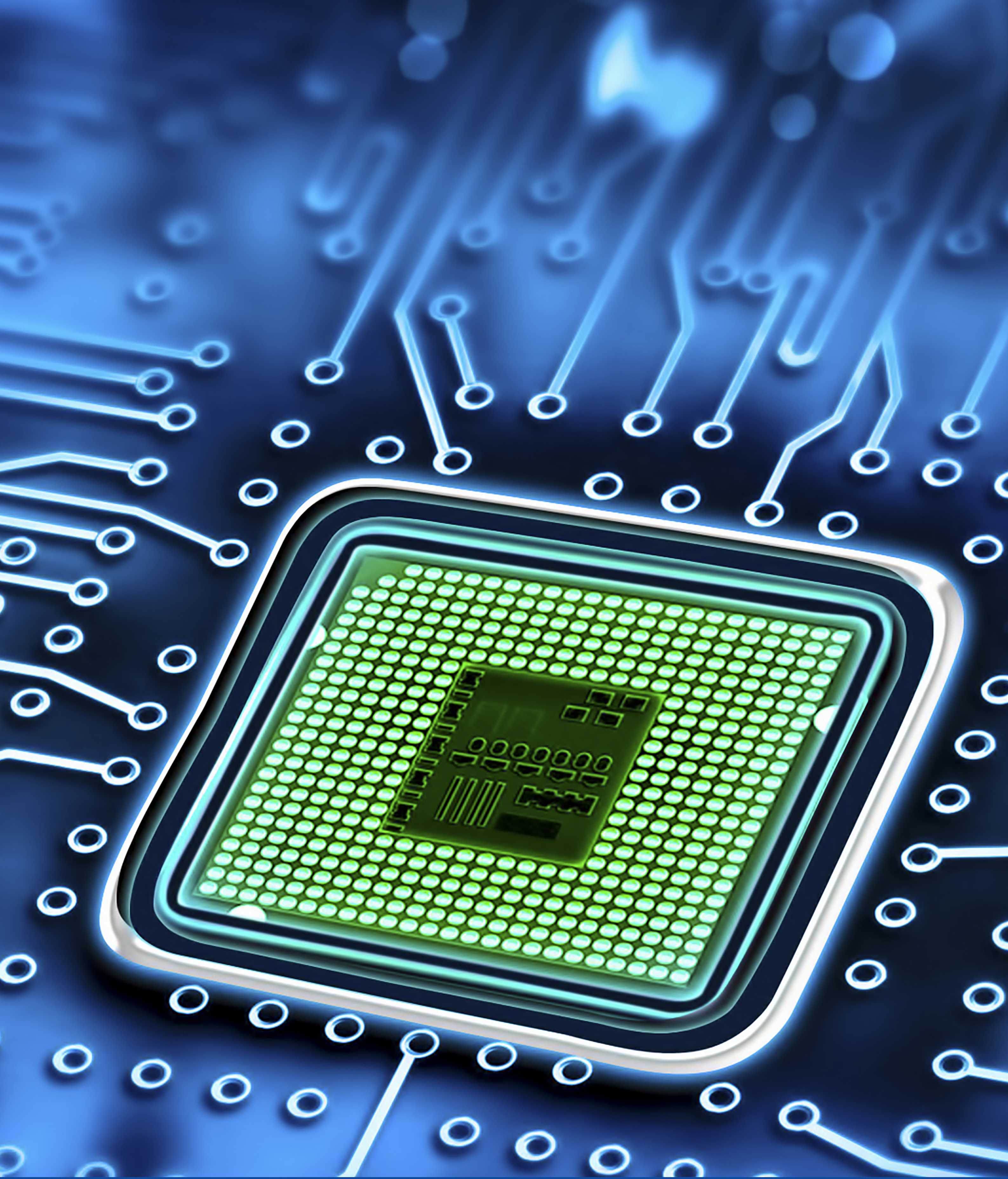


# SWEDEN'S NATIONAL SEMICONDUCTOR STRATEGY 2035

## Purpose

This strategy sets out how Sweden will strengthen its long-term competitiveness, security, and economic growth through targeted investments in advanced electronics and semi-conductors. It establishes a coordinated national approach spanning research, innovation, and industrialization, closely linked to European initiatives.

The global market for advanced electronics and semiconductors is expected to grow significantly in the coming decades, driven by artificial intelligence, electrification, and increasing demand for secure and high-performance systems. The strategy aims to ensure that Sweden is well positioned to benefit from this development and capture a larger share of the value created.

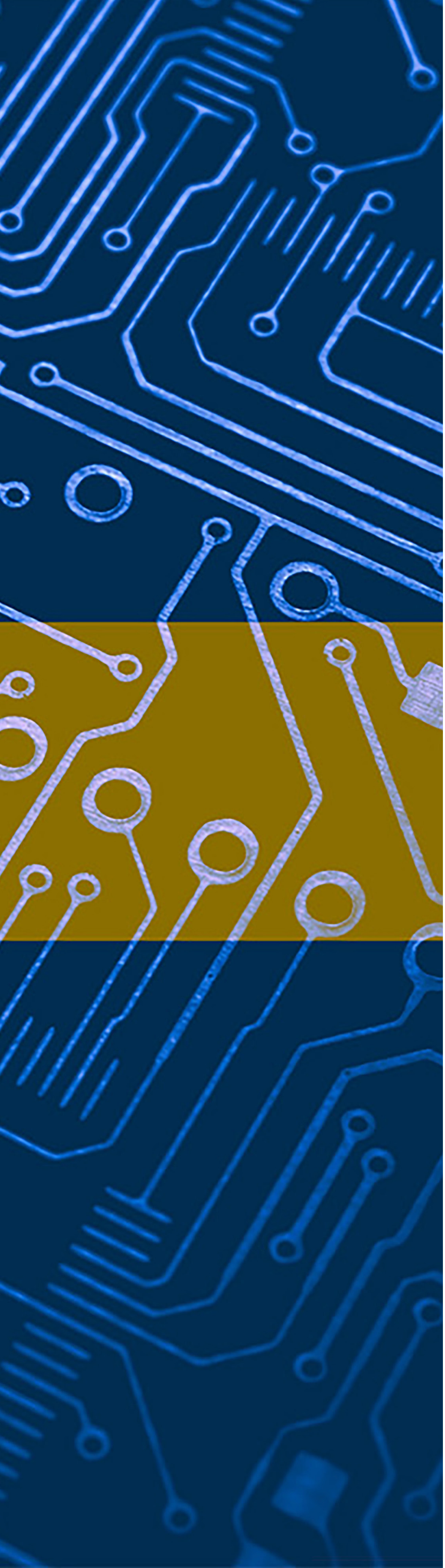
## Acknowledgements

Sweden's national semiconductor strategy has been developed by Semiconductor Sweden and is co-funded by the European Union, with additional co-financing from Region Skåne and Region Östergötland, under the oversight of the Board of Swedish Electronics Trade Association. The work has been carried out through a structured process including roundtable discussions, interviews, a questionnaire survey and engagement with a reference group comprising representatives from across the Swedish semiconductor and electronics ecosystem, including industry, academia, research institutes, and public organizations. We extend our sincere thanks to all participants for their time, insights, and constructive contributions throughout the process.

The analysis, structure and drafting of the report are based on input from the project group, reference group and contributing stakeholders.

The project group comprised representatives from Swedish Electronics Trade Association, RISE Research Institutes of Sweden, The Swedish Defence Materiel Administration - FMV, and the Strategic Innovation Program Smarter Electronic Systems. The views expressed and the conclusions reached in this report represent a synthesis of input and perspectives from all involved stakeholders, developed through a collaborative process, and do not necessarily correspond to the position of any single contributor or participating organization.

A full list of contributing participants is provided in Appendix E.



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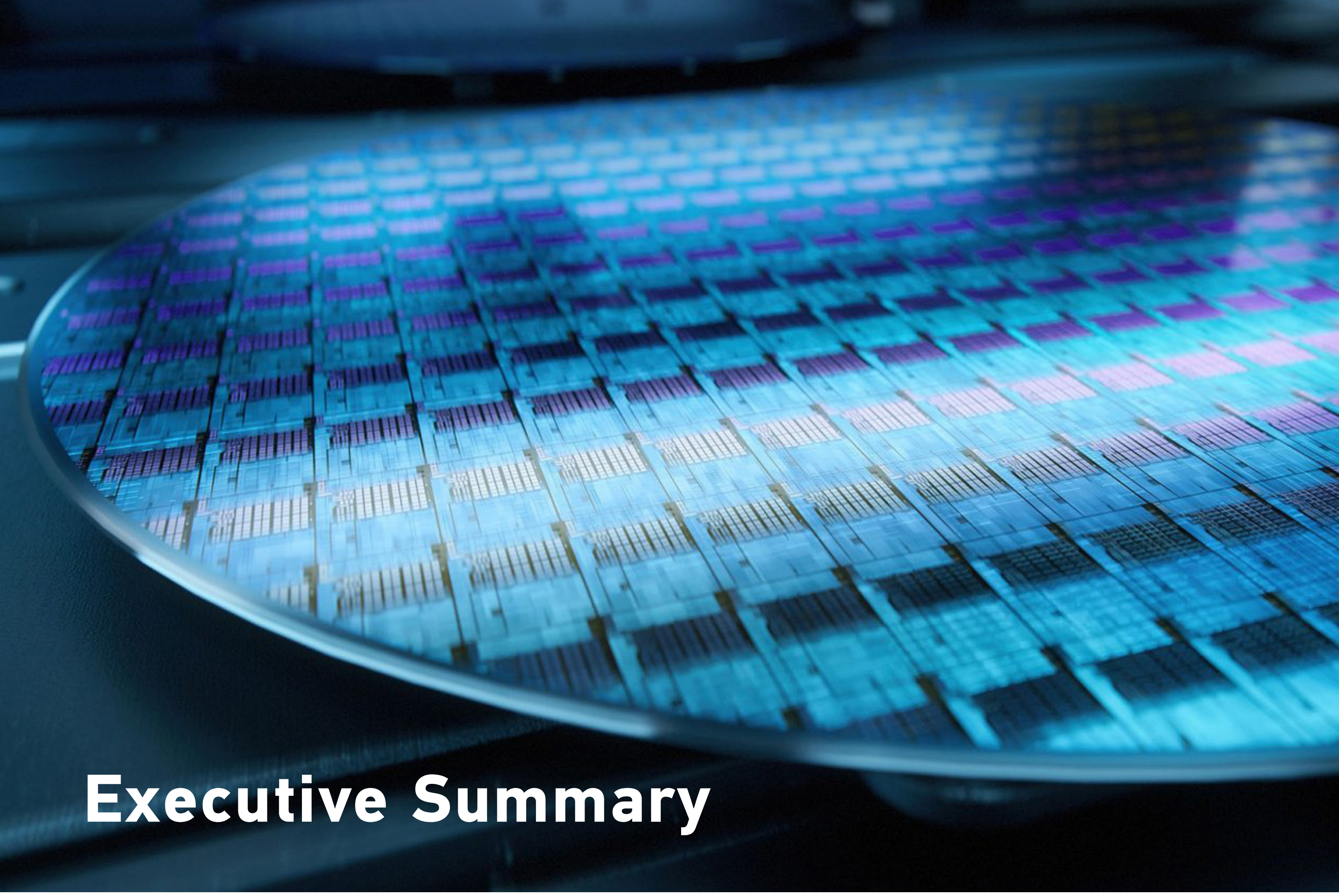

# Executive Summary

Semiconductors are the foundation and strategic enabling technology for industrial competitiveness, economic prosperity and national security. All major industrial economies have recognized this by formulating comprehensive semiconductor strategies that coordinate public and private investments, define priority segments, and align stakeholders across the value chain. Sweden is recommended to do the same to safeguard its competitiveness and resilience in an increasingly shifting geopolitical and technological environment.

The global semiconductor market is projected to grow from USD 775 billion in 2024 to approximately USD 1.6 trillion by 2030, driven by AI, cyber security, computing, wireless communication, automotive systems, electrification and industrial automation. Access to semiconductor capabilities has become a strategic driver for industrial leadership and security. Countries that integrate strong system-level capabilities with advanced semiconductor expertise will be positioned to influence future value chains and technological standards.

## Sweden's Strategic Position

Sweden is well positioned to act in the semiconductor area, with:

- Global industrial leaders such as Ericsson, Saab, ABB, Atlas Copco, Volvo, Scania, Hitachi and Alstom, all of which depend critically on advanced semiconductors and system integration capabilities. Ericsson designs some of the world's largest chips in-house.
- Specialized industrial capabilities including Silex (MEMS producer), Axis Communications (system company with in-house chip design), Mycronic (equipment supplier), and Excillum (supplier of inspection technologies).
- Strong research excellence in areas such as power electronics, photonics and high-frequency technologies, supported by national lab infrastructure through MyFab.
- A dynamic base of start-ups and scale-ups in semiconductor-related technologies.

At the same time, Sweden faces structural weaknesses:

- A fragmented ecosystem with limited national coordination.
- Insufficient growth capital and national co-funding for EU participation.
- Limited agency coordination and slower decision-making compared to peer nations.
- Low commercialization rates despite strong research output.
- A shortage of advanced semiconductor talent.
- Underfunded research environments and outdated equipment.

Without coordinated structural measures, Sweden risks erosion of industrial competitiveness, increased technological dependence and reduced resilience.

## Mission and Strategic Focus

The mission of this strategy is to strengthen Sweden's long-term competitiveness, growth, security and resilience by building leadership in semiconductor capabilities decisive for future industrial systems and critical infrastructure.

The strategy is guided by five principles:

**1.** Establish a national platform uniting industry, academia, institutes, start-ups and public agencies.

**2.** Focus on areas where Sweden can lead through system-level strengths.

**3.** Target high-impact niche technologies with long-term growth potential.

**4.** Complement European initiatives and fill critical value-chain gaps.

**5.** Secure technological resilience in trusted and mission-critical domains.

## Prioritized Technology Domains

The strategy concentrates on four domains where Sweden has both current strengths and future potential:

1. Chip and Electronic System Architectures
Leadership in advanced system architectures (SoC, multi-chip, heterogeneous integration) that define performance, energy efficiency, lifecycle management and security in mission-critical applications.

2. Power Electronics
Core to electrification, energy efficiency, automotive systems, industrial equipment and data centres.

3. Photonics
Enabling sensing and communication technologies in niches aligned with Swedish system capabilities.

4. Analog, RF and Mixed-Signal Systems
High-frequency and mmWave technologies critical to wireless communication, radar, sensing and defence.

These domains are supported by six enabling capabilities:

- System & Chip Design
- Advanced Packaging & Heterogeneous Integration
- Test, Validation & Qualification
- Industrialization & Scale-Up
- Supply Assurance & Trusted Value Chains
- Talent & Skills Development

The strategy explicitly avoids large-scale commodity manufacturing ambitions. Instead, it focuses on high-value design, integration, validation, specialization and resilience—areas where Sweden can lead.

> Access to semiconductor capabilities has become a strategic driver for industrial leadership and security
>
> All major industrial economies have recognized this by formulating comprehensive semiconductor strategies that coordinate public and private investments

## Proposed Implementation Platform: Program for Advanced Electronics (PAE)

To ensure execution, the strategy proposes establishing a Program for Advanced Electronics (PAE) as a public–private partnership, modelled on the successful Program for Advanced Digitalization (PAD).

Key characteristics:

- Founding industrial partners: e.g. Ericsson, Saab, Axis, Mycronic, Silex.
- Support from associations: e.g. Teknikföretagen and Svensk Elektronik.
- Public coordination through Vinnova.
- Strategic involvement from FMV.
- Project financing primarily through competitive open calls.
- Strong alignment with EU programs (Chips JU, IPCEI).

A budget comparable to PAD (approximately SEK 2 billion annually, shared between government and industry) is justified and consistent with commitments made by peer countries such as Finland, the Netherlands and Austria (EUR 1.5–3.5 billion over a decade). The investment will:

- Strengthen national competitiveness and resilience.
- Mobilize private capital.
- Unlock substantial EU co-financing.
- Establish Sweden as a credible European partner in semiconductor initiatives.

The different areas and proposed actions in this strategy document, should be included or when more suitable associated with PAE to strengthen the national semiconductor infrastructure.

## Strategic Rationale

Four structural arguments underpin the strategy:

**1.** Industrial Competitiveness

Around 8,000 Swedish companies rely on advanced electronics and photonics, employing approximately 260,000 people and generating SEK 1,000 billion in turnover. Semiconductor capability directly determines product differentiation, energy efficiency, security and lifecycle performance.

**2.** Economic Opportunity

Semiconductors represent high-value, high-margin industrial activity with strong multiplier effects across sectors.

**3.** Future Technology Foundations

AI, electrification, quantum technologies, secure connectivity and digital infrastructure all depend on advanced semiconductor components and integration technologies.

**4.** Geopolitical Resilience

Global semiconductor supply chains are concentrated and politically exposed. Strategic national capabilities in selected niches provide leverage, reduce vulnerability and support defence and critical infrastructure.

## Expected Outcomes

Implementation of this strategy will:

- Strengthen Sweden's capacity to design, integrate, validate and industrialize semiconductor-enabled systems.
- Increase resilience and security in critical infrastructure and defence applications.
- Enhance energy efficiency and performance in industrial systems.
- Improve EU leverage while avoiding duplication of large-scale manufacturing.
- Mobilize private and European capital.

Given projected global and industrial growth, it is reasonable to anticipate a 40–60% expansion in value creation within semiconductor-dependent sectors over the coming decade, provided Sweden acts decisively.

## Conclusion

Semiconductors are not a peripheral technology domain; they are a structural enabler for industrial leadership, resilience and security. Sweden possesses the industrial base, research competence and system-level strength required to lead in selected high-impact domains. What is currently missing is coordinated national execution. This strategy provides the framework to close that gap and position Sweden as a decisive European actor in semiconductor-enabled industrial systems.


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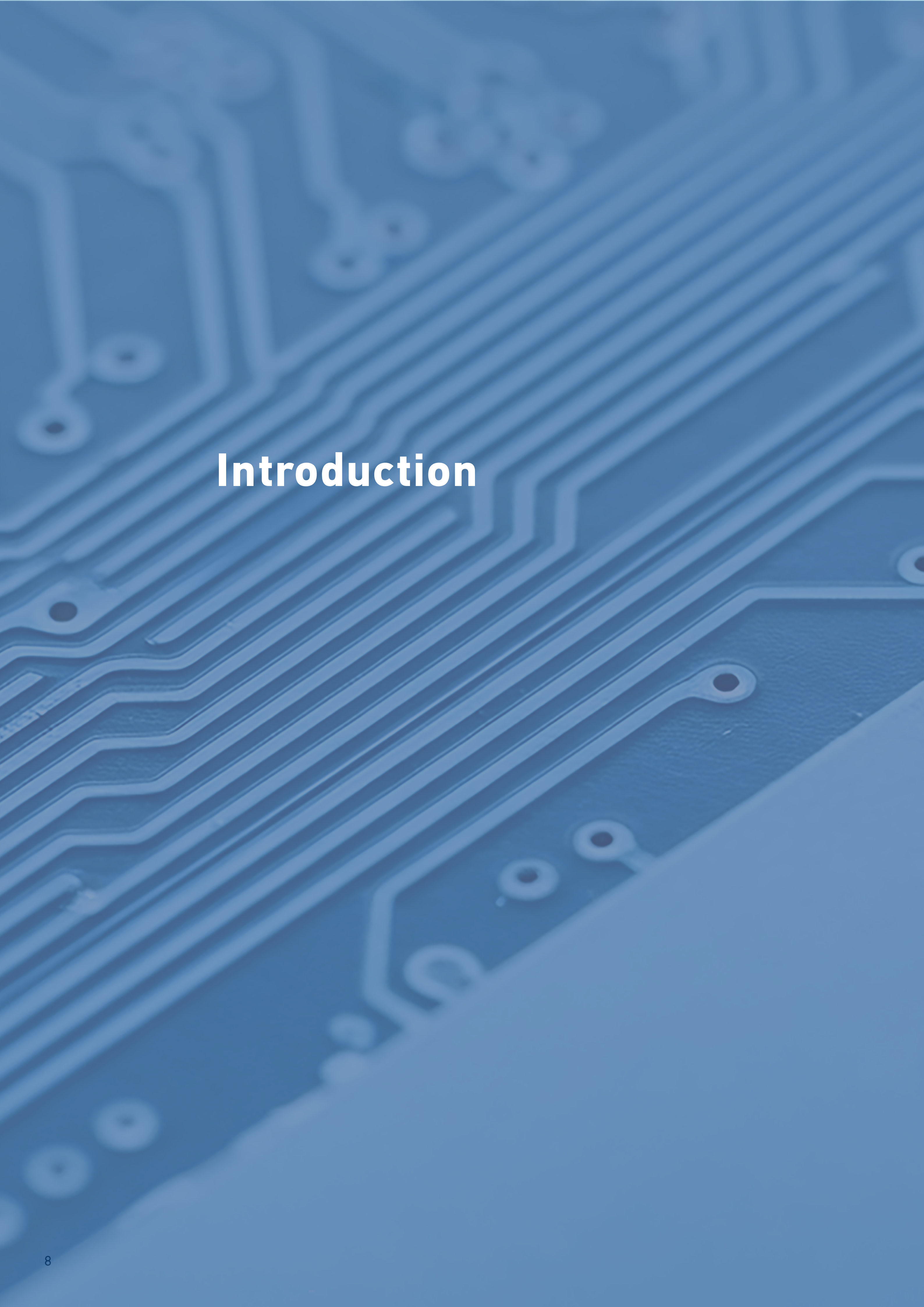


# Introduction

> Countries that combine system-level strength with competence in critical semiconductor technologies are positioned to shape future value chains and technological standards.

