improving support measures.¹⁹

Alternatively, such large-scale projects could also be supported by regional economic and structural policy instruments due to their positive effects at regional and supra-regional level (with regard to investment, employment and income, among other things). This may also include the funding of infrastructure investments related to these projects, for instance within the framework of the joint "Government/Länder Task for the Improvement of Regional Economic Structures" (GRW).

In the 21st legislative period, the Federal Government will continue to expand Germany's position as a leading centre for microelectronics. To this end, microelectronics investments will be promoted under the European Chips Act.

19 On the evaluation of support measures, see also the following document in German [\[Link\]](#)

Promoting innovative investment projects under the European Chips Act

At the end of 2024, the BMWF published a funding call on the basis of the EU Chips Act. This measure is designed to stimulate investment projects in the German semiconductor industry that boost German and European competitiveness in the field of modern semiconductor technologies through the next generation of innovative and sustainable process technologies. At the same time, this measure should expand the state of the art in Europe and contribute to the EU's objective of significantly increasing Europe's share of semiconductor manufacturing. In this context, the entire process chain is deliberately being addressed, from the manufacture of raw wafers to the construction of modules and systems via the processing of wafers, including the required equipment technology. The projects in question will make a significant contribution to expanding production capacities in Germany.

Future activities

The objective of future activities is to maintain and expand Germany's current technological leadership (e.g. in equipment engineering, power semiconductors, sensor technology, microcontrollers, security chips, wafer production and EDA software development) for the semiconductor industry by promoting innovation and transfer into implementation (see also "from lab to

fab"). Added to this are medium-term activities aimed at expanding further technological leadership in Germany which is firmly grounded in local manufacturing in the long term. These activities are located, for example, in the back-end area of semiconductor production. Advanced packaging will play a key role in microelectronics, which Germany needs to develop if it is to become competitive on the global stage. As part of an "ecosystem approach", the requisite investments are to be interlinked with innovations from the Microelectronics Research Factory and other European research and pilot line activities, focusing in particular on technologies and areas of application where a competitive advantage can be achieved over established packaging sites in Asia. At the same time, industrial application in the areas of machinery and equipment as well as materials for advanced packaging should also be promoted across Germany and Europe.

Further funding activities are also planned in the field of chip design, where both active companies and spin-offs from research institutions and universities are to be given support.

In the long term, measures for the industrial development and manufacture of innovative chips, such as neuromorphic chips, quantum chips and AI chips, are to be established.



Field of action 6: European and international cooperation

Owing to its scientific and economic presence in Europe, Germany, the EU's largest microelectronics hub, bears particular responsibility for ensuring the resilience and sovereignty of European microelectronics. Germany fulfils this responsibility at EU level as well as within international bodies such as the G7 and the OECD. This commitment is augmented by targeted bilateral cooperation with like-minded partners.

International multilateral bodies

Germany is committed to engaging in an intensive dialogue on microelectronics and semiconductor issues at the G7 level (within the framework of the Point of Contact Group on Semiconductors) and at the OECD level (within the framework of the Semiconductor Informal Exchange Network). The aims are the gaining of a better understanding of the global microelectronics ecosystem and the improved networking of microelectronics research. At the same time, existing and future strategic collaborative activities are to be reinforced.

Coordination at European level

After the EU Chips Act came into force, the European Semiconductor Board (ESB) was set up by the European Commission and the Member States. The ESB's tasks include the mapping and monitoring of the European microelectronics ecosystem in relation to the global situation as well as the establishment of a crisis prevention and management system. The ESB links all three pillars of the EU Chips Act: R&D, investment in manufacturing facilities, and coordination.

The European research and innovation measures in microelectronics are primarily realised through the European partnership Chips Joint Undertaking. The BMFTR and the federal states of Baden-Württemberg, Saxony and Thuringia finance German partners in European projects. The BMFTR represents Germany on the boards of the European partnership Chips Joint Undertaking and ensures the coherence of European and national measures.

In its role as coordinator, the BMWF supports the establishment and realisation of IPCEI (see also Field of action 5).

Future European strategy

The EU Chips Act is underpinned with EU funding until 2027. Steps must be taken now to continue European instruments and national measures and build on what has been achieved. When designing possible future measures, such as a new edition of the European Chips Act or further IPCEIs, the Federal Government is incorporating the guiding principles of this strategy (see above) into the relevant processes, including those of the "Semicon Coalition" at EU level:

1. Development and expansion of existing economic and technological strengths, particularly where European capabilities are indispensable in the global semiconductor value chain ("indispensability").
2. Opening up new markets and microelectronics technologies on the basis of research (including the pilot lines funded) in order to fill the pipeline for the next generation of chips, with special attention being paid to the future needs of European chip user industries.
3. Strengthening the resilience of existing supply chains by means of targeted measures based on a security and risk analysis, going beyond the mere focus on capacity building and market share. Consideration should also be given to the relevance of microelectronics for defence and security.

