Federal Ministry of Education and Research

Federal Ministry for Economic Affairs and Climate Action

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Research, talent pipeline, production: Impetus for the microelectronics ecosystem in Germany and Europe

This paper

Strengthening our microelectronics sector is crucially important for Germany's and Europe's industrial competitiveness, technological sovereignty and economic resilience.

In view of increasing digitalization, microelectronics is of growing strategic importance for Germany's key industries. The geopolitical challenges confronting Germany and Europe can be addressed effectively with a coordinated approach in the European Union. A crucial contribution to achieving this is through measures focusing on key positions in the global semiconductor value chain (from chip design to chip production) and reducing dependencies in important sectors (such as the automotive industry, communications, digitalization, AI, defence, etc.). **The Federal Government plans to create a strategic framework to ensure that these goals can be accomplished in a targeted, coherent and efficient way.** The strategic framework will be closely aligned with corresponding activities in the EU.

This paper outlines the focus and aims for such a strategic framework that we have jointly identified with stakeholders so far. It serves as a basis for presenting Germany's position to European and international bodies and as a starting point for a national microelectronics strategy that is to be finalized in the upcoming legislative period.

Germany's role in Europe

Europe's position in microelectronics has a wide impact on Germany's innovative and economic strength and in turn on the ability to act self-determinedly amidst geopolitical tensions. Germany has the largest microelectronics sector in the EU. It accounts for around 30% of Europe's wafer production capacity and thus contributes significantly to European semiconductor manufacturing. At the same time, Germany is fundamentally dependent on innovative microelectronics due to its high share of value added in industry. Microelectronics contributes about 4% directly and about 15% indirectly to Germany's GDP. Germany can only compete internationally in microelectronics together with its European partners.

In a joint effort with the Member States, the EU has provided an important, internationally acknowledged impetus for the expansion of microelectronics production with the European Chips Act[1] and the two IPCEIs[2] on microelectronics. Germany has utilized these instruments in the following ways: The two IPCEIs have been and are continuing to be used to implement a large number of projects to increase the industrial production of innovative technologies and applications in Germany. The European Chips Act has enabled the establishment of a new European player in chip production (ESMC), the expansion of a chip factory (Infineon) and the establishment of a decentralized Pilot Line (APECS) at the Research Fab Microelectronics Germany (FMD). These are notable achievements.

[1] Regulation (EU) 2023/1781 of the European Parliament and of the Council of 13 September 2023.
[2] Important Project of Common European Interest (IPCEI) in accordance with TFEU Article 107(3)(b).

Guiding principles for future development

We must – and we intend to – build on these successes. The European Chips Act is backed by EU funding until 2027. Steps must now be taken to ensure the continued momentum of European instruments and national measures.

Guiding principles for the design of possible future measures such as an updated European Chips Act or further IPCEIs should be:

1. Development and expansion of existing economic and technological strengths. In particular, this should focus on areas where European capabilities are indispensable in the global semiconductor value chain. In this way, we can foster our geopolitical bargaining power.

2. Development of new microelectronics technologies on the basis of the existing Pilot Lines of the European Chips Act as well as on research which has the aim of filling the pipeline for the next and succeeding chip generations. These actions should focus on the potential future needs of the European chip user industries.

3. Strengthening the resilience of existing supply chains through targeted measures based on a security and risk analysis. This must amount to far more than mere capacity building and market share. The strategic relevance of microelectronics for defence and security must also be considered.

The simplification and acceleration of administrative processes as well as the smooth interaction of different instruments are all essential to ensure rapid and focused implementation of measures.

Three factors for success: Research, talent pipeline and production:

Technological sovereignty and resilience in microelectronics and the closely connected value chains of the user industries require a focus on the critical factors of sustainable value creation: Research, development and innovation, the talent pipeline and investment – e.g. in production facilities – as well as in diversified supply chains for materials and raw materials. All these factors must be addressed together in one national strategic framework. They can achieve their international competitive impact if they are coordinated across one strategy.

The microelectronics sector is characterized by particularly high economic dynamism. Careful attention must be paid to ensure that government measures only apply where market forces are unable to develop their full effect, for example due to market distortions and where the necessity to secure technological sovereignty exists. Under this measure, the Federal Government is concentrating on the following three fields of action:

- **Research**: “Chip Design Capabilities” and “Lab to Fab” technology transfer focusing on advanced packaging are priorities for research. In this context, Research Fab Microelectronics Germany (FMD) plays a central role in the transfer of new knowledge into application, while universities work out the knowhow for the subsequent technology generation. There is decisive potential for technological sovereignty in the areas of chip design and advanced packaging that can be opened up with government research funding.
- **Talent pipeline**: A new aspect is support for the microelectronics skills base and linking such support with the research and investment projects as well as reinforcing the Federal Government’s general measures to secure the talent pipeline in this sector. This approach is

justified by the high growth in demand expected in the microelectronics sector. It is aimed at gaining more and better trained workers in synergy with the training and recruitment efforts of industry. At the same time, it is a prerequisite for successful investment.

- **Production**: A core element of the strategy are the incentives for the establishment and further development of innovative microelectronics production in Germany – of semiconductor production, advanced packaging and also of materials, production facilities and their components. Lab to Fab technology transfer will be continued systematically in conjunction with this. In view of the growth in the microelectronics market combined with the intensified global subsidy race, the priority is to increase the attractiveness of Germany as a location for sovereign value creation in the production of critical semiconductors (from 'mature' to, in particular, 'leading edge' technology nodes) and of components. The development of the design capabilities and systems competence of the chip user industries also has a role in this.

The Federal Government supports the further development of the European Chips Act in accordance with these three priorities. Even more than before, research, the talent pipeline and production must be addressed together and measures must be carefully designed and aligned with the requirements of the innovation economy. At the same time, attention must be paid to the needs, both today's and tomorrow's, of existing industries in Germany and Europe as well as to potential new fields of value creation – from AI and computing centres to quantum computers, to trustworthy electronics for secure infrastructures and defence. Only in this way can Germany be attractive for investors and the top talent. Only in this way can the state's resources be used efficiently and effectively.

Overarching conditions

In order for Germany's microelectronics ecosystem to optimally fulfil its role as a driver of innovation in the economy, we need to ensure improvements in cross-cutting locational factors and international links with strong technology partners in addition to supporting research and economic security.

Germany and Europe should remain open to investment. However, the aim should be to balance this openness with a strengthening of resilience and a reduction of economic and security risks. Overall, trade policy and industrial policy must become more coherently and strategically aligned. The Federal Government therefore intends to make consistent use of relevant protective instruments, including with regard to microelectronics, and to further develop them where necessary. In doing so, we will consult and agree on this at European and also at international level and will closely follow the development of measures by other major microelectronics players, in particular the USA and Asia, and respond accordingly in the European context.

Due to its scientific and economic position in Europe and as the EU's leader in microelectronics, Germany bears special responsibility for the resilience and sovereignty of European microelectronics. Germany fulfils this responsibility at EU level and within international bodies such as the G7 and the OECD.

Concerted action continues

The bases for this paper were also developed from discussions with the relevant national actors. They are all called upon to organize and expand their measures in a synergetic way. In addition to the Federal Ministry of Education and Research (BMBF) and the Federal Ministry for Economic

Affairs and Climate Protection (BMWK) as lead ministries within the Federal Government in this field, commercial companies, research institutions, education providers, industry associations and the *Länder* all have a responsibility to provide their input. We will also continue this concerted action with the stakeholders in the further process of the strategy's development and beyond.