Semiconductors are a critical technology for industrial competitiveness, as well as for national prosperity and security. That is a fact for all industrialized nations, including Sweden. Many countries and regions have therefore formulated semiconductor strategies, where segments and actions are prioritized and coordinated, goals and tasks for key stakeholders are laid out, and investment budgets – public and private - are suggested or allocated. This document aims at also giving Sweden such an advantage, to secure our long-term competitiveness, growth, security and resilience.

Sweden has many strengths that are relevant to this strategy. Ericsson is a global leader in telecom infrastructure, and SAAB produces some of the best fighter aircraft in the world. Companies like ABB, Atlas Copco, Volvo, Scania, Hitachi and Alstom spearhead the electrification of industrial equipment, heavy vehicles and societal infrastructure. All of them are heavily dependent on semiconductors and the capability to integrate the semiconductors into electronic systems. Ericsson is designing some of the largest semiconductors in the world in-house.

Swedish world class companies also include Silex (the world's largest producer of MEMS components micro electro-mechanical systems), Axis Communications (producer of surveillance cameras built on in-house designed semiconductors), Mycronic (maker of production equipment for digital screens and semiconductors as well as for electronic system production) and Excillum (maker of laser equipment for e.g. 3D-inspection of semiconductors). There is also a range of very promising Swedish start-ups and scale-ups in the semiconductor field.

Swedish universities feature world-class research in e.g. power electronics, photonics and high frequency radio technology. The universities share a network of semiconductor labs through the MyFab organization, which is also utilized by research institutes, start-ups and scale-ups.

There are also several weaknesses in the Swedish semiconductor ecosystem. It is quite fragmented, with very limited national collaboration. Research environments are severely underfunded, often relying on outdated equipment. Funding for start-ups and scale-ups is also a pressing issue, as is the national co-funding necessary for taking part in EU projects. The national agencies are perceived as less collaborative and less forward-leaning than in comparable countries. There is also a general shortage of available talent. Thus, despite academic excellence, research results leading to successful companies are impeded.

Also worth noting is that geopolitical factors are threatening our national resilience. The global semiconductor market is under pressure, not least due to rising tensions between China and Taiwan, and between China and the USA. Taiwan is where an absolute majority of the most advanced semiconductors are manufactured, USA is home to the majority of the large semiconductor companies, and China is spending huge amounts of money to catch up in the global semiconductor race. The increased tensions, including tariffs and trade bans, have resulted in strained supply chains, where buyers of semiconductors cannot always count on getting what they need, especially not the most advanced products. Having semiconductor strengths, albeit in select niches, gives leverage in such situations.

As global competition intensifies, access to semiconductor capabilities has become a strategic factor for economic resilience, security and industrial leadership. Countries that combine system-level strength with competence in critical semiconductor technologies are positioned to shape future value chains and technological standards. A detailed discourse on semiconductor geopolitics can be found in Background A.

However, a proper semiconductor strategy also holds great business opportunities. Initial investments can be high, and lead times are usually longer than for e.g. software technology, but the rewards are greater. It is worth restating that the global semiconductor market is poised to reach 1,6 trillion USD by 2030, more than double the amount of 2024, see the graph in figure 1. Increasing demand from computing and data storage, coupled with strong additional growth from wireless, automotive and industrial applications, are the main market drivers.

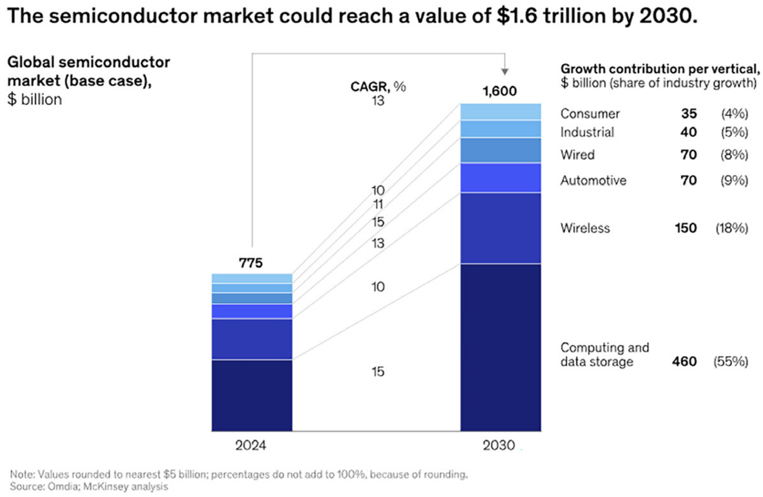



Figure 1: The global semiconductor market is expected to double by 2030.
Source: McKinsey & Company / Omdia.

The strategy is also about securing the future. Already today, modern society and industry depend on the tight integration of software, electronics and systems, with semiconductors forming the critical physical foundation. Two examples: a modern smart home contains between 1 000 and 5 000 semiconductors, and an electric car between 1000 and 3 000 such devices. Future advances in artificial intelligence, future connectivity, quantum technologies, electrification and secure digital infrastructure all rely on continued progress in semiconductor and photonic technologies. Software and system architecture define functionality, while system-level performance, energy efficiency, reliability and security are determined by semiconductor components and integration technologies.

Worth pointing out is also that the Swedish Innovation agency Vinnova's analysis of Sweden's strategic technology areas identifies semiconductors and advanced electronics as foundational enablers across AI, digitalization, energy systems, automotive and defence, reinforcing the need for national capability at component and integration level - not only at system level.

This strategy builds on the strength of all the stakeholders in the Swedish semiconductor ecosystem - industry, academy, institutes, start-ups and scale-ups, national and regional agencies – while recognizing the importance of common European ambitions and investments in the field. It targets technologies with high, long-term impact and growth potential, secures technological resilience where possible and where it matters, and it aims at filling critical gaps in the Swedish and European value chains. Global trends for technology, environment and politics are considered, as well as the complex nature of semiconductors, their surrounding electronic systems and supply chains.

While the sector is characterized by extreme specialization, complex value chains, and intense international competition, Sweden holds a strong, long-standing tradition in research, development and innovation. This strategy establishes the foundation for Swedish leadership in prioritized segments of the semiconductor industry.

## Mission, guiding principles and structure

The mission of this strategy is to strengthen Sweden's long-term competitiveness, growth, security and resilience by building leadership in semiconductor capabilities and related fields that are decisive for future industrial systems and critical infrastructure. This is necessary to ensure Sweden's role in the global semiconductor industry.

**The strategy builds on five guiding principles:**

**1.** Establish a platform for the development of the semiconductor ecosystem, uniting the efforts of industry, start-ups, scale-ups, research institutes, academia and relevant public agencies. This platform could preferably be set up as a private-public-partnership, ensuring that the investments are prioritized to areas with clear industrial demand, aligned with national capabilities and a credible path to deployment.

**2.** Focus on areas where Sweden can lead through system-level strengths, leveraging the Swedish capacity in complex system design and integration to build semiconductor capabilities.

**3.** Target niche technologies with high long-term impact and growth potential, e.g. power semiconductors, MEMS, photonics and high-frequency technology.

**4.** Fill critical gaps in the European value chain, complementing rather than duplicating European initiatives.

**5.** Securing technological resilience where it matters most, e.g. within trusted hardware, secure systems architectures, and resilient supply for critical infrastructure and defence applications.

The strategy is structured around four prioritized technology domains – System architectures, Power electronics, Photonics and Analog, RF and Mixed signal systems. These technologies are underpinned by six horizontal capabilities - System & chip design, Advanced packaging & integration, Test, validation and metrology, Industrialisation & Scale-up, Supply assurance and Access, and Talent & Skills. The longevity of the strategy is ensured by investments in long-term research for future technologies, as well as a national coordination and funding, and alignment with EU initiatives. The figure 2 below illustrates this structure.

The technology domains and the national capabilities correspond well to the guiding principles. The strategy sets clear goals for each of them, as well as suggesting key actions for achieving the goals. A detailed description of the domains and capabilities, as well as the goals and suggested key actions, can be found in Background B.

## Suggested platform setup

Establishing the proper platform for the semiconductor ecosystem is a vital key to success. Fortunately, Sweden has previous experience with successful platforms in other technologies. The Program for Advanced Digitalization, PAD, could serve as a model for the setup. PAD, founded in 2021 through an initiative by ABB, Ericsson, Saab, Teknikföretagen and Vinnova, focuses on AI and other advanced digital technologies through the entire value chain. PAD's ambition is to continue until 2030, with an annual budget of 2 billion SEK, half of which comes from the industry and the other half from the government. The government has hitherto assigned 300 MSEK for 2023, and 500 MSEK per year for 2024-2027. These sums have been matched by the private sector and other partners. Financing projects through open calls is the main operation of PAD, but it also serves as a hub for the Swedish AI ecosystem and a natural partner for e.g. EU programs including IPCEI projects.

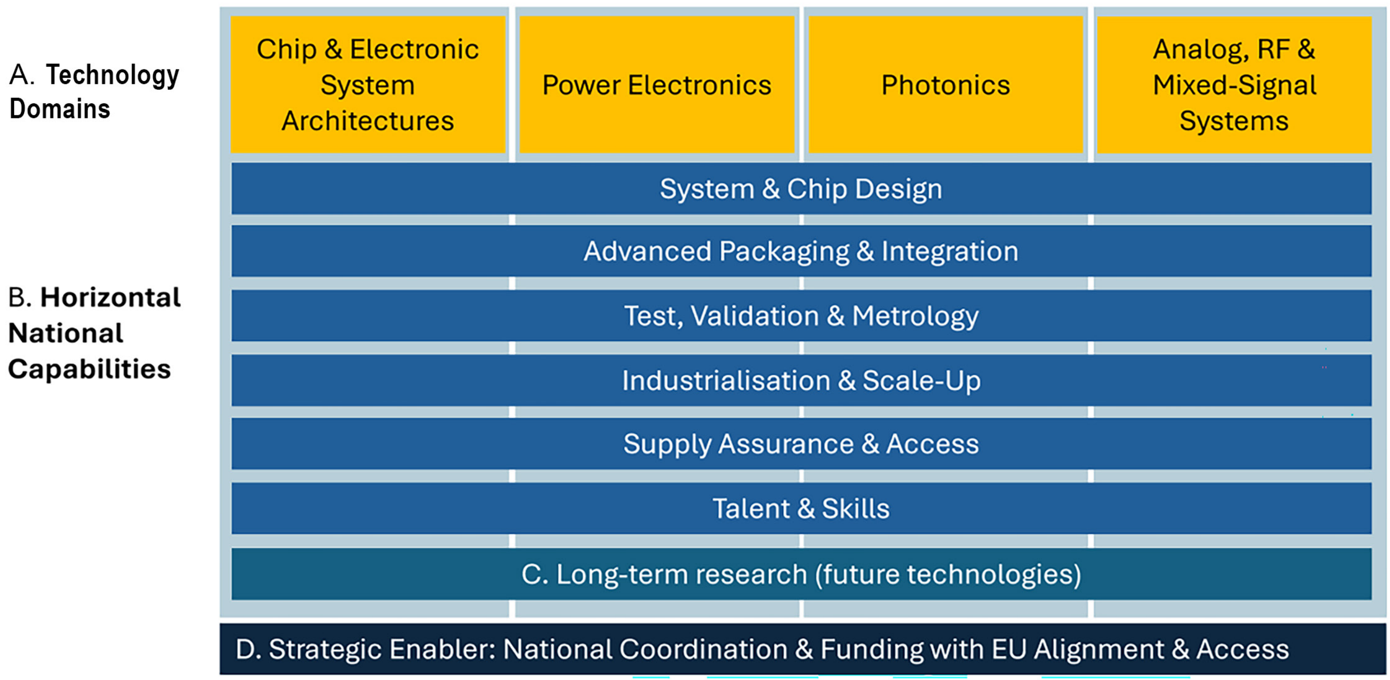



Figure 2. Technology domains and national capabilities suggested in this strategy

> The longevity of the strategy is ensured by investments in long-term research for future technologies as well as a national coordination and funding and alignment with EU initiatives.

A similar platform for semiconductors and electronics – tentatively named The Program for Advanced Electronics, PAE, would be instrumental for a flourishing Swedish semiconductor ecosystem. Suggested founders include companies like Ericsson, Saab, Axis Communication, Mycronic and Silex, with support from organisations like Teknikföretagen and Svensk Elektronik. Vinnova should have a similar role as in PAD. Given the strategic nature of the semiconductor field, the Swedish Defence Materiel Administration, FMV, should also have a role in PAE. Assuming a broad commitment to this strategy, the detailed setup of the PAE could be defined by a "coalition of the willing", i.e. corporations, agencies and organizations willing and able to support such a platform.

It is reasonable to believe that the PAE should have a budget on par with the PAD. This is in line with comparable EU countries' investments in their semiconductor strategies. As examples, Finland, the Netherlands and Austria have each committed public investment to their semiconductor development in the range of 1,5 to 3,5 billion Euro over a decade. Such a targeted investment in semiconductor capabilities will strengthen Sweden's long-term competitiveness, improve the national resilience, unlock European co-financing and of course mobilise private national as well as international investment. It will also ensure that Sweden has a natural speaking partner for European semiconductor projects, e.g from Chips JU, and for IPCEI consortia.

## Suggested technology focus

The global semiconductor ecosystem is complex and full of interdependencies. No nation, not even the USA or China, possesses semiconductor sovereignty. All national strategies, including this one, must thus focus on national strengths and priorities.

As shown in Figure 2, this strategy suggests that the Program for Advanced Electronics prioritizes four technology domains where Sweden features strength today and high potential for tomorrow: Chip and Electronic System Architectures, Power Electronics, Photonics and Analog, RF and Mixed Signal Systems. The technology domains should be supported by enabling capacities within six fields: System & Chip Design, Advanced Packaging, Test, Industrialization, Supply Assurance and Talent Development. The technology domains and supporting enabling capacities are described in the table below.

## Strategic Technology Domains

| | |
|---|---|
| **Chip and Electronic System Architectures** | Architecture-level leadership in advanced electronic systems, including SoC, multi-chip and heterogeneous solutions, that determine performance, energy efficiency, security and lifecycle behaviour in mission-critical applications for Swedish system companies. |
| **Power Electronics** | Central to electrification, energy efficiency and industrial systems, automotive systems and data centres, where Sweden has strong industrial and academic positions. |
| **Photonics** | Enabling technology for sensing, defence, security and communication, with focus on selected niches where Sweden has existing capabilities and strong system-level integration. |
| **Analog, RF and Mixed-Signal Systems** | Including microwave and mmWave technologies underpinning wireless communication, radar and sensing technologies critical to connectivity, security and defence. Strong Swedish research. |

## National Enabling Capabilities

| | |
|---|---|
| **System and Chip Design** | Translating system-level requirements into chip- and electronic-systems architectures through specification, partitioning and cross-domain co-design, spanning SoC, multi-chip and heterogeneous solutions. Strong research including SCCC, Swedish Chips Competence Centre. |
| **Advanced Packaging and Heterogeneous Integration** | Integrating diverse semiconductor technologies into complete electronic systems using advanced packaging, chiplet and integration approaches. |
| **Test, Validation and Qualification** | Verifying performance, reliability, security and compliance of chips and electronic systems across development, qualification and lifecycle. |
| **Industrialization and Scale-up** | Transitioning technologies from development to production through process development, qualification, supply-chain readiness and manufacturability support. |
| Supply Assurance and Trusted Value Chains | Securing reliable access to critical technologies, materials, manufacturing capacity and tools across trusted supply chains, strengthening national and corporate resilience. |
| Talent and Skills Development | Attracting, developing and retaining the advanced technical and system-level skills required across the semiconductor value chain. |

Included in this strategy is an action program, where the suggested developments of the prioritized technology domains and national enabling capacities are laid out in detail. This action program consolidates all the suggested actions into an implementation-oriented framework.

## Expected outcome

This strategy, and its action program, will strengthen Sweden's capacity to design, integrate, validate and industrialize semiconductor-enabled systems with long lifecycles and high trust requirements. It enhances competitiveness, resilience, security and energy efficiency, while maximizing leverage of EU investments in e.g. Chips JU and IPCEI:s, and avoiding duplication of large-scale manufacturing efforts. The positive effects include economic growth and jobs, more innovation, supporting the digital and green transition and strengthening the national security.

Sweden has already today a strong industrial position in e.g. telecom, automotive, industrial automation, defence and medical technology. Around 8,000 Swedish companies depend on advanced electronics and photonics, employing approximately 260,000 people and generating SEK 1,000 billion in turnover. Semiconductors are central to this value creation, determining performance, energy efficiency, security, reliability and long-term competitiveness in both products and industrial operations. Projecting how these numbers would be ameliorated by this strategy would be a delicate exercise but given the general industrial and societal development it would not be unreasonable to assume a 40-60 % increase over a period of ten years. Positive effects on the $CO_2$ footprint come as a bonus.

# Background

A. Strategic context: Global European and Swedish Perspectives

B. Vision and Objectives for 2035, and suggested Action Program

C. A Swedish Semiconductor SWOT

# A: Strategic context: Global, European and Swedish Perspectives

## Global Trends Shaping the Semiconductor Industry

Global semiconductor value chains have enabled affordable, high-performance electronics and accelerated digitalization worldwide. Recent disruptions - from pandemics to trade restrictions and geopolitical conflict - have exposed vulnerabilities and **highlighted the need for greater resilience and strategic autonomy**, creating new opportunities for Member States within the EU's semiconductor initiatives.

At the same time, the exponential growth in data traffic and computational demand, driven by 5G/6G, artificial intelligence, the Internet of Things and autonomous systems, is sharply **increasing demand for high-performance and energy-efficient electronics.** The electrification of transport, industry and energy systems further amplifies this trend, making semiconductors - particularly in power electronics, RF, photonics and sensing - central to both sustainability and climate objectives as well as industrial competitiveness. Energy efficiency across digital and physical infrastructure is increasingly determined by semiconductor design and technologies, and system-level integration.