In doing so, simplifying and accelerating processes in practical implementation and ensuring the smooth interaction of various instruments are essential.

International bilateral exchange

International cooperation with selected partners will be expanded, with appropriate consideration given to research security. Cooperation with Taiwan on research, development and talent is to be expanded. Similarly, cooperation with South Korea in the field of semiconductor research will continue. Collaboration with other countries, particularly in the field of research, is being explored. There is also a desire to expand international dialogue on issues of economic security and specific risks in the field of microelectronics.

International bilateral fora such as the Trade and Technology Councils (TTC) are being used by the EU

and participating countries (e.g. the US and India) to coordinate approaches to global trade, key economic and technology issues and to deepen transatlantic trade and economic relations. Furthermore, the EU is working with various countries (at present Singapore, Japan, Canada and South Korea) in the context of digital partnerships to turn Europe into a digitally connected continent. The Federal Government supports the EU in international bilateral exchanges and makes use of existing fora and partnerships. They include, in particular, the Federal Government's digital dialogues, which can also serve as a platform for sharing regulatory experience and identifying specific collaborative projects between companies and research institutions in the field of microelectronics, e.g. with India as an emerging manufacturing location for microelectronics.

Norms and standards

Among other things, norms and standards form the basis for securing supply chains and sales opportunities for German and European semiconductor manufacturers. In the field of microelectronics, they also play a key role in defining trustworthy products and supply chains.

At the same time, norms and standards are the subject of geo-economic disputes and hence have strategic significance. With the "German Strategy Forum for Standardisation", the BMWI is facilitating dialogue between stakeholders and the Federal Government with a view to strengthening Germany's role in international standard setting.

The Federal Government will monitor the situation in international standardisation in relevant fields related to microelectronics and will continue to oppose the geopolitical exploitation of standardisation. It will also examine whether the transfer of research and industrialisation results into standardisation can be accelerated by supporting appropriate expenditure on standardisation work carried out by enterprises.





Framework conditions

In order for Germany's microelectronics ecosystem to best fulfil its role as an innovation driver in the economy, we must take into consideration the improvement of overarching location factors and international networking with technologically strong partners, as well as research and economic security. In this respect, the Federal Government's priority is to improve horizontal locational conditions, such as reducing energy prices, cutting red tape and speeding up approval procedures. Where necessary, this is to be complemented by the targeted design of sector-specific factors with a view to international competitiveness as well as the strengthening of demand for secure, locally produced chips.

The disruption of microelectronics supply chains during the "chip crisis" of 2021–23 has already demonstrated the vulnerability of the microelectronics industry in recent years. Given that the microelectronics value chain is more globalised than almost any other sector of the economy, geopolitical tensions are increasing, and power is increasingly being exercised via access to high technologies, Germany must take an active stance with regard to research and economic security in the field of semiconductor technology.

Improving the general framework conditions

The coalition agreement for the 21st legislative period specifies and elaborates on key issues for boosting the economy's locational advantages (internationally competitive energy costs, public infrastructure,

planning and approval/bureaucracy, skilled workers, taxes and duties). Specific projects that will impact on the microelectronics industry, amongst others, include measures to reduce electricity prices and shorten approval procedures, to support the European omnibus package in order to reduce bureaucratic burdens, to adopt a risk-based approach to chemicals without a total ban on entire substance groups, and to introduce even more effective assessment procedures in foreign trade law. They are meant to focus on reinforcing European technology clusters and preventing a loss of expertise. In addition, the rules and practices governing support measures for industrial investments and large-scale projects should be brought up to date and the relevant bureaucratic hurdles reduced.

With regard to acquiring and supporting foreign investment, the Federal Government is assisted by the expertise of its economic development agency, Germany Trade and Invest (GTAI), which provides foreign investors with a comprehensive range of information and services. The Federal Government will supplement this with a regular high-level investor conference.