Compute-intensive applications in AI, advanced communication and automation require optimisation across the full technology stack, from hardware to software. This shifts the competitive focus from individual components to system architectures, chip design, advanced packaging and co-design of hardware, software and algorithms. For industrial companies in Sweden, the **ability to control system-level performance, energy efficiency, security and long product lifetimes** is becoming a decisive competitive factor, increasing the strategic importance of semiconductor competence even in sectors that have not traditionally developed semiconductors in-house.

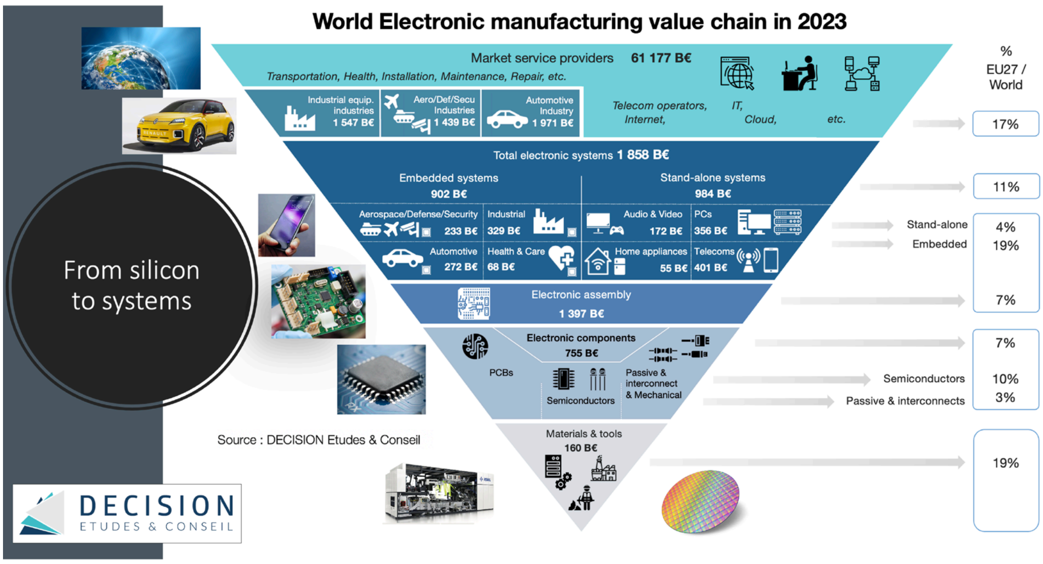



Figure 3: Illustrates the global electronic components and systems value chain, highlighting that the largest share of value creation occurs at system, integration and service levels.
Source: DECISION Etudes & Conseil, data for 2023

As functionality, performance and differentiation increasingly move from the system level into the chip, future system leadership depends on engagement across semiconductor components, integration and industrialization, in addition to system-level capabilities. Without such engagement, design influence and value creation may increasingly shift towards upstream supplier ecosystems. Strengthening semiconductor capabilities is therefore critical.

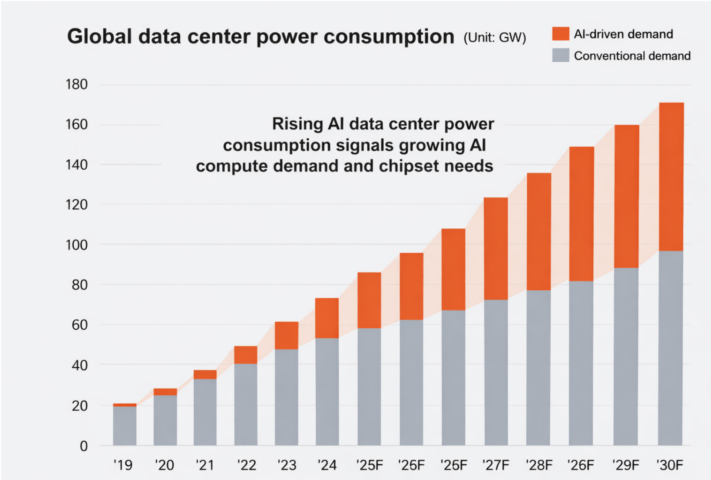



Figure 4: Rapid growth in AI-driven data centres power demand highlights energy efficiency as a system-level constraint, reinforcing the need for more energy efficient semiconductor architectures, packaging and interconnect technologies. (AI-generated)

Electronics and semiconductor technologies are becoming strategic assets for differentiation, security and long-term competitiveness. The **ability to understand, select, integrate and develop semiconductor-based solutions** is increasingly essential for optimising products and systems across long lifecycles, particularly in safety- and security-critical applications. This places new demands on skills, design capabilities and value chain coordination.

In parallel, the global shortage of semiconductor-related skills is emerging as a major bottle-neck to technological progress and industrial growth. Competition for engineers and specialists in chip design, system architecture, manufacturing, testing and industrialisation is intensifying. Addressing this challenge requires sustained investment in **education, lifelong learning, mobility** between academia and industry, and improved relative conditions for **attracting and retaining international talent** in competition with other leading semiconductor and technology nations.

Finally, semiconductor-intensive development is increasingly exposed to rising costs and uncertainty related to raw materials, energy, capital and trade conditions, including tariffs, export controls and other forms of trade friction. Hardware development is inherently long-term, capital-intensive and risk-bearing, amplifying the impact of such uncertainty and increasing sensitivity to cost volatility and access conditions. This reinforces the importance of **predictable, long-term financing, shared industrial infrastructure and development environments that reduce cost and risk**, as well as continued progress in resource efficiency through digitalization, automation and more efficient processes.

These global trends explain why semiconductors have become strategically decisive for competitiveness, resilience and security. The next section focuses on the semiconductor technology trends expected to deliver the highest industrial and strategic impact over the coming decade.

## Semiconductor Technology Trends with High Impact

For decades, progress in semiconductors was driven primarily by transistor scaling, making individual transistors smaller, faster and cheaper, commonly referred to as Moore's law. While scaling remains important, it is no longer the dominant source of innovation or competitiveness. Increasingly, performance and differentiation arise from how semiconductor components are combined, integrated and tailored into complete systems. Future semiconductor value creation is therefore driven as much by architecture and integration as by further miniaturisation.

A central trend is the shift towards chiplet-based and modular system architectures, where multiple smaller, specialised chips are combined into a single system rather than relying on one large monolithic device. Each chiplet performs a specific function - such as computing, communication, power management or sensing - and the full system is assembled from these building blocks. This approach shortens development cycles, improves cost efficiency and enables the combination of diverse technologies within one system. By reducing reliance on the most advanced manufacturing processes, chiplet-based systems increase flexibility, scalability and supply-chain resilience while supporting long product lifetimes and high reliability.

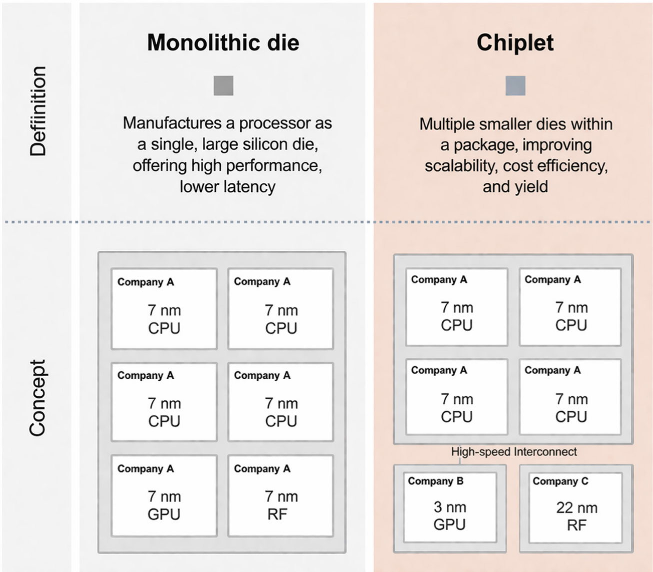



Figure 5: Chiplet-based architectures replace a single large die with multiple specialized dies integrated in one package, improving yield, flexibility and cost efficiency. (AI-generated)

Advanced packaging and **heterogeneous integration (2.5D/3D)** are key enablers of this shift. These technologies connect multiple chips vertically and horizontally within a single package, allowing them to function as one tightly integrated system. Performance, energy efficiency and functionality can therefore be increased without relying solely on leading-edge manufacturing nodes. This trend addresses one of Europe's most pronounced capability gaps and is particularly relevant for Swedish system applications with long lifetimes, high reliability and complex integration requirements.

In parallel, **AI-optimized and application-specific hardware architectures** are becoming increasingly important. Instead of using general-purpose processors, hardware can be tailored to specific tasks, delivering higher energy efficiency, predictable performance and tighter system integration. While leading-edge nodes remain important for peak performance, they are economically viable mainly at very large volumes and offer diminishing returns for many edge, real-time and safety-critical workloads. In such cases, architectural specialization delivers greater system-level gains than further scaling, making this trend highly relevant for industrial automation, autonomous systems, 5G/6G and defence.

**Photonics and optical interconnects** - technologies that use light rather than electrical signals to transmit information - are becoming critical for future communication, sensing and radar systems. This includes III–V compound semiconductors and hybrid integration approaches that enable high-speed, high-frequency and low-loss signal transmission. While European investments focus heavily on silicon photonics, there are clear opportunities to complement these efforts with application-driven photonics linked to RF, sensing and defence, areas where Sweden has strong competence.

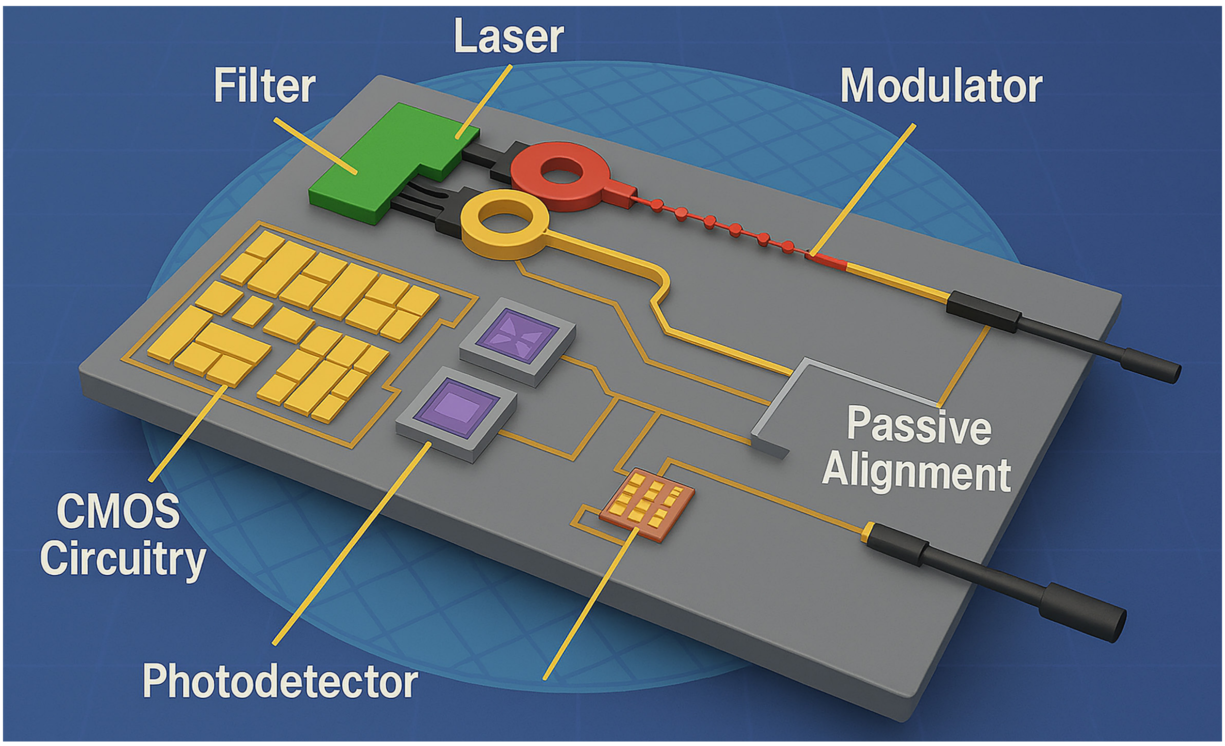



Figure 6: Photonic integrated circuits (PICs) integrate multiple optical functions, including light generation, modulation, routing and detection onto a single chip. PICs enable high-speed, energy-efficient communication and processing. (AI-generated)

These integration-driven trends also underpin the growing relevance of **quantum technologies**. Quantum systems rely on advanced semiconductor materials, specialized processes, heterogeneous packaging and cryogenic electronics operating at extremely low temperatures. While large-scale quantum computing remains a longer-term objective, near- and mid-term advances in quantum sensing, communication and enabling hardware already to depend on semiconductor-based platforms and tight system integration. Strengthening capabilities in semiconductors, photonics, RF and heterogeneous integration therefore directly supports quantum technology readiness.

Finally, **hardware-level security**, including roots of trust and physically unclonable functions (PUFs) - built-in hardware mechanisms that uniquely identify and protect devices against tampering and cloning - is becoming a strategic differentiator.

## European Semiconductor Value Chain Gaps

Despite recent European initiatives, including the EU Chips Act and the Chips Joint Undertaking (JU), structural gaps persist across the European semiconductor value chain. These gaps extend well beyond front-end fabrication and reflect weaknesses in scale, resilience, access and system integration across multiple stages.

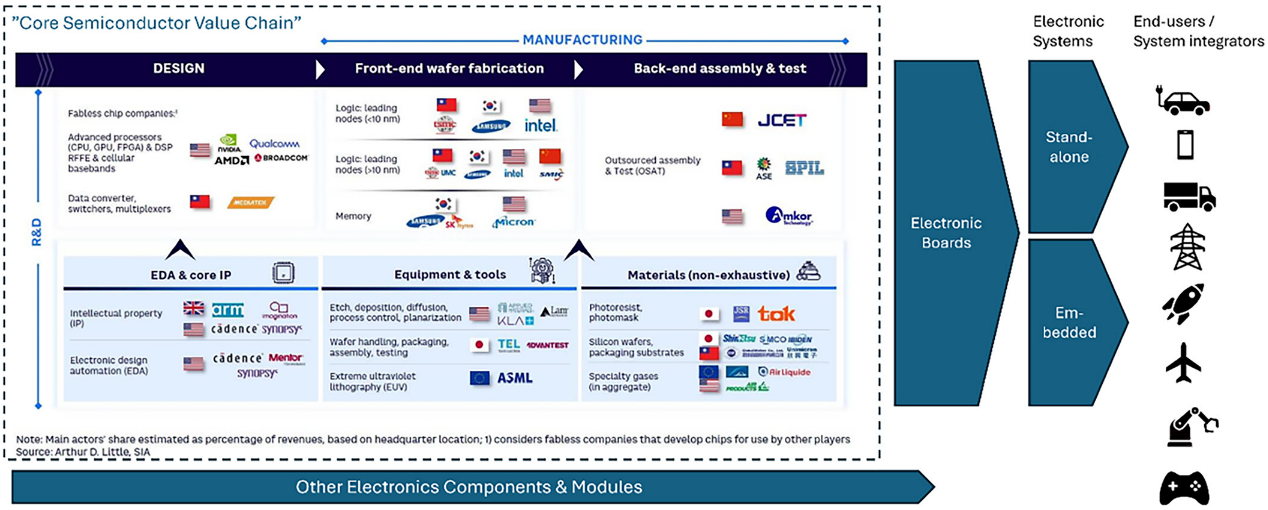



Figure 7: The core semiconductor value chain and its extension into electronics manufacturing and system integration. Source: Arthur D. Little, SIA, adapted

**Wide-bandgap power electronics**, primarily based on SiC and GaN and complemented by continued advances in silicon power devices, enable efficient handling of high voltages, high power levels and elevated temperatures. These capabilities are essential for electrification, energy infrastructure, vehicles and industrial systems. The trend combines high industrial relevance with strong security and resilience implications and aligns closely with Swedish industrial needs.

**MEMS technologies**, micro-electromechanical systems, that integrate tiny sensors and actuators directly on a chip, are increasingly important for autonomous systems, industrial automation, medical devices and defence. Sweden has strong competence in this field, built on decades of research and industrial activity and supported by an advanced MEMS ecosystem and manufacturing capabilities.

Europe retains strong capabilities in selected technologies and domains. However, the value chain as a whole remains fragmented and insufficiently coupled, limiting Europe's ability to translate semiconductor technologies into trusted, reliable and competitive industrial systems at scale and over long lifecycles. The most critical gaps relate to insufficient capacity, constrained access, weak industrialisation pathways and limited system-level integration across design, manufacturing, packaging, test and downstream electronics production.

Front-end fabrication is the wafer-level process where semiconductor devices are formed on silicon or compound semiconductor substrates. While front-end fabrication is capital-intensive, technologically specialised and highly concentrated globally, it alone does not deliver usable components. Competitive and trusted semiconductor-based systems require complementary capabilities across chip design, design tools (EDA) and IP, materials and equipment, back-end processes (packaging, test and qualification), and downstream electronics manufacturing and system integration.

Much of this value is realised through fabless and fab-light models, where companies focus on chip architecture and design while manufacturing is carried out by specialised external foundries. Semiconductor chip design is therefore becoming a decisive capability for a much broader set of system companies, not only for traditional semiconductor firms. Investments in semiconductor design capabilities, including access to advanced EDA tools, modelling and verification environments, and design IP, are increasingly essential to support this transition.

Europe's design strength, however, depends heavily on access to advanced EDA tools and design IP that are largely controlled by non-European providers and increasingly subject to export controls and usage restrictions. This dependency represents a strategic vulnerability, reinforcing the need to treat semiconductor design capability and its supporting infrastructure as a long-term strategic investment priority for Sweden and Europe.

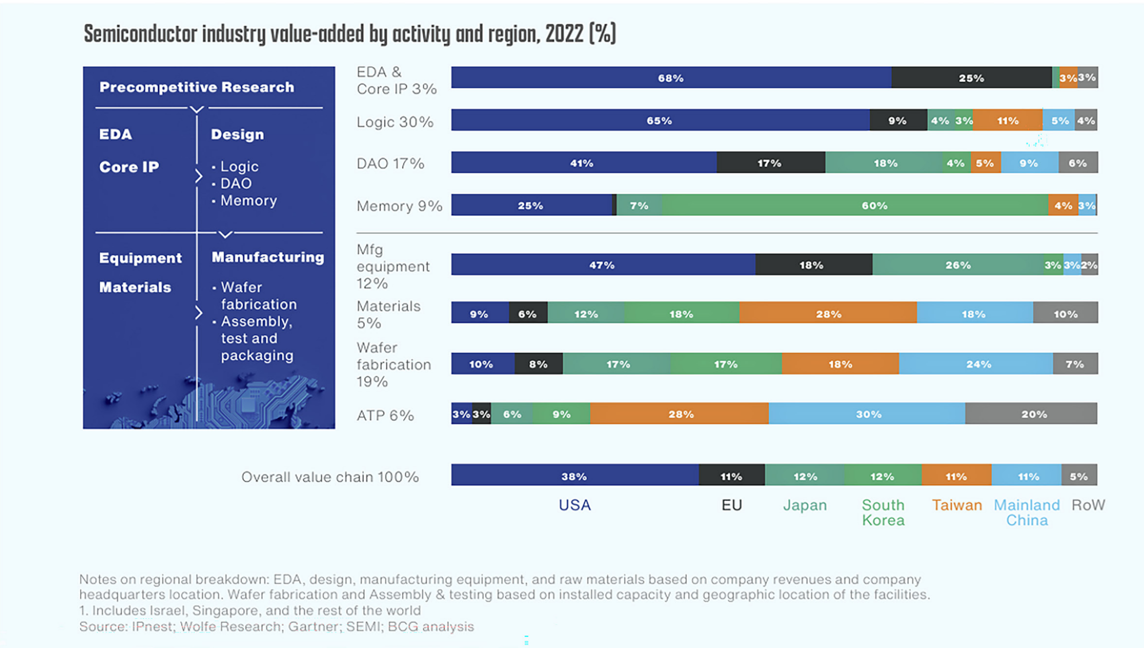



Figure 8: Semiconductor Value add by activity and region. Note ATP is "Assembly, Packaging and Test". Source: Boston Consulting Group, SIA (2024)

## Chip design as a strategic leverage point

Chip design is a key source of value creation and control in the semiconductor value chain, and one of Europe's relative strengths. Increasingly, system performance, energy efficiency, security and lifecycle behaviour are determined at the chip level rather than at the system level. As functionality and differentiation move into the chip, design capability becomes a central strategic asset, and maintaining competitiveness and control requires that this capability be actively strengthened and broadened.

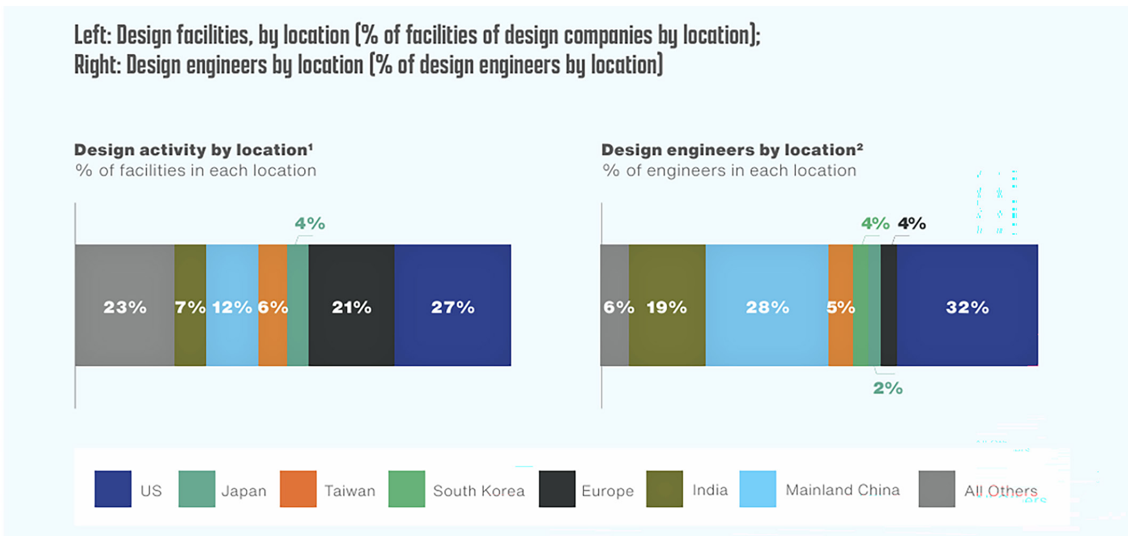



Figure 9: Semiconductor design activity and talent are highly concentrated geographically, with Europe holding a smaller share of global design facilities and engineers relative to its industrial dependence on semiconductors. Source: Boston Consulting Group, SIA

## Front-end fabrication and the foundry gap

Front-end fabrication is the wafer-level process where semiconductor devices are manufactured. While capital-intensive and technologically specialised, fabrication alone does not deliver usable components. Competitive semiconductor-based systems require complementary capabilities across design, materials, equipment, back-end processing and downstream electronics manufacturing.

Europe hosts several strategically important fabrication and foundry assets, including specialty foundries such as X-FAB, manufacturing operations by Global Foundries, planned capacity such as ESMC, integrated device manufacturers such as Infineon, and advanced-node manufacturing operated by Intel in Ireland. Together, these assets provide Europe with valuable manufacturing capability across a range of technologies.

However, Europe has limited availability of open-access, globally competitive foundry capacity that is broadly accessible to external customers across logic, mixed-signal, RF and specialty technologies. Much of Europe's fabrication capacity is either:

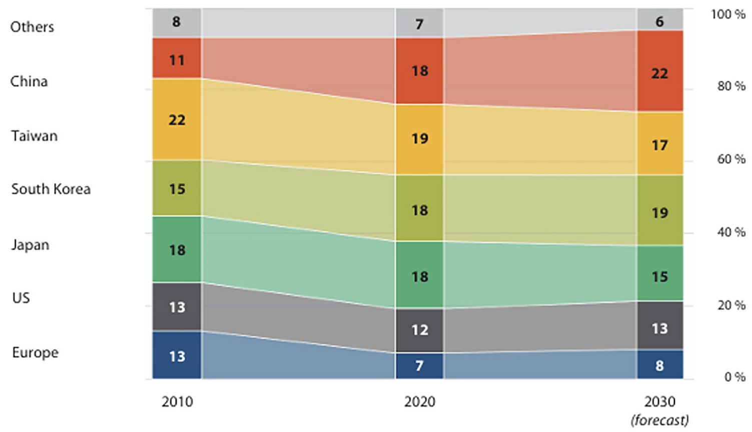
- Integrated within IDMs and optimised for internal product roadmaps
- Application-specific or customer-anchored
- Constrained in scale, technology scope or access flexibility

Advanced-node manufacturing in Europe is likewise largely tied to captive or vertically integrated production models, rather than open foundry services. As a result, European fabless and fab-light companies, including a growing number of system companies developing custom chips, remain structurally dependent on non-European foundries for both advanced and mature technologies. This dependence constrains access and flexibility, increases exposure to geopolitical and export-control risks, and limits Europe's ability to prioritise critical applications or secure supply under stress.

## Manufacturing gaps span leading-edge, mature and specialty technologies

Europe's manufacturing challenge therefore extends well beyond leading-edge nodes. Structural capacity and resilience gaps persist across parts of the mature and specialty manufacturing base that are critical for industrial, automotive, telecom, energy and defence applications. These gaps relate primarily to scale, surge capacity, long-term availability and access, rather than to missing technological know-how. This include:

- Limited scale and resilience in parts of the mature-node landscape (e.g. mixed-signal, power and RF),
- Constraints in the scalable deployment of specialty technologies, including wide-bandgap power devices and RF/mmWave technologies, and
- Insufficient availability of automotive-qualified capacity with long-term commercial and volume guarantees.




Note: All values shown in 200 mm wafer size equivalents; the chart excludes capacity below 5000 wafers starts per month or less than 200 mm. This reflexts the modern semiconuctor manufacturing facilities capacity where wafe diameter is greater than or equal to 200 mm.

Figure 10: Share of global chip capacity by region in 2010-2030. Global semiconductor manufacturing capacity remains highly concentrated geographically, with Europe holding a comparatively small and declining share. This concentration reinforces Europe's exposure to external supply risks and the need for a system-level resilience strategy. Source: EC analysis based on Boston Consulting Group and SIA (2024).

## Why fab investments in Europe are necessary – but not sufficient

Rebuilding semiconductor manufacturing capacity in Europe is necessary to ensure access, resilience and long-term technological relevance. However, neither individual countries nor Europe can economically replicate the full diversity, scale and specialisation of global semiconductor manufacturing.

Different chip categories rely on highly specialised process technologies, equipment stacks and integration know-how, and are subject to distinct qualification regimes, customer requirements and lifecycle constraints. Semiconductor manufacturing further requires long-term operational continuity and volume stability, rather than short-term scale-up. As a result, even substantial fab investments cannot on their own resolve Europe's resilience challenges, including security and competitiveness. Without complementary foundry access models, back-end capacity and industrialisation pathways, new fabrication capacity risks remaining application-constrained, underutilised or strategically brittle.

In addition, the European market is too small to sustain high-volume fabs based on domestic demand alone. Europe no longer hosts many globally dominant, high-volume semiconductor product platforms capable of fully loading advanced manufacturing capacity. Consequently, fab investments in Europe cannot be justified by an "independence" or self-sufficiency logic alone. They must be embedded in export-oriented strategies, linked to global markets and competitive end-use applications.

Strategic manufacturing capacity in Europe must therefore be combined with:

- Robust downstream capabilities, including advanced packaging, test, validation and system integration
- Trusted and diversified international manufacturing access
- Strong European coordination on capacity allocation, priority access and crisis response.

Without this broader system perspective, fab investments risk becoming underutilised, economically fragile and strategically ineffective - even if technically successful.

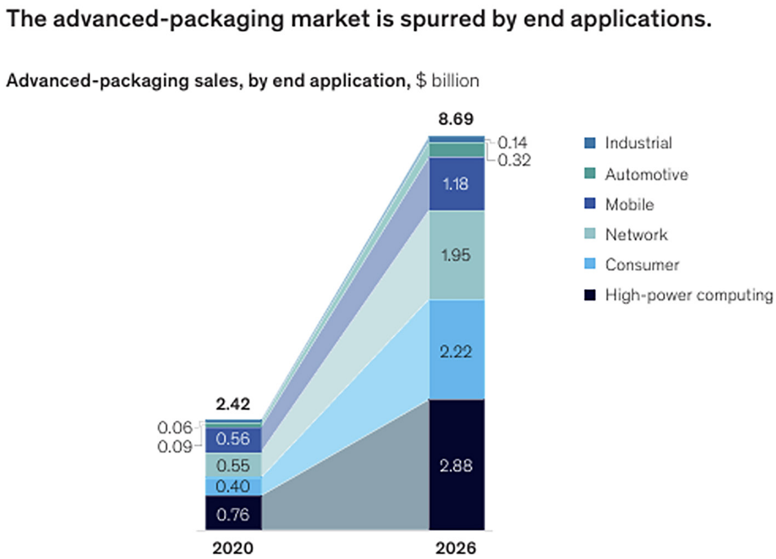



Figure 11: The advanced-packaging market is expected to more than triple between 2020 and 2026, driven by high-performance computing, networking and automotive applications. Source: Yole; McKinsey & Company.

## Back-end, industrialisation and lifecycle gaps

Across many semiconductor categories, Europe's most acute system-level constraints increasingly lie in back-end stages, including packaging, test, validation, qualification and lifecycle support, rather than in wafer fabrication. For many system-critical applications, these stages dominate performance, reliability, security and lifetime in industrial, automotive, defence and infrastructure systems, yet remain fragmented and insufficiently scaled in Europe.

These constraints are particularly evident in system-intensive technologies such as analog and mixed-signal components, RF and micro-wave systems, power electronics modules, sensors and MEMS, heterogeneous and chiplet-based architectures, and high-reliability components for safety-critical applications. Although many rely on mature process nodes, their demanding requirements place disproportionate importance on back-end capabilities.

"Europe no longer hosts many globally dominant, high-volume semiconductor product platforms capable of fully loading advanced manufacturing capacity.Consequently, fab investments in Europe cannot be justified by an "independence" or self-sufficiency logic alone.

Several technologies below rely mainly on mature manufacturing processes, but impose demanding requirements on reliability, traceability, qualification and lifecycle support that place disproportionate importance on back-end capabilities.

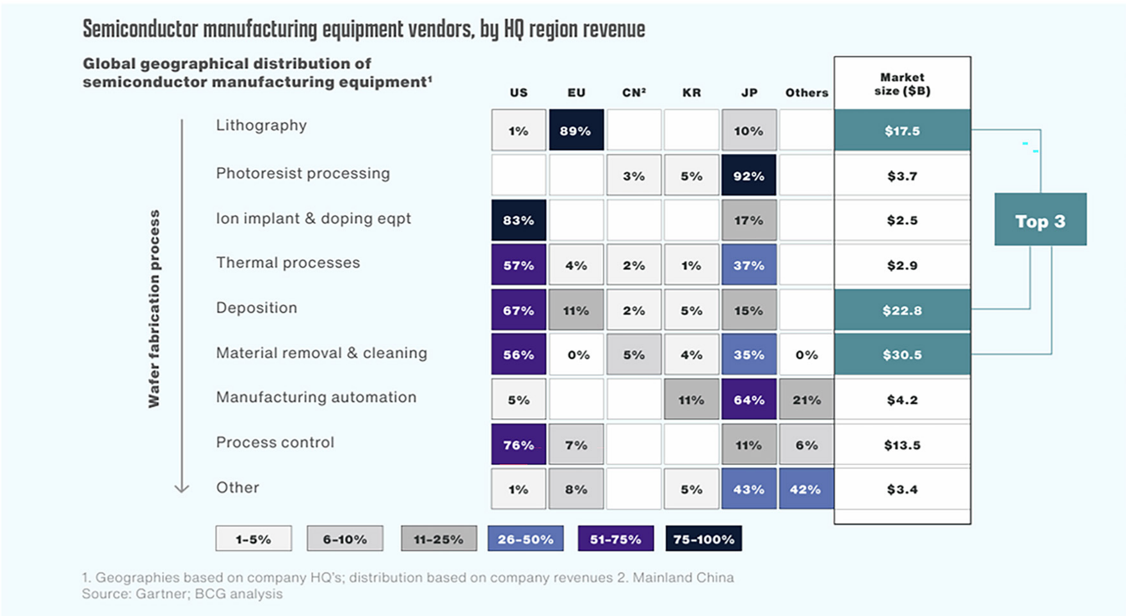
- RF, microwave and millimeter-wave technologies, where advanced packaging, calibration and system-level validation are critical.
- Power electronics modules (SiC/GaN), where thermal management, reliability and lifetime dominate system performance.
- Sensors, MEMS and mixed-signal components, which require application-specific packaging, calibration and long-term qualification.
- Heterogeneous and chiplet-based systems, combining logic, memory, RF, photonics and power.
- High-reliability and safety-critical components for defence, space, energy and industrial infrastructure.

## Manufacturing equipment and process technologies as a strategic leverage

Beyond fabrication capacity itself, control over the technologies that enable manufacturing, including semiconductor equipment, metrology and process integration, shapes yield, reliability, performance limits and technology roadmaps across the entire value chain. OECD analysis highlights that leadership in selected equipment segments can deliver disproportionate strategic influence, even without large domestic fabrication capacity.

Europe’s position in this area is exemplified by ASML in the Netherlands, whose globally unique leadership in advanced lithography underpins semiconductor manufacturing worldwide and demonstrates how system-critical equipment capabilities confer strategic leverage far beyond national production volumes.

While Europe cannot and need not replicate the full global equipment landscape, selective leadership in system-critical equipment and process technologies can strengthen resilience, reduce dependency risks and reinforce downstream integration. Countries with strong precision engineering and process know-how can therefore create disproportionate strategic leverage by anchoring critical positions in the semiconductor value chain.


Semiconductor manufacturing equipment vendors, by HQ region revenue

Global geographical distribution of semiconductor manufacturing equipment[1]

| Wafer fabrication process | US | EU | CN[2] | KR | JP | Others | Market size ($B) |
|---|---|---|---|---|---|---|---|
| Lithography | 1% | 89% | | | 10% | | $17.5 |
| Photoresist processing | | | 3% | 5% | 92% | | $3.7 |
| Ion implant & doping eqpt | 83% | | | | 17% | | $2.5 |
| Thermal processes | 57% | 4% | 2% | 1% | 37% | | $2.9 |
| Deposition | 67% | 11% | 2% | 5% | 15% | | $22.8 |
| Material removal & cleaning | 56% | 0% | 5% | 4% | 35% | 0% | $30.5 |
| Manufacturing automation | 5% | | | 11% | 64% | 21% | $4.2 |
| Process control | 76% | 7% | | | 11% | 6% | $13.5 |
| Other | 1% | 8% | | 5% | 43% | 42% | $3.4 |



1. Geographies based on company HQ's; distribution based on company revenues 2. Mainland China
Source: Gartner; BCG analysis

Figure 12: Semiconductor manufacturing equipment markets are highly concentrated, with Europe, the United States and Japan dominating most system-critical segments. Leadership in these technologies provides disproportionate strategic leverage over semiconductor manufacturing and technology roadmaps, even without large domestic fab capacity. Source: Gartner, Boston Consulting Group.

## Extended electronics value chain: PCB, assembly and manufacturing competence

Over time, high-volume, cost-driven electronics manufacturing has largely been outsourced from Europe, creating structural vulnerabilities in parts of the extended electronics value chain - particularly in advanced PCB manufacturing and large-scale electronics assembly (PCBA). While this has improved short-term cost efficiency, it has increased dependence on external manufacturing ecosystems and shifted sustainability and supply-chain risks outside Europe.

Importantly, Europe retains strong capabilities in low- to medium-volume, high-complexity and high-reliability PCB manufacturing and assembly, and hosts leading suppliers of electronics manufacturing and test equipment. This indicates that critical process and industrial know-how remain present, albeit unevenly distributed and insufficiently scaled.

However, the erosion of high-volume manufacturing has weakened hands-on industrialisation experience and reduced Europe's ability to scale production, optimise costs and absorb manufacturing shocks. This, in turn, disrupts the feedback loop between design, manufacturing, packaging and system integration - especially for technologies transitioning from industrial niches to broader deployment.

Even when large-scale manufacturing is performed abroad, domestic manufacturing competence remains strategically critical. It is essential for qualifications, lifecycle management, security, system integration and engineering education. Without such hands-on industrial exposure, Europe's design and system capabilities risk becoming increasingly abstract, undermining long-term technological leadership.

## Critical raw materials - a cross-cutting vulnerability

Semiconductor and advanced electronics value chains depend on critical raw materials, including high-purity silicon, compound semiconductor materials (such as SiC and GaN), specialty metals, chemicals and advanced substrates. Europe is highly dependent on a small number of non-European suppliers, with significant concentration in countries that have used export controls and trade restrictions as policy tools. These dependencies constitute a systemic vulnerability. Disruptions at the materials level can therefore propagate quickly into fabrication, packaging, qualification and downstream electronics manufacturing.

While raw materials are not the primary focus of this strategy, diversification of supply, trusted processing and purification, and materials engineering and qualification competence are essential to value-chain resilience. In this context, Sweden and the Nordic region possess underutilised material resources and processing capabilities that can contribute to European resilience — not by eliminating dependencies, but by reducing exposure and increasing strategic optionality when combined with downstream industrial capabilities.

See appendix C for a list of critical raw materials concentrated among a few sub tier component suppliers.

## The Swedish Semiconductor Ecosystem

The Swedish semiconductor ecosystem is relatively small but broad, comprising on the order of 80 core actors in the direct semiconductor value chain, and approximately 120 when components and modules are included. The ecosystem is dominated by fabless companies, manufacturing- and process-enabling equipment suppliers, and research and development infrastructure. The presence of own fabs, pure foundry services and fully integrated device manufacturers is limited, with MEMS as a notable exception.

A defining characteristic of the ecosystem is its strong SME orientation. Most companies are small or micro-sized, particularly within fabless design, components and modules, and specialised equipment and process technologies. This structure implies high innovation capacity and significant long-term scaling potential, but also a strong dependence on access to external manufacturing, packaging and industrial qualification capabilities. SME growth is further constrained by limited access to long-term investment capital and persistent shortages of specialized talent.

Although Sweden lacks large-scale foundries, it hosts several globally significant niche manufacturing and manufacturing-enabling capabilities. Silex Microsystems is one of the world's leading MEMS foundries, providing Sweden with a unique position in MEMS manufacturing at mature nodes. In photonics, Sweden has strong research and early industrial activity across silicon and non-silicon integrated photonics and advanced materials, even though volume manufacturing is largely external.

On the manufacturing-enabling side, Mycronic holds a world-leading position in mask writers for mature nodes, supplying essentially the entire global market in this segment and representing one of Sweden's strongest leverage points in the global semiconductor value chain. The ecosystem also includes several smaller but technology leading in areas such as vacuum technology, precision motion, metrology, RF components, epitaxy, materials and process equipment, which are critical enablers for semiconductor manufacturing worldwide.

An important strength not fully visible in company statistics is the role of system companies integrating advanced electronics. Companies such as Ericsson and Axis Communications possess world-leading in-house semiconductor design and system architecture capabilities tightly coupled to RF, sensing, computing and secure systems. Security- and safety-critical system requirements, including long lifecycles, hardware trust and evidence integrity, create strong demand for trusted chip design, validation and supply-chain control. These capabilities are primarily used for internal product development rather than offered externally, but they play a critical role in anchoring advanced semiconductor competence, driving demanding system requirements, and shaping Sweden's position in future domains such as 6G, advanced sensing and secure, mission-critical electronics.