Specific framework conditions for microelectronics

Attractive framework conditions are a prerequisite for attracting private investment from home and abroad. The second pillar of the EU Chips Act creates, among other things, regulatory relief for production

facilities for semiconductors, equipment and key components. Integrated Production Facilities and Open EU Foundries can be granted the status of being of the highest national importance and will be dealt with accordingly in approval procedures. Ensuring the security of semiconductor supplies and the resilience of the semiconductor ecosystem can be considered an overriding public interest within the meaning of the EU Fauna-Flora-Habitat Directive as well as the EU Water Framework Directive. The Federal Government will work towards realising the relevant privilege in a timely manner within the framework of national processes. The aim is to speed up approval processes so as to increase planning security for companies setting up manufacturing facilities and “design centres of excellence”.

Additional sector-specific concerns of the Federal Government relate to accelerating IPCEI processes and revising and further developing the European Chips Act. To this end, the Federal Government is working with other EU Member States to develop specific suggestions and ideas for the upcoming European review process.

Stimulating local demand

Application sectors such as the security and defense industry, aerospace, automotive, medical technology, as well as information and communications technology, are central to the demand for secure microchips and therefore to the utilization of existing production capacities and location decisions regarding new investments. Where possible and appropriate, measures to stimulate demand will be examined, for example, in public procurement and contract awarding or through local content requirements. Such measures can only be implemented in a coordinated European manner and must be carefully coordinated with the WTO. Additionally, this must not lead to a significant buildup of bureaucracy or to additional public spending through new subsidies.

Reinforcing economic and research security

Microelectronics value chains are both global and complex. This means that the German (and also the European) market will not be able to be self-sufficient, and this is therefore not a realistic scenario. The Federal Government’s goal is, therefore, to safeguard resilient value creation in all relevant sectors, while largely maintaining international supply chains.

Diversification options play a central role here – through cooperation with partners in like-minded countries, but also through the promotion of new investments, start-ups or the scaling of production facilities in Germany. Furthermore, local strengths should be consciously protected and developed, and their geopolitical weight increased through technological excellence and indispensability. Similarly, within the framework of multilateral international structures (e.g. G7 and OECD), a balance of legitimate interests should be promoted while German and European concerns are safeguarded.

The National Security Strategy of June 2024 already outlined horizontal measures to strengthen economic security. The European Economic Security Strategy, published in June 2023, also establishes a European framework in which microelectronics is specifically named as one of the so-called critical technologies. In the 21st legislative period, the Federal Government will develop and present a National Economic Security Strategy based on these principles.

One of the key challenges in the area of research and economic security is complementing the openness in trade, innovation and investment relations that we desire but which others question by strengthening resilience and reducing economic risks.

Companies are called on to develop and apply appropriate supply chain risk management measures; following the “chip crisis” of 2021-23, this has already been done in some cases. The Federal Government supports this effort through active economic diplomacy and foreign trade promotion by the Federal Ministry for Economic Affairs and Energy, the Federal Foreign Office and its diplomatic missions abroad, as well as the network of German Chambers of Commerce Abroad and Germany Trade and Invest.

The Federal Government’s raw materials fund is intended to support projects for the extraction, processing and recycling of critical raw materials. It focuses entirely on critical or strategic raw materials as defined by the European Critical Raw Materials Act (CRMA), including silicon, germanium, gallium, tantalum and rare earths. This will also be of benefit to the microelectronics sector as it will facilitate the diversification of raw material supplies.

The EU Chips Act will create a coordination mechanism at European level to enable Member States and the European Commission to closely coordinate their efforts with regard to monitoring supply chains, semiconductor supply, demand forecasting and anticipation of bottlenecks. The European Semiconductor Board (ESB) collects and evaluates relevant information on supply chain risks and existing dependencies so as to map vulnerabilities and bottlenecks. The coordination mechanism under the EU Chips Act's third pillar enables joint crisis assessment and joint measures for crisis response and prevention.

Where Germany already has its own chip manufacturing facilities, we will monitor the development of production as well as the market situation in third countries and investigate any unfair practices. Should we encounter any unacceptable distortions of competition, we will consistently apply the EU's trade defence instruments (anti-dumping and anti-subsidy measures).

Germany is an open investment location in which foreign investment is highly welcome, provided that it does not compromise our security. We shall, therefore, consistently utilise and further develop the instruments of investment review, also with regard to microelectronics.

Outwardly, we will work to ensure that sensitive technologies such as microelectronics are not inadvertently leaked and used against us for military or intelligence purposes. To achieve this, we will reinforce research security and consistently apply export control regulations, adapting them to the latest developments.

As part of an EU-wide review, the Federal Government will examine whether and what security risks are associated with foreign investments in the field of microelectronics. In all of this, we fundamentally want to keep market access open for the export-oriented local economy.