In addition, several leading global semiconductor companies maintain sales, application support and customer-facing operations in Sweden, reflecting strong system-level demand and advanced users. In a few cases, this presence also includes development activities. This underscores Sweden's role as a high-value market and integration environment for advanced semiconductor-based systems.

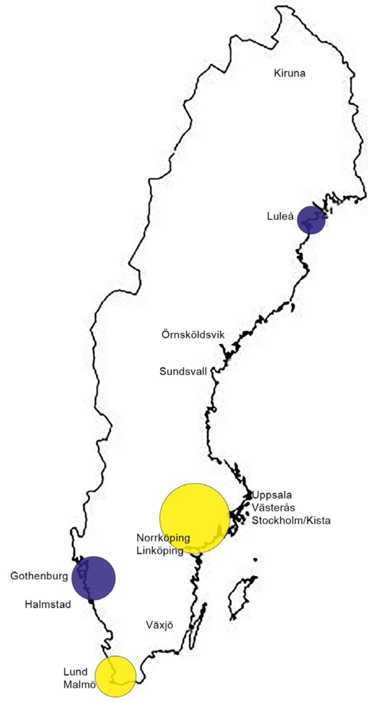



Figure 13. Sweden's semiconductor ecosystem is concentrated in regional hubs, reflecting a cluster-based structure centred on system companies, specialized SMEs and research infrastructure.

Geographically, activity is concentrated in hubs, see figure 13.

- North of Sweden – Focus on advanced materials, mineral supply chains, and renewable energy (space and satellite systems, climate tech, and large-scale computing).
- Stockholm/Uppsala/Västerås – IC design, RF & photonics, telecom ASICs, power electronics (telecommunications, defence, advanced sensing, MEMS and manufacturing-enabling technologies, and industrial electronics).
- Gothenburg & Halmstad – system design, RF/mm-wave, quantum technology and 2D materials (automotive electronics, radar systems, and communication technologies).
- Linköping & Norrköping – advanced materials, wide-bandgap semiconductors and advanced processes (power electronics, sensors, printed electronics, and next-generation computing systems).
- Lund/Skåne – nanoelectronics, MEMS, materials and advanced sensing technologies (communications, photonics, life science instrumentation, and medical technologies).

Within power electronics and wide-bandgap semiconductors, Sweden has one of its most coherent national positions across materials research, epitaxy, device physics, system integration and end-user demand. Strong industrial pull from automotive, energy, industrial automation and defence applications provides a credible foundation for system-driven innovation in this area, even where upstream device manufacturing remains accessed through European partners. Existing industry-led coordination initiatives indicate that value-chain collaboration is feasible when anchored in system requirements and industrial deployment.

Industrial-grade advanced packaging and high-volume test and validation remain clear structural gaps. Sweden does, however, have a well-established base of academic cleanroom infrastructure. Cleanrooms at KTH, Chalmers, Lund University and Uppsala University are coordinated through the Myfab network, enabling advanced prototyping and early-stage development, including for industrial and commercial users. In addition, RISE, together with partners, operates limited small-scale production and pilot activities, including at the KTH-owned Electrum Laboratory in Kista and the ProNano infrastructure in Lund.

These facilities are primarily designed for research, prototyping and early validation. They do not provide the scale, certification, availability or service-based access required for industrial qualification, pre-production and market entry. Bridging this gap from strong research infrastructure to industrial-grade pilot production and qualification, remains one of the central challenges addressed by this strategy.

As a result, while Sweden has strong research-oriented test, characterisation and validation capabilities, capacity for industrial qualification, advanced packaging and OSAT-like services remains limited. Many Swedish fabless companies and system developers therefore depend on external partners, often in Asia, for packaging, volume testing and manufacturing scale-up.

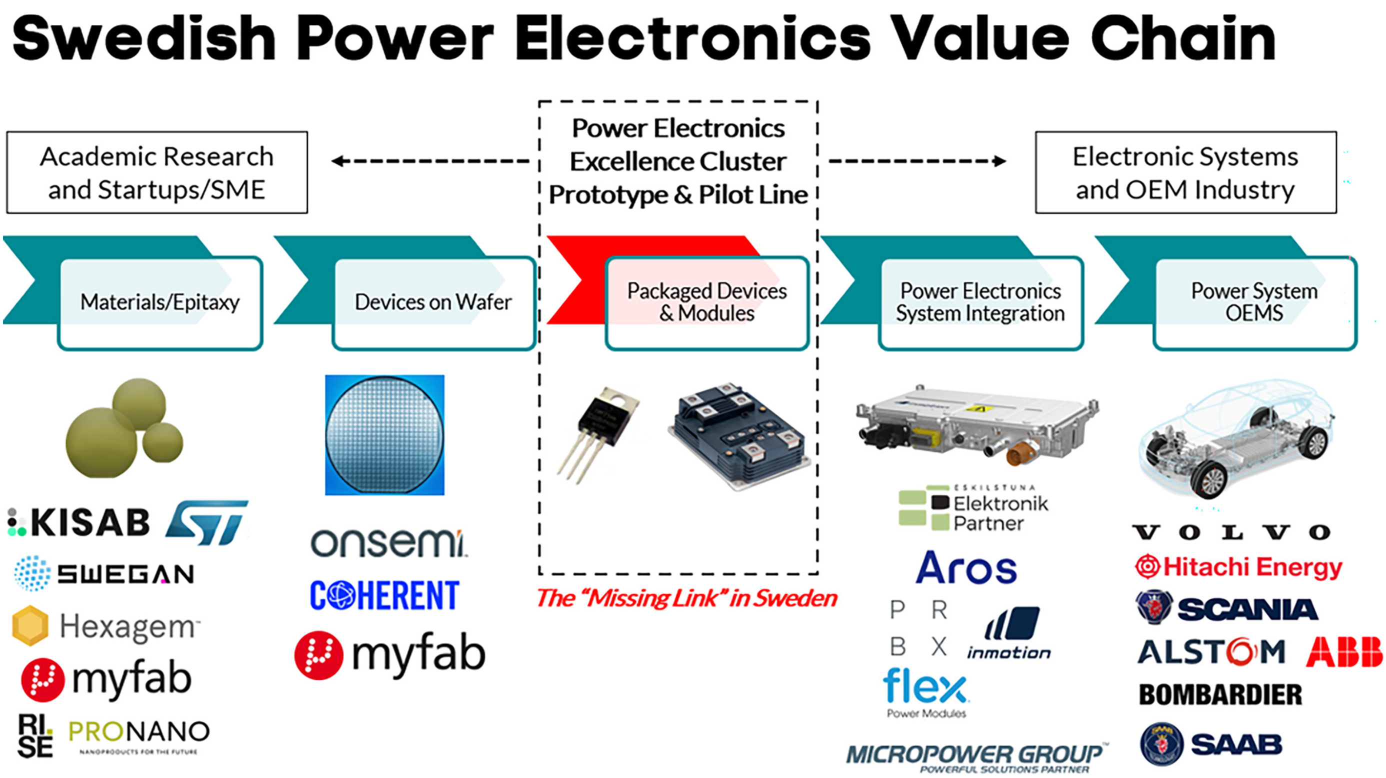



Figure 14: The Swedish power electronics value chain (SiC and GaN). Power electronics based on SiC and GaN form Sweden's most coherent semiconductor ecosystem, from materials research to system integration and end-user industries. The lack of industrial-scale packaging, testing and power module production is an essential "missing link" for industrialization and growth. Source: RISE

## Current ecosystem initiatives and coordination structures in Sweden

- **Semiconductor Sweden** serves as the national industry platform and coordination forum for the semiconductor ecosystem. Its role is to connect actors, provide visibility, support agenda-setting and represent Swedish semiconductor interests nationally and at international level. Semiconductor Sweden does not operate infrastructure, fund R&D or deliver technical services.
- **Swedish Chips Competence Centre (SCCC)** is Sweden's node in the European network of competence centres established under the EU Chips Act. Its primary function is to facilitate access for SMEs and startups to knowledge, design support, pilot lines, MPW services, testing and European facilities. SCCC acts as an access and navigation function rather than as an owner or operator of industrial capabilities.
- **National competence centres and RTO-led initiatives**, primarily involving RISE and universities, focus on capability development, research infrastructure and technical competence in selected parts of the semiconductor value chain. These environments are essential for research, prototyping, methods and skills development, but are generally not structured to provide industrial-scale, service-based delivery aligned with commercial requirements.
- **Academic excellence clusters and research programmes** concentrate on scientific excellence, long-term knowledge generation and talent supply. Their contribution lies in people, ideas and advanced research rather than industrialisation, scaling or sustained operational delivery.

## Summary of Strategic Opportunities for Sweden

Based on global trends, emerging technologies, European value-chain gaps and Sweden's current positioning

Europe's semiconductor challenge cannot be addressed through fab investments alone. While targeted investments in leading-edge, mature and specialty manufacturing are necessary, long-term competitiveness, resilience and security require a broader system perspective that strengthens integration, qualification, industrialisation and trusted international collaboration.

Against this backdrop, Sweden's strategic opportunity lies in addressing critical European value-chain gaps where system competence, reliability and integration are decisive. Rather than competing on volume manufacturing, Sweden can build high strategic leverage by strengthening and combining capabilities in areas where it already holds strong positions and where European needs are most acute.

### Sweden can focus on:

- System and chip design capabilities, especially in RF, analogue, mixed-signal and application-specific architectures for mission-critical systems
- Advanced packaging and heterogeneous integration, enabling the integration of RF, photonics, power and sensing into qualified system-level modules
- Test, validation and qualification for high-reliability, safety- and security-critical electronics
- Power semiconductor technologies, particularly wide-bandgap materials such as silicon carbide and gallium nitride
- Industrialisation and system integration for secure, low-volume, long-lifecycle and high-reliability applications
- Manufacturing-enabling technologies and equipment, where Swedish companies already play important roles in the global semiconductor value chain

By strengthening these capabilities and embedding them more deeply in **European semiconductor and electronics ecosystems**, Sweden can achieve disproportionate strategic leverage, enhance European resilience and competitiveness, and secure a **durable role as a trusted system-level partner.**

# B: Vision and Objectives for 2035, and suggested Action Program

## Vision

Sweden shall remain and further strengthen its position as a leading industrial nation. Long-term competitiveness, innovation capacity, and economic growth shall be supported through technological leadership and strategic investments in strategic technologies such as advanced electronics and semiconductors.

Sweden shall establish a distinct international position in semiconductors and contribute to strengthening Europe's competitiveness, security, resilience, and strategic autonomy. Sweden shall act as a trusted partner in global value chains with like-minded countries.

## Objectives

The strategy aims to:

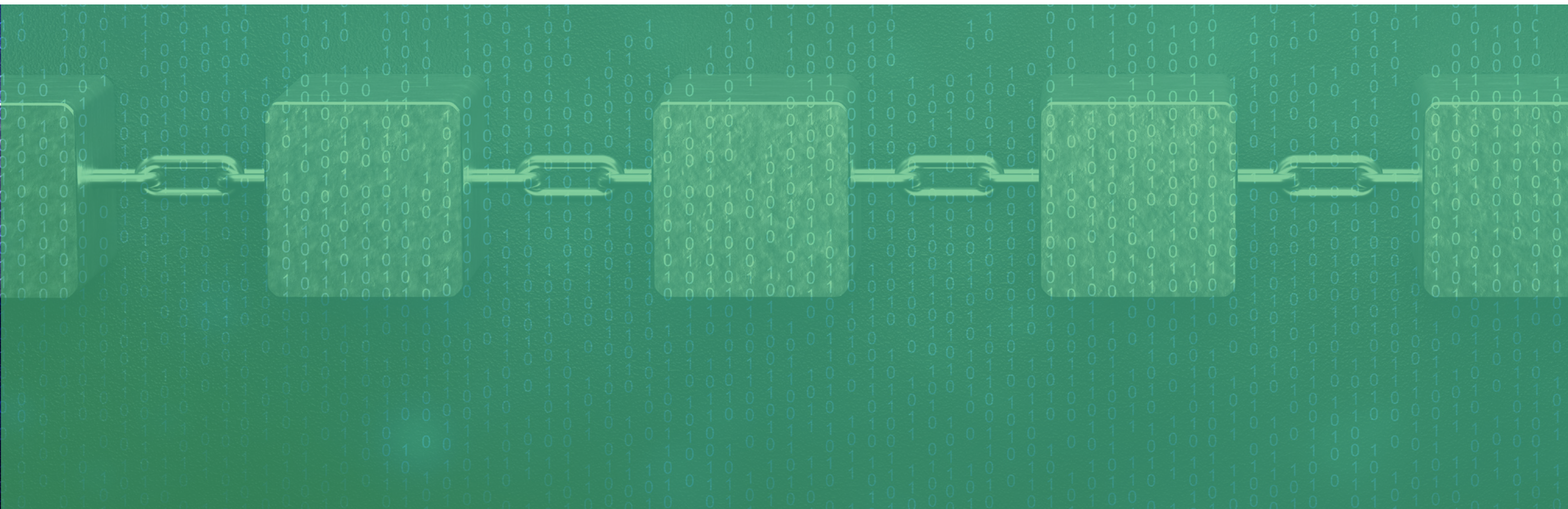
- Establish Sweden as a leader in selected high-impact semiconductor domains and strategically critical capabilities
- Ensure secure access to critical semiconductor technologies
- Increase employment in the electronics and semiconductor industry
- Strengthen the position of Swedish companies in European and global value chains
- Increase the number of startups and scale-ups in deeptech

### 1. Strategic national coordination and international positioning

A national platform, here called the Program for Advanced Electronics, PAE, similar to the existing Program for Advanced Digitalization. This strategic program needs to be funded by public and private partners and should give the industry structured access to technical and scientific expertise, financing projects through open calls. It could be initialized by a "coalition of the willing", i.e. corporations, research institutes, universities and agencies willing and able to support the platform. The PAE should also have the role of coordinating national actions across ministries, agencies (e.g. Vinnova, Tillväxtverket, VR, FMV) and potential industrial partners for participation in European pilot lines, programs and funding, and be a natural speaking partner for e.g. Chips JU and microelectronics IPCEIs.

### 2. Strategic leadership in selected semiconductor domains

By leading in selected, highimpact semiconductor domains and niches, Sweden strengthens its system industries and secures a trusted and influential position in European and global semiconductor value chains. This leadership is built on industrial and technological expertise that already exists in Swedish companies and research environments and is realized through effective national coordination.



### 3. Research, skills, and talent

Long-term investments in research excellence, alongside the expansion of engineering and specialist education, are essential to build a strong foundation. At the same time, industrial PhD programs and increased mobility between academia and industry should be developed to enhance knowledge transfer. In addition, supporting the creation of deeptech companies is essential to translate research into innovation and competitiveness.

### 4. Long-term scale-up financing

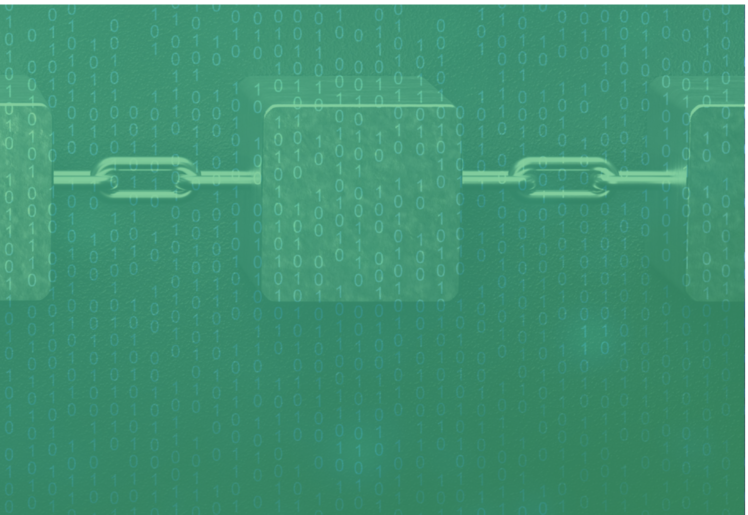
Predictable public–private investment frameworks enable companies to scale from prototype and pilot production to early industrial manufacturing and global markets, supporting long-term competitiveness and value creation in Sweden.

### 5. Faster innovation and scale-up

A strong, collaborative ecosystem enables joint systemlevel problem solving and accelerates the transition from prototypes to industrially qualified products through shared capabilities in system architecture, integration and industrialization.

### 6. Capabilities enabling competitive, robust and secure electronics

Shared national capabilities in system and chip design, advanced packaging and integration, and test, validation and metrology - combined with coordinated access to pilot and pre-production facilities - enable secure, robust and high-performance electronics and strengthen the competitiveness of Swedish companies across telecom, defence, automotive, energy and industrial applications.



### 7. Strengthening European strategic autonomy

Sweden contributes to European strategic autonomy and supply-chain resilience by addressing critical value-chain gaps, particularly in advanced packaging, test, validation and metrology, system architectures, and key enabling technologies such as photonics, RF and microwave systems, and wide-bandgap power electronics.

### 8. Trusted partnerships and resilient supply

Strong partnerships with countries that share robust regulatory frameworks, export control regimes and security standards ensure access to critical semiconductor technologies and materials, reduce supply-chain and geopolitical risks, and reinforce Sweden's role as a trusted and reliable partner in the global semiconductor ecosystem.

### 9. National preparedness and trusted production

National resilience is strengthened through systematic supply-chain risk monitoring and early-warning mechanisms, closely linked to European initiatives. Security of supply for defence and critical infrastructure is reinforced through trusted European and Swedish-based final process steps - such as packaging, testing and validation - reducing dependence on non-EU supply chains for the most sensitive applications.

## Monitoring

Key indicators include:

- employment and investment levels
- number of scaleups and new companies
- participation and leadership in EU programs
- availability of strategic capabilities
- resilience of supply chains

A baseline shall be established at the start of the strategy (e.g. 2026).

# Strategic Priorities

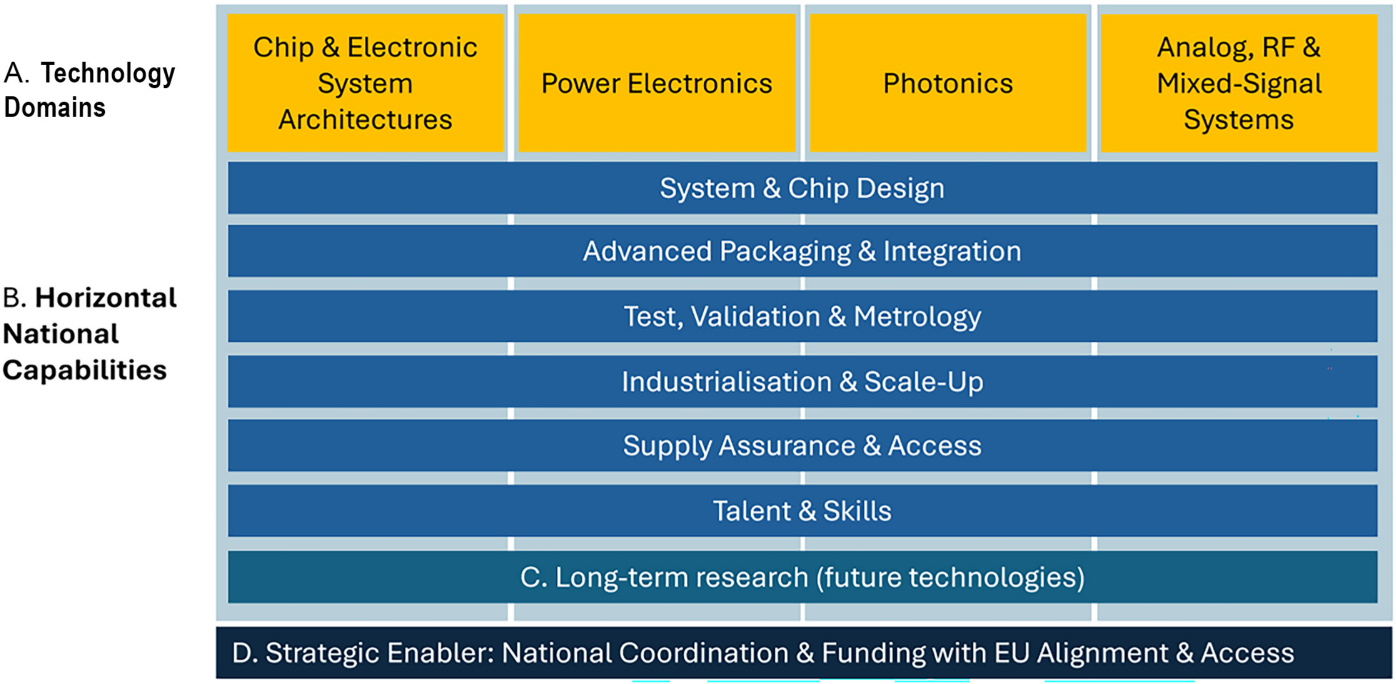



Figure 15. Overview of the Swedish semiconductor strategy. A: Priority Technology Domains; B: Cross-cutting capabilities and infrastructures; C: Long-term research and future technologies; D: Strategic enabler for national coordination and EU alignment.

## How the strategy is structured

Sweden's semiconductor strategy is designed to deliver industrial impact through a three-layer logic: Focus, enable and advance. National efforts are focused on four Priority Technology Domains, leadership is enabled through six shared national capabilities, and long-term competitiveness is advanced through sustained research that prepares Sweden for technology shifts beyond 2035. The domains define what Sweden builds leadership in, while the capabilities define how it is enabled and scaled. Coordinated national and EU funding and alignment act as strategic enablers across all three layers, turning industrial strengths into influence.

## What Sweden should focus on: Four Priority Technology Domains

At the core of the strategy are four Priority Technology Domains, shown in the top layer of Figure 15 (A), which define where Sweden should concentrate its efforts to achieve industrial impact and strategic relevance. The strategy focuses on selected niches within these domains, where Sweden has strong industrial relevance, established capabilities and realistic potential for a leading position in European, while ensuring that national investments reinforce and complement European initiatives rather than duplicate them.

- Chip and Electronic System Architectures - Architecture-level leadership in advanced electronic systems, including SoC, multi-chip and heterogeneous solutions, that determine performance, energy efficiency, security and lifecycle behaviour in mission-critical applications for Swedish system companies.
- Power Electronics - Central to electrification, energy efficiency and industrial and automotive systems where Sweden has strong industrial positions.
- Photonics - Enabling technology for sensing and communication, with focus on selected niches where Sweden has existing capabilities and strong system-level integration.
- Analog, RF and Mixed-Signal Systems, including microwave and mmWave technologies - Underpin wireless communication, radar and sensing technologies critical to connectivity, security and defence.

## How Sweden enables leadership: Horizontal National Capabilities

The four Priority Technology Domains are enabled by six Horizontal National Capabilities, which represent Sweden's most important long-term structural commitments. These foundational capabilities cut across technologies and industries and are essential for competitiveness, resilience, and industrial scale-up. The strategic need for these capabilities is shared across the priority domains; however, their technical realization and focus may differ by domain, reflecting distinct requirements in areas such as RF, photonics, power electronics and system architecture.

- System and chip design - Translating system-level requirements into chip- and electronic-system architectures through specification, partitioning and cross-domain co-design, spanning SoC, multi-chip and heterogeneous solutions.
- Advanced packaging and integration - Integrating diverse semiconductor technologies into complete electronic systems using advanced packaging, chiplet and integration approaches.
- Test, validation and metrology - Verifying performance, reliability, security and compliance of chips and electronic systems across development, qualification and lifecycle.
- Industrialisation and scale-up support - Transitioning technologies from development to production through process development, qualification, supply-chain readiness and manufacturability support.
- Supply security and access - Securing reliable access to critical technologies, materials, manufacturing capacity and tools across trusted supply chains.
- Talent and skills - Attracting, developing and retaining the advanced technical and system-level skills required across the semiconductor value chain.

## How Sweden stays ahead: Long-term Research (future technologies)

Alongside near- and mid-term priorities, Sweden's semiconductor strategy recognizes the critical role of long-term research (C in Figure 15) in safeguarding scientific excellence and technological leadership, while enabling Sweden to respond to emerging opportunities in the 2030–2040 timeframe. Sustained competitiveness depends on excellence in both fundamental and applied research, anchored in industrial system-level challenges and future technology needs.

At the same time, staying ahead requires ambitious technological innovation and development in industry. Start-ups, scale-ups and established system companies play complementary roles in advancing technologies beyond the laboratory toward industrial deployment. The strategy emphasizes the need for effective collaboration models that connect research environments with industrial innovation enabling early, structured cooperation between smaller technology companies and large system integrators. Such collaboration is essential to share risk, accelerate validation in real system contexts, and ensure that promising technologies can be integrated, scaled and retained within the Swedish and European semiconductor ecosystem.

The strategy deliberately avoids prescribing fixed long-term research tracks. Instead, priorities evolve from industrial system challenges identified through lead-user programs, system demonstrators and system-level validation. This ensures industrial relevance and impact while preserving scientific openness, academic excellence and exploratory freedom.

## What ties it together: Strategic Enabler - National Coordination & Funding with EU Alignment and Access Funding

As indicated above, effective national coordination across ministries, agencies, strategic programs, academia and industry, is a critical enabler of Sweden's semiconductor strategy. It ensures that Sweden's industrial and technological strengths are coherently mobilized and strategically positioned across priority technology domains, national capabilities and long-term research tracks, enabling Sweden to act as a coherent system actor rather than a collection of disconnected initiatives. The Program for Advanced Electronics would fulfil this role, in collaboration with relevant agencies.

International positioning is a central strategic role of national coordination, ensuring that Sweden is represented by knowledgeable, technically credible actors in European and global initiatives, with a clear mandate to articulate national priorities and system roles. Through expert-driven participation in European programs, partnerships, roadmaps and standardization activities, Sweden secures influence and a durable seat at the global semiconductor table. Domain-specific delivery platforms function as Europe-facing interfaces, aggregating national competence and enabling leadership in projects and work packages rather than fragmented participation.

### Technology scouting and transition function

As part of national coordination, a dedicated function is suggested to continuously identify, assess and guide emerging semiconductor technologies, materials and integration approaches into Sweden's priority domains. This function supports evidence-based prioritization, early evaluation and timely transition into pilot activities and European programs, ensuring that national investments remain adaptive, forward-looking and aligned with industrial needs and European roadmaps.

## Sweden's Priority Technology Domains

The strategy focuses on selected niches within the domains below, where Sweden has strong industrial relevance, established capabilities and realistic potential for a leading position in European, The PAE is suggested be the primary mechanism to realize the different suggested hubs and centres, to strengthen the national semiconductor infrastructure.

### Chip and Electronic System Architectures

**Future competitiveness, security and value creation in advanced electronics increasingly depend on electronic system architectures, spanning both chip- and system-level design decisions, rather than on individual chips or SoCs considered in isolation. This creates a strategic opportunity for Sweden to lead where its system industries are strongest.**

#### Why this matters for Sweden

• System-level leverage: Value creation, differentiation and control increasingly move to system architecture and integration, areas where Sweden's system industries have global strength.

• European gap and strategic position: Europe lacks mature chiplet and heterogeneous integration ecosystems; leadership here gives Sweden a seat at the table without building leading-edge fabs.

• Future-critical applications: AI compute, 5G/6G, advanced sensing, autonomy and secure defence systems increasingly depend on heterogeneous integration to deliver performance, energy efficiency and cost-effectiveness, and - when architected accordingly - support system-level trust through secure partitioning, verification and supply-chain resilience.

#### What this area covers

This domain focuses on heterogeneous integration and chiplet-based system architectures that combine compute, memory, analog/mixed-signal functions, RF/microwave, photonics, power and sensing into tightly integrated, energy-efficient and cost-effective systems, including security- and safety-critical system architectures with embedded hardware trust, secure partitioning and long-lifecycle integrity requirements.

### Goal

Advance next-generation electronic system architectures that integrate chiplet-based and heterogeneous combinations of analog/mixed-signal, RF, microwave, photonic, power and sensor technologies to deliver secure, high-performance and energy-efficient platforms for AI computing, advanced sensing and communication across industrial, telecom, mobility and defence applications.

## Key actions, suggested

• Competence Hub for Heterogeneous System Integration and Demonstrators

Establish a national, industry-led competence hub to coordinate and strengthen Swedish capabilities in heterogeneous and chiplet-based system integration. The hub will provide access to expertise, demonstrators, shared methods and European infrastructures (e.g. Chips JU pilot lines), reinforcing rather than duplicating EU investments, and serve as a local point for competence-building and structured collaboration between industry, research and European initiatives.

• Industry-driven lead-user programmes for system architecture development

Enable leading system companies to define future system architectures and requirements, and to drive challenge-driven and collaborative development with smaller technology companies and research actors, anchored in real industrial deployment.

> "Establish a national, industry-led competence hub to coordinate and strengthen Swedish capabilities in heterogeneous and chiplet-based system integration. The hub will provide access to expertise, demonstrators, shared methods and European infrastructures

• Coordination of Swedish participation in EU system-architecture programs

Strengthen and coordinate Swedish participation in European programs on system architectures, heterogeneous integration and secure electronics to build national architecture competence, influence standards, interfaces and roadmaps, and secure access to shared platforms and methods, including system-level security, trusted supply chains, critical materials and hardware assurance, without sharing proprietary system designs.

## Power Electronics & High-Performance Compound Semiconductors

**Power electronics are critical for Sweden because they underpin electrification, energy efficiency and industrial competitiveness across automotive, energy systems, data centres, industrial automation and defence – areas where Sweden has strong system industries and strategic interests. Advanced power electronics represent a strategic leverage point where Sweden can translate strong research and industrial demand into leadership through system integration, rather than device-scale manufacturing.**

### Why this matters for Sweden

• Enabler of electrification and energy system resilience: Advanced power electronics are essential for efficient and reliable electrification of transport, industry and energy systems that underpin Sweden's economy.

• Energy efficiency and sustainability at system level: Power electronics represent one of the most effective levers for reducing lifetime energy consumption and environmental impact across electrified transport, energy infrastructure and industrial systems. Even marginal efficiency gains translate into disproportionate reductions in energy losses, cooling demand, material stress and system operating costs over long lifecycles.

• Strong national competence with system-level leverage: Sweden has deep research and industrial expertise in SiC and GaN technologies, reliability and operation in harsh environments, combined with strong system-level industrial demand - while value creation and competitiveness are concentrated in integration, modules and qualification rather than fabs.

• Addresses European bottlenecks and resilience needs: Packaging, module integration and qualification remain European gaps; addressing these strengthens resilient and trusted power electronics supply chains for civil and defence applications.

### What this area covers

This priority domain focuses on wide-bandgap and advanced compound semiconductor technologies for high-performance power electronics, spanning materials, devices, modules, integration and system deployment. The approach is explicitly system-driven: Upstream device manufacturing is accessed through European and trusted international partners, while strategic control is retained at module, integration, qualification and lifecycle level.

### Goal

Strengthening wide-bandgap and emerging compound semiconductor technologies that enable efficient, reliable and high-performance semiconductor-based power, RF and microwave electronics for automotive, energy systems, industrial automation and defence.

## Key actions, suggested

• Coordinate the national SiC, GaN and emerging wide-bandgap power electronics value chain, from materials and epitaxy to modules and system deployment, including structured access to European device manufacturing.

• Launch industry-driven power electronics system demonstrators validating performance, reliability and qualification of SiC/GaN modules in real industrial, automotive and energy applictions.

## Photonics

**High-performance photonics is a key enabler of future communication, sensing, data centres and defence systems. Advanced non-silicon photonics offers Sweden an opportunity to build leadership in system-differentiating technologies that complement, rather than duplicate, Europe's strong focus on silicon photonics.**

### Why this matters for Sweden

• Performance beyond silicon: Non-silicon photonics (III–V, lithium niobate) enables functions not achievable with silicon photonics, serving performance- and reliability-critical systems where system value dominates over component cost.

• Builds on strong Swedish system strengths: Sweden has leading system companies and research capabilities in telecom infrastructure, sensing, autonomy and defence, creating strong demand for high-performance photonic components and integrated solutions.

• Strategic differentiation and security relevance in Europe: While European investments focus on silicon photonics for data centres, leadership in non-silicon and hybrid photonics gives Sweden a distinct role in performance-driven, sensing-centric and defence-relevant applications, while reducing strategic dependencies.

• Energy efficiency and sustainable system scaling: Photonic integration enables high-bandwidth communication, sensing and signal processing with significantly lower energy consumption per transmitted bit compared to purely electronic solutions. This reduces power demand, cooling requirements and infrastructure load in data-intensive and distributed systems, digital and physical infrastructure.

• Enabling quantum applications: Quantum technologies represent an emerging application area with strong links to photonics and semiconductor integration. Large parts of future quantum systems are expected to be photonics-based, while scalable implementation requires integration on semiconductor chips. With a ten-year horizon, this could become a strategically relevant domain where Sweden can build on its strengths in photonics, materials and system integration.

### What this area covers

This priority domain centres on advanced non-silicon photonics technologies, including III–V and lithium-niobate–based integrated photonics, spanning device design, heterogeneous integration, testing, qualification, and deployment for communication, sensing and measurement applications, including telecom, industrial, automotive, and defence applications.

### Goal

Develop advanced photonics and electronic-photonic integrated technologies enabling ultra-high-bandwidth communication, precision sensing and advanced signal processing, including quantum communication and photonic quantum-technology platforms where strategically relevant, and establish strong capabilities in design, heterogeneous integration, testing and industrial qualification for telecom, industrial, automotive and defence applications.

## Key actions, suggested

- Establish an industry-led coordination and roadmap function, aligning Swedish photonics companies, system users and research actors around shared industrial priorities, and serving as a structured interface to European photonics initiatives. The focus is on coordination and strategic alignment to reduce fragmentation, accelerate industrial uptake and improve access to European platforms, rather than establishing a new national infrastructure hub.

- Launch application-driven photonics system demonstrators integrating non-silicon photonics with electronics, packaging and validation for telecom, sensing and defence use cases.

- Enable structured industrial access to national photonics research infrastructure, including access models, integration support and alignment with validation and qualification capabilities.

> "RF and microwave system excellence underpins Sweden's global position in telecom infrastructure and is essential for continued leadership in 5G/6G, IoT and future wireless platforms

## Analog, RF and Mixed-Signal Systems, including microwave and mmWave technologies

**Secure wireless communication, sensing, signal conversion and electromagnetic control are foundational to Sweden's leadership in telecom, defence and mission-critical infrastructure. Analog, RF and mixed-signal system technologies are a strategic area where competitiveness, security and industrial strength converge, and where Sweden can continue to lead through system-level expertise.**

### Why this matters for Sweden

- Foundation of telecom leadership: RF and microwave system excellence underpins Sweden's global position in telecom infrastructure and is essential for continued leadership in 5G/6G, IoT and future wireless platforms. At the same time, Sweden's direct RF, analog and mixed-signal chip footprint for telecom has declined over the past decade, increasing reliance on non-European suppliers and reinforcing the importance of rebuilding and sustaining selective national capabilities.

- Critical for defence, security and sensing: Radar, electronic warfare, secure communications and advanced sensing depend on trusted RF system capabilities, making national competence essential for defence autonomy and secure supply chains.

- System-level differentiation and resilience: Competitive advantage in analog, RF and mixed-signal systems increasingly comes from architecture, co-design, integration, calibration and validation, and from technology features such as passives, interconnects, power handling and data-conversion efficiency, rather than from continued transistor node scaling alone - supporting trusted, long-lifecycle systems and reducing dependency on single technologies.

### What this area covers

This priority domain centres on analog, RF, mixed-signal, microwave and millimetre-wave system technologies, spanning system architecture, co-design, integration, validation and industrial deployment of advanced signal chains and electromagnetic systems for communication, sensing and signal processing.

### Goal

Advance analog, RF, mixed-signal, microwave and millimetre-wave system technologies that enable secure, high-performance communication, sensing and signal processing, strengthening Sweden's leadership in telecom, defence and mission-critical systems.

## Key actions, suggested

• Establish national analog, RF and mixed-signal system testbeds providing shared, neutral infrastructure for system-level integration, validation and real-world demonstration of analogue, RF and mixed-signal systems in telecom, sensing and defence contexts. The testbeds shall operate with governed, contract-based access models ensuring IP protection, secure project separation and, where required, classified access, and be aligned with existing industrial and defence test environments.

The testbeds should be anchored in concrete industrial use cases, lead customers and procurement or standardization pathways, thereby enabling specialized technology providers to validate and integrate their solutions into larger systems.

• Enable trusted access to RF, analog and mixed-signal pilot and industrial pre-production capabilities, including CMOS, SiGe, GaN and III–V technologies, through European pilots and selected national providers.

# Horizontal National Capabilities

## System and Chip Design

**System and chip design is a primary source of value creation, differentiation and control for Sweden's leading system industries. As performance, energy efficiency, security and lifecycle behaviour are increasingly determined at chip level, access to design competence is becoming essential for a growing number of system companies. Strong national design capabilities allow Swedish companies to specify, influence and integrate advanced semiconductor technologies sourced from global and European manufacturing ecosystems, rather than treating critical components as opaque black boxes.**

### Why this matters for Sweden

• Sweden's strongest semiconductor capability and value driver: Global competitiveness in telecom, defence, automotive and industrial systems is built on advanced system and chip design rather than ownership of high-volume manufacturing, while recognizing the importance of volume for cost efficiency and margins.

• Architectural leadership beyond node scaling: Future competitiveness increasingly depends on system architectures, chiplets, heterogeneous integration and secure partitioning rather than transistor scaling, aligning closely with Sweden's strengths in complex, long-life systems.

• Foundation for security and cross-domain integration: Design capabilities underpin hardware security and trusted electronics and are essential for integrating digital, analog and mixed-signal (including data converters), RF, photonic, power and sensing technologies into coherent systems.

### What this area covers

This strategic capability centres on system-level and chip-level design spanning architecture definition, cross-domain co-design, modelling, verification and design-for-manufacturing of advanced semiconductor-based systems. It includes digital, analogue and mixed-signal, RF, photonic and sensor-integrated design, as well as security architectures and methodologies enabling reliable, secure and scalable electronic systems

### Goal

Strengthen Sweden's semiconductor and system-level design capabilities by advancing secure hardware, AI-accelerator and domain-specific compute architectures, and cross-domain co-design including chiplet-based multi-die-integration across digital, analog and mixed-signal, RF, microwave, photonic, power and sensor technologies.

## Key actions, suggested

• National cross-domain semiconductor design centre. Establish a coordinated national design competence function, operating as a virtual competence hub, that provides Swedish system companies and SMEs with access to cross-domain semiconductor design expertise that may not be available in-house (digital, analog/mixed-signal, RF, photonics and power domains), without compromising IP or duplicating capacity. The centre serves as a national contact point to European design platforms and pilot lines (e.g. APECS), aggregating Swedish demand and enabling structured access to EU infrastructure. The SCCC could serve as a natural starting point.

• Full-stack system co-design capability. Enable Swedish companies to build in-house capability for co-design across hardware, software, AI and mechanics, supported by shared methods, toolchains and competence development, to optimize whole-system performance, energy efficiency, security and certifiability.

• Long-term national access to advanced EDA tools and IP. Establish a national access framework that lowers entry barriers to advanced commercial EDA tools, modelling environments and security IP through aggregated demand and predictable access models particularly for SMEs, while operating within standard commercial licensing terms, complemented by open-source tools where appropriate.

This action should be implemented in close alignment with relevant European initiatives, such as the Chips JU Design Platform, leveraging EU-level procurement and access mechanisms where available.