Concerted action and national coordination

Germany boasts a diverse ecosystem in microelectronics, with a large number of companies, research institutions and universities, networks and associations. The Microelectronics Strategy links the initiatives of the Federal Government, the federal states and the European Union under one roof for the very first time, thereby making a decisive contribution to the Federal Government's High-Tech Agenda. The success of the strategy depends on continuing the dialogue and on all the stakeholders working together in a concerted effort. The Federal Government will, therefore, intensively cultivate the relevant networks and assist coordination with a national "Chips Office".

Continuing concerted action

Formats for pre-competitive collaboration between all stakeholders, including companies and associations, exist primarily at the federal state level. Examples include Silicon Germany, initiated in the state of Saxony, the Bavarian Chips Alliance, and Baden-Württemberg's chip ecosystem round table. Numerous associations are also intensively involved in microelectronics and offer their own exchange formats, such as ZVEI, VDA, VDMA, BDI and VDE. To ensure the success of this concerted action, the Federal Government will continue the intensive dialogue with stakeholders that was established when the strategy was being developed.

Maintaining and strengthening networks

Nationwide networks such as "ForLab-NataliE" and "Chipdesign Germany" also enable an intensive dialogue within the ecosystem. Furthermore, joint measures and a division of labour between the universities and research institutions involved are intended to efficiently increase their attractiveness to young professionals. Collaborative projects in which universities, research institutions and companies work closely together also remain key to the transfer from research to application.

"Chips Office"

In order to improve coordination between the relevant federal ministries and the federal states involved in the microelectronics ecosystem, the BMFTR and BMWI intend to break new ground by establishing a joint "Chips Office".

Learning strategy

The Federal Government is presenting this document as a "learning strategy" that can be adapted during the course of its implementation in consultation with stakeholders as part of the concerted action and in response to external factors (e.g. budgetary, European or geopolitical). The strategy thus also puts into practice the planned roadmap process of the German High-Tech Agenda for the key technology of microelectronics.

The dialogue with stakeholders is being jointly coordinated and consolidated by the Federal Ministry of Research, Technology and Space (BMFTR) and the Federal Ministry for Economic Affairs and Energy (BMWE). Coordination within the Federal Government is being carried out by the already established Microelectronics Task Force.

With a microelectronics conference entitled “Research & Skilled Workers”, the BMFTR aims to create a framework from 2025 onwards to unite relevant stakeholders in the spirit of concerted action. All insights gained from the conference will be taken into account when developing the learning strategy.

The existing formats described above will primarily be used for the agile further development of the strategy, for exchange and coordination

Imprint

Publisher

Federal Ministry for Research,
Technology and Space
Division for Electronics Research and Autonomous
Driving; Supercomputing
53170 Bonn
bmftr.bund.de

Federal Ministry for
Economic Affairs and Energy
Public Relations
10100 Berlin
bundeswirtschaftsministerium.de

October 2025

Text

BMFTR
BMWE

Photo credits

Titel: Adobe Stock/Acronym
S. 2: Adobe Stock/Gorodenkoff
S. 3: Adobe Stock/Viacheslav Yakobchuk
S. 5: Adobe Stock/Gorodenkoff
S. 6: Adobe Stock/SMART.art
S. 8: Adobe Stock/xiaoliangge
S. 9: Adobe Stock/M. Johannsen
S. 10: Adobe Stock/xiaoliangge
S. 13: Adobe Stock/alotofpeople
S. 14: Adobe Stock/Acronym
S. 16: Adobe Stock/Gorodenkoff
S. 19: Adobe Stock/S Fanti/peopleimages.com
S. 22: Adobe Stock/Gorodenkoff
S. 24: Adobe Stock/Halfpoint
S. 26: Adobe Stock/matpit73
S. 28: Adobe Stock/Moon Safari
S. 31: Adobe Stock/Dusan Petkovic

This publication is issued free of charge as a specialist information release by the Federal Ministry for Research, Technology and Space and the Federal Ministry for Economic Affairs and Energy. It is not intended for sale and may not be used for election campaigning by political parties or groups.

[bmftr.bund.de](https://www.bmftr.bund.de)

[bundeswirtschaftsministerium.de](https://www.bundeswirtschaftsministerium.de)

 [@BMFTR_Bund](https://twitter.com/BMFTR_Bund)

 [@bmftr.de](https://www.facebook.com/bmftr.de)

 [@bmftr.bund](https://www.instagram.com/bmftr.bund)

 [@BMWE_](https://twitter.com/BMWE_)

 [@wirtschaftspolitik](https://www.facebook.com/wirtschaftspolitik)

 [@wirtschaftspolitik](https://www.instagram.com/wirtschaftspolitik)