• System-level modelling and virtual validation capability. System-level and multi-physics simulation to reduce technical risk before hardware implementation.

• Secure and safety-critical system and chip design competence. National competence in security-by-design and safety-critical architectures for defence and critical infrastructure.

• National chiplet design and prototyping programs. Establish national, industry-driven programs that enable Swedish actors, particularly SMEs, to access and utilize European chiplet pilot lines such as APECS, supporting chiplet-based architecture design and prototyping from concept to first demonstrator. The programs leverage national cross-domain design competence and focus on standards alignment and packaging ready designs.

• Independent design verification and risk-reduction services. Provide independent readiness and risk-reduction checks prior to tape-out and pilot manufacturing, particularly for SMEs. The service covers design verification, DFM/DFT, packaging readiness and compatibility with pilot lines, without replacing foundry sign-off or proprietary manufacturing validation.

• Secure design environments for critical electronics Trusted and classified design environments for export-controlled and security-sensitive projects.

• Export control and secure international design collaboration hub. National support for export control compliance and trusted international design collaboration.

## Advanced Packaging & integration

**Advanced packaging and heterogeneous integration enable system-level leadership through system-driven integration and co-design, reducing dependence on leading-edge fabs while shifting value towards architecture, integration and reliability. However, sustained market relevance requires that such solutions are scalable by design, enabled through standardization, modular chiplet approaches and clear pathways from pilot to volume manufacturing. This positions Sweden to take a high-value role in chiplets, photonics, power electronics and secure systems, where performance, trust and system integration matter.**

### Why this matters for Sweden

• Europe's largest semiconductor gap and Sweden's opportunity: Advanced packaging and heterogeneous integration represent one of the most significant structural weaknesses in the European value chain, where Sweden has strong system competence and industrial relevance to play a leading role in application-driven integration and industrial deployment.

• Performance and efficiency beyond node scaling: Future gains increasingly come from integration, interconnects and system architecture rather than transistor scaling, making packaging a decisive competitive lever.

• Enables secure, resilient and long-lifecycle systems: Heterogeneous integration supports secure architectures, redundancy and long product lifecycles required for defence, energy and industrial automation, while also enabling faster time-to-market, cost-efficient scaling and technology agility through modular integration and reuse of validated components.

### What this area covers

This strategic capability centres on advanced packaging and heterogeneous integration, enabling the combination of multiple semiconductor and non-semiconductor technologies into high-performance, energy-efficient, reliable and secure system-in-package (SiP) solutions. It spans integration architectures, packaging processes, co-design and industrialization of complex multi-technology modules. Value creation in this area lies primarily in integration know-how, system architecture, reliability, qualification and time-to-market, rather than standalone packaging IP.

### Goal

Establish internationally competitive capabilities in advanced packaging and heterogeneous integration to enable high-performance, energy-efficient and secure electronic systems. The focus is on bridging advanced R&D and industrial deployment through industrial pre-production capabilities, rather than large-scale commercial packaging manufacturing.

## Key actions, suggested

• National pilot and pre-production capability for advanced packaging. Shared national access to physical pilot and industrial-grade pre-production infrastructure for system-driven advanced packaging, focused on 2.5D/3D integration, chiplets and heterogeneous integration across RF, photonics, power electronics and MEMS. The capability enables prototyping, qualification and low-volume industrialization of complex modules, and complements European pilot lines rather than duplicating them.

• Industrial-grade heterogeneous integration, co-design and metrology. A national, cross-cutting competence for chip–package–system co-design, in-line testing and metrology that ensures manufacturability, reliability and industrial readiness of heterogeneous integrated modules. The capability supports and de-risks pilot and pre-production activities and is applicable across multiple facilities, industrial flows and application domains.

• RF system-in-package competence hub. A nationally coordinated, federated competence hub for RF system-in-package technologies, aligned with the national cross-domain semiconductor design centre and the Competence Hub for Heterogeneous System Integration. The hub interfaces with SoC and chiplet design to enable chip–package–system integration, and supports pilots, standardization, qualification and industrial deployment for telecom and defence systems, and provides application- and sector-specific leadership rather than general-purpose packaging or SoC design capacity.

## Test, validation & Metrology

**Trusted test, validation and qualification are critical for Sweden because they represent one of Europe's largest structural weaknesses in the semiconductor value chain and constitute some of the most sensitive and security-critical stages for advanced and dual-use technologies.**

### Why this matters for Sweden

• Critical European gap with high strategic sensitivity: Test, validation and qualification are decisive for semiconductor yield, reliability and time-to-market, yet remain a major European weakness, especially for advanced, heterogeneous and mission-critical technologies - risking that strong design translates into limited commercial value capture.

• Security-driven need for trusted environments: In defence, secure communications, space, automotive and critical infrastructure, test and qualification data can expose system architectures, vulnerabilities and operational limits. Requirements are therefore primarily driven by laws, export controls and security regulations, not cost optimisation, making nationally governed trusted environments essential.

• Enabler for industrialisation beyond pilot production: System-level validation, qualification and reliability testing are required to bridge the gap from prototype to series production, complementing European pilot and pre-production manufacturing lines capacity by enabling verification, repeatability and compliance needed for scale-up and lifecycle support.

### What this area covers

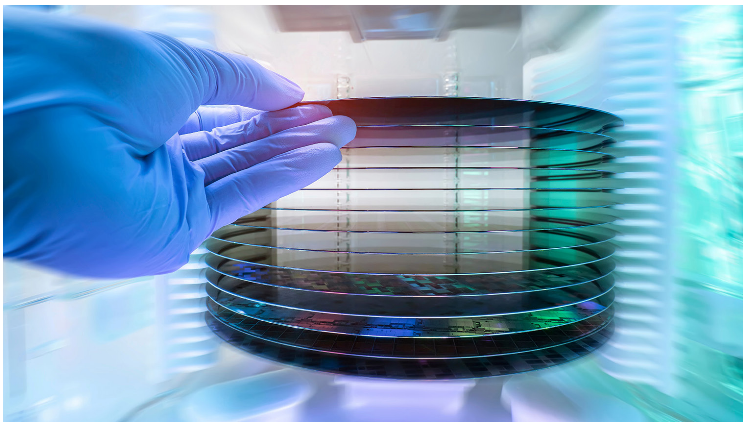
This strategic capability centres on trusted test, validation, qualification and metrology environments that ensure the performance, reliability, safety and security of advanced semiconductor devices and heterogeneous system modules. It spans device-, package- and system-level testing, reliability assessment and advanced metrology required for both industrialisation and late-stage, security-critical validation.

### Goal

Establish trusted and nationally accessible, industrial-grade test, validation and metrology capabilities enabling secure qualification and system-level validation of advanced devices and heterogeneous integrated systems.

## Key actions, suggested

- Trusted national test, validation and metrology capability. Nationally accessible trusted test and qualification services for mission-, safety- and security-critical electronics, including secure and classified access tiers.
- Industrial-grade qualification and reliability testing. Qualification, re-qualification and reliability testing aligned with automotive, industrial and defence standards, enabling certification and go/no-go decisions.
- Advanced metrology and non-destructive inspection. Shared access to advanced metrology and non-destructive inspection for packaging, photonics, RF and power electronics, supporting failure analysis and industrial readiness.



## Industrialisation, Scale-up

**This strategic area is focused on enabling the industrialisation and scaling of semiconductor technologies into competitive products and system capabilities, creating conditions for growth and long-term industrial presence in Sweden and Europe.**

In semiconductors, photonics and quantum-enabling technologies, this transition is capital-intensive, high-risk and slow - yet decisive for long-term industrial value creation. Stable, predictable and mission-oriented investment is therefore essential to enable qualification, pre-production and early series manufacturing, and to allow SMEs and scale-ups to compete globally without relocating key development and production activities abroad.

IVA's analysis of Key Strategic Technologies, shows that Sweden's challenge is not lack of scientific excellence, but insufficient conversion of advanced technologies into industrial leadership. Gaps in pilot capacity, scale-up financing and coordinated delivery create a persistent "valley of death" between research and deployment. Many Swedish semiconductor start-ups face a severe financing gap in the scale-up phase, where capital requirements increase sharply due to qualification, pilot production and early series manufacturing. In the absence of sufficient patient capital, companies are often forced into early acquisition or exit decisions driven by financing constraints, frequently outside Sweden or Europe, or premature public listings as a uniquely Swedish fall-back option. This results in a systematic loss of long-term industrial value creation, despite strong early innovation. Addressing this requires long-term intervention focused on industrial readiness, system validation and deployment - not short-term project funding.

### Why this matters for Sweden

- The critical bridge from R&D to market: Without access to certified pilot manufacturing and pre-production, Swedish companies, especially start-ups and scale-ups, cannot qualify products with global OEMs or enter regulated markets.

- Essential for resilience, sovereignty and trusted supply chains: Defence, telecom, automotive, energy and medical applications require trusted and traceable industrial flows; national access to pre-production and qualification reduces strategic dependencies.
- Enables SME growth and deep-tech scale-up: Industrialisation is both a technical and financial challenge; access to manufacturing readiness and scale-up financing is decisive for retaining growth and value creation in Sweden.

### What this area covers

This strategic capability centres on enabling a seamless transition from research and development to market-ready semiconductor-based products by providing access to existing pilot manufacturing, industrial-grade pre-production, qualification and scale-up support, including targeted scale-up financing and national co-funding for European programs.

It addresses the critical steps required to industrialise, certify and manufacture high-reliability devices and system modules for global markets. Strong incentives for early company formation have created a vibrant start-up landscape but require complementary mechanisms to enable technology maturation beyond low TRL prior to industrial scale-up.

Complementary low-to-medium volume and modular manufacturing approaches may, where relevant, be used to support rapid iteration, niche production and SME industrialisation for specialty semiconductor devices, without duplicating large-scale European volume manufacturing investments.

### Goal

Enable industrialisation by providing access to pilot manufacturing, pre-production, qualification and scale-up support, including targeted financing, so companies can deliver certifiable products.

## Key actions

- Coordinated national access to EU pilot and pre-production lines A single Swedish access point to European pilot lines, MPW services, packaging and industrial grade pre-production, with managed pipelines and SME-oriented access support, designed to reduce transaction costs and avoid additional service mark-ups.
- Stable and accessible industrial infrastructure for SMEs and scale-ups Establish long-term operation and access models for cleanrooms, pilot and pre-production facilities with predictable pricing, capacity and service conditions, including time-based or flat-fee access models where appropriate. This includes securing predictable, multi-year financing for operation, maintenance and continuous upgrading, ensuring long-term industrial relevance, reliable access for system companies and SMEs, and alignment with evolving European platforms.
- National scale-up financing for deep-tech industrialisation Financing instruments linked to industrialisation milestones such as qualification, A/B samples and early series production, designed to crowd in private capital and industrial competence.
- National co-funding for EU semiconductor programmes Secured and predictable national co-funding to enable full Swedish participation in EU programmes such as Chips JU and IPCEIs to avoid lost access to EU funding and industrial leverage.
- Incentives for semiconductor entrepreneurship and industrial R&D Targeted incentives to support start-ups, scale-ups and increased industrial R&D in semiconductor-based technologies, designed to enable long-term company building and talent retention in Sweden and Europe, aligned with long deep-tech time horizons.
- Talent attraction linked to industrialisation Fast-track talent and skills measures directly tied to pilot operations, scale-up needs and industrial deployment.
- Industry-driven lead-customer programmes Lead-customer engagement to reduce market risk through early qualification, procurement pathways and joint roadmaps for SMEs.
- Governance and security frameworks for industrialisation Standardised frameworks for IP, data protection, export control and certification enabling trusted and secure industrialisation.

## Why industrialisation fails without targeted intervention - and why it matters

Semiconductor and advanced electronics innovation is characterised by long development cycles, high capital intensity and stringent qualification requirements. Significant investment is required well before revenue generation, particularly for pilot manufacturing, testing, certification and early series production.

Conventional market financing mechanisms are often poorly suited to these conditions. Venture capital models typically favour rapid scaling and short time-to-exit, while bank financing is constrained by technical risk and limited collateral. As a result, promising technologies frequently stall in the transition from prototype to industrial readiness, despite clear industrial demand.

At the same time, successful industrialisation of semiconductor-based technologies can generate disproportionate long-term value. Companies that secure critical system positions - such as in advanced integration, power electronics, RF systems or industrial-grade components - often become indispensable suppliers within global value chains. While fewer in number and slower to emerge than software start-ups, such companies can achieve substantial scale, long-term profitability and strategic relevance.

Targeted public intervention is therefore required to reduce risk at critical transition points, enable private co-investment and unlock this long-term industrial upside. Without such mechanisms, Sweden risks systematically underinvesting in high-impact technologies that are essential for competitiveness, resilience and future growth, despite their potential to create the next generation of globally significant industrial companies.

This complements, rather than competes with, investments in software and digital innovation by addressing areas where market failure is structural and long-term returns depend on early industrial risk-sharing.

## Supply Assurance & Access

**Supply assurance and access are critical for Sweden because semiconductors underpin all advanced industrial systems. Sweden's industrial base is system-intensive and export-dependent, while domestic semiconductor manufacturing is very limited. This creates a high dependence on global value chains outside Sweden's direct control. Supply assurance is therefore essential for industrial continuity, security and crisis preparedness, as well as for maintaining innovation capacity and enabling rapid transition from emerging technologies to mission-critical applications.**

### Why this matters for Sweden

- High dependency and geopolitical vulnerability: Sweden's system industries depend on globally distributed semiconductor value chains with concentrated, often extra-European dependencies across raw materials and multiple critical stages, creating exposure to disruptions, export controls and geopolitical tensions.
- Critical for defence, infrastructure and industrial resilience: Secure and predictable access to components is essential for defence, telecom, energy, automotive and industrial automation, where supply interruptions have immediate security and societal consequences.
- Strategic raw material potential with long lead times: Sweden has relevant raw material resources, but limited extraction, processing and qualification capacity. While this represents long-term strategic potential, it offers limited short-term protection against supply disruptions.
- Controllability and trusted operation of critical systems: Dependence on globally sourced hardware and software introduces risks related to hidden dependencies, remote control, software updates and embedded backdoors in critical systems. These risks are directly addressable through supply assurance, certification, lifecycle control and governance frameworks.
- Disproportionate impact on SMEs and scale-ups: Smaller companies lack purchasing power, buffers and direct supplier access, making coordinated national mechanisms essential to prevent loss of innovation capacity during supply disruptions.
- High system exposure with limited upstream control: Sweden's economy is dominated by system-level industries with high semiconductor dependency but minimal influence over upstream manufacturing, making national coordination essential even within a common European market.

### What this area covers

This strategic capability centres on ensuring secure, diversified and reliable access to semiconductors and semiconductor-enabled components for Swedish industry, including SMEs and scale-ups. It focuses on national coordination, preparedness and strategic interfaces to European and trusted global supply chains.

### Goal

Ensure secure, diversified and reliable access to semiconductors by strengthening national capabilities that reduce supply-chain vulnerabilities and maintain continuity of supply for Swedish industry.

## Key actions, suggested

- Strategic European and international supply assurance partnerships. Establish supply assurance partnerships with the EU and like-minded countries to secure access to manufacturing, packaging, testing and critical components.
- National semiconductor supply-chain intelligence capability. Enable continuous mapping and monitoring of supply-chain dependencies and risks, linked to European early-warning mechanisms.
- Strategic assessment of critical raw materials. Assess how Swedish and regional critical raw materials can contribute to national and European semiconductor supply resilience.
- European competence hub for obsolescence and end-of-life management. Establish Sweden as a hub for lifecycle and obsolescence management for long-lifecycle semiconductor-dependent systems in defence, telecom and energy.

## Talent & Skills

**Long-term competitiveness in semiconductors and semiconductor-enabled systems ultimately depends on people, skills and talent. Skills shortages represent one of the most binding constraints on growth, resilience and industrial capacity across Sweden's priority technology domains.**

### Why this matters for Sweden

• Skills shortages constrain growth and industrialisation: Shortages in design, packaging, test, manufacturing and system engineering limit the ability of Swedish companies to scale, industrialise and compete globally, particularly in hardware-intensive and security-critical sectors.

• Requires a "full-pipeline" approach across the education and skills system: While the inflow of graduates from semiconductor-relevant engineering programmes remains insufficient relative to long-term industrial needs, demand for engineering education exceeds available capacity, largely due to funding constraints. Early bottlenecks in the education system further reduce the pool of students able to qualify for and apply to higher engineering programmes, resulting in underutilised talent potential. Continued STEM initiatives, alongside measures to address capacity and funding constraints across the pipeline, are therefore essential.

• Essential for sovereignty and long-term resilience: National access to skilled personnel underpins trusted supply chains, secure industrialisation and long-term defence and infrastructure capability, while global competition for semiconductor talent is intensifying. In this context, access to international expertise is essential for Sweden's position in the semiconductor value chain. Current migration and work permit processes constitute a practical bottleneck for accessing critical competences and risk limiting the effectiveness of talent attraction measures. Beyond administrative processes, international recruitment also depends on Sweden's overall attractiveness for highly skilled talent, including predictable net compensation and career prospects in an increasingly competitive international context.

### What this area covers

This strategic capability centres on implementing coordinated measures to build, attract and retain a sustainable and globally competitive semiconductor talent base across the full skills pipeline, from education and reskilling to advanced research, industrialisation and production. It addresses both current shortages and future competence needs linked to Sweden's strategic domains and national capabilities.

### Goal

Build, attract and retain a globally competitive semiconductor talent base across education, reskilling, research and industrialisation.

### Key actions, suggested

• National semiconductor competence and education strategy. A coordinated national skills strategy defining priority competences, capacity targets and long-term governance across education, research and industry.

• Upskilling, reskilling and pilot-line workforce training. Continuous training programmes for engineers, technicians, operators and process specialists aligned with pilot manufacturing, packaging, test and industrialisation needs.

• Semiconductor talent attraction and fast-track immigration. Targeted international recruitment and fast-track immigration pathways for critical semiconductor competences. Implementation requires that identified administrative and attractiveness-related barriers to international recruitment are addressed.

• Fellowships, internships and mobility programmes. Structured mobility between academia, research institutes and industry, including internships linked to pilots, testbeds and demonstrators.

• Advanced interdisciplinary and industrial doctoral training. Industry-linked doctoral and professional education programmes aligned with Sweden's priority technology domains and national capabilities, while actively leveraging collaboration with leading European and international education and research ecosystems.

"Current migration and work permit processes constitute a practical bottleneck for accessing critical competences and risk limiting the effectiveness of talent attraction measures.

# C: A Swedish Semiconductor SWOT

Sweden's semiconductor position is characterized by strong system-level industrial demand and internationally competitive capabilities in system architecture, chip design, RF, power electronics, MEMS industrialization, emerging photonic technologies, reliability engineering and security-critical electronics, combined with high-quality research in key enabling technologies.

The main structural weakness lies in fragmented funding for scaling, the gap between research and industrial deployment, with limited access to shared pilot lines, advanced packaging, test, validation, and pre-production and industrial qualification capabilities, compounded by weak national coordination and skills shortages.

Sweden's opportunity is not large-scale manufacturing, but to become indispensable in selected system-critical niches that strengthen European value chains. Without decisive action, Sweden risks remaining a generator of advanced knowledge while exporting industrial value creation, losing influence, talent and strategic relevance in an increasingly competitive global semiconductor landscape.

Based on Roundtable discussions and interviews

## Strengths

Sweden has an unusually strong **system-level industrial demand base** for semiconductors, anchored by globally competitive companies in telecom, defence, automotive, industrial automation, mining and surveillance. Interviews consistently highlight deep capabilities in system architecture, ASIC and SoC design, RF and microwave technologies, power and energy-efficient electronics, reliability engineering, security and long-lifecycle, high-reliability products.

In parallel, Sweden hosts internationally recognised **research excellence** in wide-bandgap materials (SiC, GaN), MEMS, RF, photonics, advanced materials and quantum-adjacent technologies, as well as several **world-leading niche companies**. The Swedish ecosystem is characterised by strong system integration, high engineering quality and a collaborative, trust-based innovation culture, rather than scale manufacturing.

## Weaknesses

Across most semiconductor domains, a central weakness is the **structural gap between research and industrial deployment.** While MEMS represents an exception, Sweden generally lacks sufficient domestic capability to industrialise semiconductor technologies at scale. Access to pilot lines, pre-production, advanced packaging, test, validation and industrial qualification is fragmented and inadequate, forcing companies to industrialise abroad or build costly in-house solutions. This is consistent with Vinnova's assessment that Sweden's primary competitiveness challenge lies not in research excellence, but in converting advanced technologies into industrial-scale, market-ready solutions through pilot production, qualification and deployment.

**Financing and governance challenges are systemic.** Short investment horizons, fragmented funding instruments, limited national risk-sharing and insufficient co-funding capacity constrain long-term industrialisation, hamper scaling, and reduce Sweden's ability to participate fully in Chips JU and other European semiconductor programmes. **Weak coordination and unclear roles across public actors and funding bodies** further limit Sweden's influence in shared European roadmaps, pilot platforms and capability development, despite strong technical competence and industrial demand.

These challenges are compounded by **skills shortages** across the full pipeline, from a too low interest and preparedness in STEM education to shortages of experienced engineers, technicians and industrialisation specialists in areas such as chip design, verification, packaging and test. **Roles and responsibilities** across universities, research institutes and public actors are often unclear. **Limited mobility of personnel** between academia, industry and public administration further weakens knowledge transfer, policy capability and mutual understanding across the semiconductor ecosystem.

In addition, SMEs and system companies face disproportionate challenges related to regulatory compliance, export controls and supply-chain transparency, particularly in cross-border and security-sensitive contexts.

## Opportunities

Sweden's opportunity lies not in large-scale foundry manufacturing, but in **becoming indispensable in selected system-critical niches** that strengthen both Sweden and Europe. By focusing on system-level leadership, chips design, advanced integration, power electronics, RF, photonics and industrial-grade validation, Sweden can take high-value positions in the European semiconductor ecosystem without duplicating capital-intensive manufacturing.

Multiple actors emphasise the need for shared industrial infrastructure, particularly **pilot and pre-production, advanced packaging, test and qualification**, together with clearer national coordination and **stronger coupling between start-ups, scale-ups and large system companies**. By reinforcing, rather than duplicating, European manufacturing leaders, Sweden can focus national applied R&D on solving concrete industrialisation, integration and qualification challenges faced by European fabs and pilot lines, creating sustained industrial demand for Swedish capabilities and securing influence in European value chains.

## Threats

Without decisive and focused action, including sustained and coordinated public and private investments, Sweden risks becoming a country that **generates advanced knowledge while exporting industrial value creation**. If this competence is not industrialised and applied in sustained production and deployment, knowledge and capability will gradually decay, while continued under-utilisation of European initiatives, weak national coordination and a lack of long-term industrial capital increase the risk of talent, intellectual property and industrialisation activities relocating abroad.

Interviews also highlight rising geopolitical risks, single-source dependencies, export controls, abrupt end-of-life decisions and vulnerabilities in critical materials and back-end processes. Sweden risks losing relevance and influence in Europe's semiconductor ecosystem at a time when strategic importance, competition and security considerations are increasing.

Recent national analyses, including IVA's mapping of key strategic technologies, show that Sweden demonstrates strong scientific performance in semiconductors and related enabling technologies, but comparatively weaker conversion into patents, scale-ups and sustained industrial investment. This gap between scientific potential and technological leadership reflects insufficient industrialisation and underscores the need for targeted, mission-oriented semiconductor capability building focused on industrialisation, integration and system deployment.

# International Collaboration

## International comparison of semiconductor strategies

Leading semiconductor manufacturing nations and specialised technology leaders alike have adopted state-backed strategies to secure influence and resilience in the semiconductor value chain. Large economies generally prioritise manufacturing scale and fabrication capacity, while specialised count-ries focus on critical technologies, equipment, integration and system-level positions where strategic leverage exceeds scale. In both models, success is underpinned by long-term public financing, clear industrial focus and strong coordination between government, industry and research actors.

The United States, China, South Korea and Japan have committed public and public-private investments measured in hundreds of billions of euros. Their strategies primarily target advanced manufacturing capacity, leading-edge logic and memory, and vertically integrated national ecosystems, using scale, capital intensity and domestic market pull to secure dominant positions in core technologies. These strategies also include measures for increased resilience, minimizing the reliance on foreign partners where possible, and ensuring strong international partnerships where national capabilities are unviable.

The European Union, through the EU Chips Act, has adopted a hybrid approach that combines manufacturing investments with strong emphasis on equipment, materials, pilot lines and research infrastructure. European capabilities remain distributed across member states, and no single country seeks full value-chain coverage independently. Instead, the European model relies on complementarity, specialisation and coordinated access across countries.

Smaller and mid-sized countries with successful semiconductor strategies, such as the Netherlands, Belgium, Finland, Austria, Ireland and Singapore, seem to follow a different path. Rather than competing on scale, they have focused on clearly defined technology niches, shared research and pilot infrastructures, strong design and system integration capabilities, and close alignment between industry, academia and government. Examples include ASML-driven lithography leadership in the Netherlands, imec's pan-European pilot line model in Belgium, and Finland's focus on RF, MEMS, photonics and advanced materials.

**Government incentives by major region (left to right by size of GDP)**

| | | US | Mainland China | EU | Japan | South Korea | Taiwan |
|---|---|---|---|---|---|---|---|
| Guidance | Target | Achieve resiliency in semiconductor supply chain | Reach 70% self-sufficiency by 2025 | Gain 20% global share by 2030 | Earn $112B sales by 2030 | Secure foothold in Logic, bolster fab leadership | Breakthrough 1 nm by 2030 |
| | Guiding policy | CHIPS and Science Act, 100-Day Supply Chain Review | National IC Outline, 14th Five Year Plan | Digital Compass 2030 | Strategy for Semis and the Digital Industry | K-Belt Semiconductor Strategy | Angstrom Semiconductor Initiative, Moonshot program |
| Measures | Key Incentive amounts | $39B in grants[1] | $142B in equity funds | $47B in grants | $17.5B in grants | $55B in tax incentives | $16B in tax incentives[4] |
| | Key Initiatives | 25% investment tax credit<br>Grants under the CHIPS Act<br>State-level support | Big Fund I, II, III and local funds<br>State-owned enterprise leaders<br>National science fund | Grants and loans under EU Chips Act<br>Tax credits<br>State aid allowances[2] | National fiscal funding<br>Leading-Edge Semiconductor Technology Center | Tax incentives under K-Chips Act<br>Private-public education programs | Financial subsidies under the Chip Innovation Program<br>Industry-academia co-op, tax credits |
| Impact | New fab & ATP investments since 2020[3] | 26 | ~30[5] | 8 | 4 | 3 | 7 |

1. $39B for manufacturing; $13.2B for R&D and workforce development
2. Important Projects of Common European Interest (IPCEI)
3. Comprises fab and ATP projects that have been announced, started, or completed since 2020
4. 25% tax credit pledging to give back $2.25B per annum over 7 years.
5. May undercount the total number of sites in China.

Source: Gartner; SIA; Press releases; Company disclosures; Government websites; BCG analysis

Figure 16: Governments worldwide are investing heavily to strengthen semiconductor supply chains, but approaches and outcomes vary widely. The figure highlights that incentive scale alone does not guarantee manufacturing capacity, reinforcing the need for complementary system-level and value-chain strategies. Source: Gartner, SIA, BCG analysis.

## Sweden's strategic positioning

Sweden's semiconductor strategy differs from large-scale manufacturing-led models. With significantly lower public funding levels than major semiconductor nations, Sweden does not seek to replicate leading-edge fabs or full value-chain sovereignty. Instead, Sweden aims to adopt a selective, system-driven strategy aligned with its industrial structure, security priorities and international role. This positioning is consistent with successful niche-oriented strategies in comparable countries and complements EU-level investments rather than duplicating them. Sweden leverages strong system companies in telecom, defence, automotive and industrial automation as lead customers, using demand pull, system integration and long-term industrial needs - rather than subsidies alone - to accelerate innovation, industrial uptake and European value-chain impact.

## Financing perspective

Compared to global peers, Sweden's public semiconductor investments - if implemented according to this recommendation - are modest, but deliberately focused. The strategy emphasises:

- High leverage per invested SEK
- Shared national infrastructure rather than firm-specific subsidies, and
- Integration into European and trusted international ecosystems.

International comparison shows that there is no single winning semiconductor model. Countries succeed either through scale or through indispensability. Sweden's strategy deliberately chooses the latter: Becoming an essential partner in system-critical semiconductor technologies that underpin Europe's and allied nations' future digital, industrial and security capabilities.

### Summary of Sweden's strategic focus areas vs international strategies

**Where Sweden aligns with global leaders**

- Packaging, chiplets and heterogeneous integration
- Pilot and prototype manufacturing
- Design and co-design capabilities
- Compound semiconductors (SiC/GaN)

**Where Sweden complements EU**

- III-V and hybrid photonics instead of silicon photonics
- RF, radar, EW technologies
- WBG integration with sensing and autonomy

**Where Sweden is unique**

- RF + RF-photonics (rarely a priority elsewhere)
- Integration across RF, photonics, sensing, power, MEMS and AI
- System-industry-driven architecture goals (6G, defence, industrial automotive)
- Strong "industrial enabler" base (vacuum, metrology, tools, relative to country size)

## Targeted international collaboration

Sweden's semiconductor strategy is based on selective national strengths and system-level leadership. To close critical capability gaps and ensure access to essential technologies, Sweden should pursue targeted international partnerships.

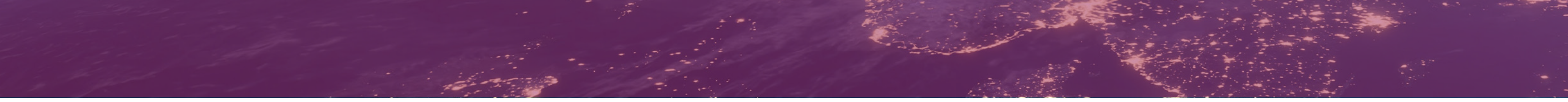
In several critical areas, most notably advanced logic manufacturing, advanced memory and semiconductor design tools, Sweden and Europe remain structurally dependent on a small number of non-European countries.

Sweden should intensify strategic collaboration within the European Union and with a limited number of like-minded global partners, primarily Taiwan, South Korea and Japan, whose capabilities are critical for access to advanced semiconductor technologies. Targeted collaboration with partners such as Singapore and Canada can further complement these relationships, particularly in areas such as advanced packaging, manufacturing excellence, materials and emerging semiconductor technologies. International collaboration is not a substitute for national or European capability, but a force multiplier.

By aligning targeted international partnerships with Sweden's priority technology domains and European initiatives, Sweden can secure access to critical technologies, reduce strategic dependencies over time, and strengthen its position as a trusted and valuable partner in global semiconductor value chains.

| Semiconductor area/ Value-chain segment | Countries with highest dependency | Why alignment is necessary | Diversification options |
|---|---|---|---|
| **Advanced logic manufacturing (CMOS)** | Taiwan, South Korea | Exclusive access to leading-edge wafer fabrication | South Korea (secondary source); Japan (Rapidusemerging, long term) |
| **Advanced memory (DRAM, NAND, HBM)** | South Korea, Unite States | Dominant global memory production | Non in Europe; limited process diversification via Japan |
| **Semiconductor design & EDA** | United States | Near-total dominance of EDA tools and design ecosystems | Partial EU base (Siemens EDA); research-level open tools |
| **Advanced packaging & chiplets** | Taiwan, United States | Hig-volume advanced packaging and OSAT | Europe (imec, CEA-Leti, Fraunhofer - R&D/pilot); Japan (materials, bonding) |
| **RF, microwave and mmWave** | United States (partial) | Defence-grade RF and mmWave technologies | Strong European alternatives; Japan for materials/components |
| **Power semiconductors (SiC, GaN)** | Japan, United States | Substrates and GaN device ecosystems | Europe (devices, modules, systems); Japan remains critical upstream |
| **Photonics & optoeleltronics** | United States (partial) | Advanced components and co-integration | Strong Europeans capabilites; Japan for components |
| **Materials, substrates and chemicals** | Japan, United Stats | Photoresists, resins, wafers and specialty materials | Limited Europeans alternatives; diversification within Japan/US suppliers |
| **Test, validation and qualification** | United States (partial) | Certain defence and space qualification flows | Strong European capabilities in system-level, reliability and security-critival tests, validation and qualification |

Figure 17: Overview of major dependencies in the semiconductor value chain and semiconductor area. Blue-shaded rows identify the most critical external dependencies for Sweden's semiconductor ecosystem, where national or European self-sufficiency is not feasible in the near term and where targeted international partnerships are therefore essential. Source: Information compiled from different sources by project



## Indicative Investment

Comparable EU countries, such as Finland and the Netherlands, commit public investments in the range of €1.5–3.5 billion over the decade, focused on leverage positions rather than full value-chain replication.

> It is our recommendation that the Program for Advanced Electronics is financed on a level comparable to the countries mentioned

| Country | Public investment | Approx. SEK | Horizon |
|---|---|---|---|
| Sweden (proposal) | €0.8-1.2 bn | 9-13 bn | 8-10 yrs |
| Finland | €1.5-2.0 bn | 17-23 bn | ~10 yrs |
| Austria | €1–2 bn | 11–23 bn | ~10 yrs |
| Belgium | €2–3+ bn | 22–34 bn | long-term |
| Netherlands | €2.5–3.5 bn | 28–40 bn | ~7 yrs |

Targeted public investment in semiconductor capabilities is used to unlock European co-financing, mobilise private investment and strengthen long-term competitiveness in Sweden's system industries.

It is our recommendation that the Program for Advanced Electronics is financed on a level comparable to the countries mentioned, through private, national and European sources.

**The return on investment will be high, due to:**

- Focus on system-level capabilities, not capital-intensive fabs
- Strong alignment with EU funding and shared infrastructure
- Direct industrial pull from telecom, defence, automotive, energy and industrial automation
- Emphasis on industrialisation, packaging, test and qualification, where value capture is highest

# Appendix list:

**Appendix A:** International semiconductor strategy comparison

**Appendix B:** Current financial opportunities for Swedish semiconductor companies

**Appendix C:** Critical Raw Materials Concentration

**Appendix D:** Methodology of Strategy Development

**Appendix E:** Participants in roundtable discussions, interviews and reference group

**Appendix F:** Glossary of Key Semiconductor Terms

**Appendix G:** References

# Appendix A – International semiconductor strategy comparison

Below is a table with examples of known data from some relevant countries. Note that the development of this strategic area is moving fast and therefore can facts and figures have changed since the investigation was made.

| Country | Core Competencies (Current) | Weaknesses | Future Goals | Key Companies/ Institutes | Reported Funding (EUR/USD) |
|---|---|---|---|---|---|
| **USA** | Advanced chip design. Defense. | Limited domestic fabs, relliacnce on TSMC et al. | Onshore advanced manufacturing. AI chips. | Intel, Nvidia, AMD and many more. | 52 BUSD (Chips Act) |
| **China** | Large scale, manu-facturing, memory, low-cost chips. | Technology gaps vs leading-edge nodes. Export restrictions. | Domestic design, advanced logic nodes. | SMIC, Huawei, HiSilicon | 47,5 BUSD (CNY 344 Bn), Big Fund Phase III. |
| **EU** | Equipment, materials, pilot infrastructure | Fragmented capacity, dependence on external actors. | Reach 20% global market share, develop EU found-ries. | ASML, ST Microelectronics, Infineon | 43 BEUR (European Chips Act |
| **South Korea** | Memory chips | Energy costs, cyclical market, shortage of talent | Expand memory and logic clusters. Power electro-nics. | Samsung, SK Hynix | 420 BUSD (622 trillion Won) in tax incentives and Public-Private-Partnerships |
| **Japan** | Mems, ALD, sensors, quantum computing | Lost volume logic fabs, high rebuild cost. | 2 nm logic, quantum chip leadership. | Toshiba, Renesas, Rapidus. | 6,8 BUSD, whereof 3,9 BUSD to Rapidus. |
| **India** | Design services, outsourcing, ATMP | No foundries, foreign tech dependency. | Domestic foundries, defense chips, full-stack design | Tata Elxsi, Wipro | 10 BUSD |
| **Malaysia** | OSAT, low-cost production. | Weak in design capacity. | Advance into design and R&D. | Infineon Malaysia, STMicroelectronics | 5,3 BUSD in 3-phase plan. |
| **Singapore** | Wafer fabs, backend packaging | Limited local IP/design capability, small domestic market. | Strengthen R&D, support local startups and IP creation. | Globalfoundries, UMC, IMEA*STAR | 4,5 BUSD (grants + R&D initiatives). |

| Country | Core Competencies (Current) | Weaknesses | Future Goals | Key Players | Reported Funding (EUR) |
|---|---|---|---|---|---|
| **Austria** | Wafer bonding/ litho (EVG), sensor technology. | No front-end logic fab, niche ecosystem | Strategic design and tooling hub in EU. Fab in Premstätten, EU-wide design platform. | EV Group, ams OSRAM, Infineon Austria | 0,6 BEUR (in Premstätten fab via EU) |
| **Belgium** | Imec R&D, silicon platf-omrs. | No volume manuf. R&D heavy. | Lead in EU pilot lines. R&D powerhouse in Europe. | Imec | EU-funded R&D via Imec |
| **Czech Republic** | Power chips, IC design, CEITEC research. | No memory or logic fabs, small local ecosystem | Triple chip sector by 2029, national competence center. | Onsemie Czechia, CEITEC | 0,25 BEUR |
| **Finland** | MEMS, sensors, photonics, quantum, ALD | No volume fabs, shortage of talent. | Niche fabs, national design hubs. 6 BEUR revenue, 20 000 jobs by 2035. | Nokia Design, Vesper | 5 BEUR (target for public-private partnership). |
| **France** | STMicroelectronics fabs, metrology, inspection tech. | No advanced logic foundry, high chip import cost | Industrial sovereignty via national capacity. Expand Crolles fab, national investments | STMicroelectronics | 5 BEUR (Électronique 2030) |
| **Germany** | Materials, equipment, fab investments (TSMC). | Lacks cutting-edge foundry, subsidy dependent. | Attract advanced fabs, lab-to-fab pipelines. Sustainable EU microelectronics hub. | Infineon, Bosch, Intel Germany | 20 BEUR, incl. Intel/TSMC support. |
| **Ireland** | Intel fabs, design, EU integration | Small industry, dependent on EU support. | Create EU R&D hub, talent growth. 34 500 new jobs. EU hub for chips. | Intel Ireland, Analog Devices | Intel & EU co-funded projects. |
| **Italy** | Chiplet packaging, SiC fab in Catania, design | Lacks cutting-edge logic production. | Chiplet fabs, support national design ceners. Support EU autonomy, attract global fabs. | STMicroelectronics, Silicon Box, Technoprobe. | 3,2 BEUR (Silicon Box) + STMicro funding. |
| **Netherlands** | ASML lithography, NXP, materials expertise | No front-end foundry, export dependent. | Expand system design and testing capacity. Tooling and integration leadership in EU. | ASML, NXP | Part of EU budget via ASML and NXP. |
| **Poland** | Power elecronics, photonics, early R&D (GaN, SiC) | No foundry, dependent on EU & foreign OEMs | Intel assembly/test, photonics and pilot centers. Production and innovation node in central EU. | Intel Poland, UNIPRESS, Lukasiewicz-IMiF | Intel investments + EU pilot line support. |
| **Portugal** | Packaging, photonics, design | No volume production, emerging ecosystem | Innovation-led eco-system scale-up. Lab-to-fab innovation. EU Chips Act alignment. | Amkor Portugal, INESC-ID | 500 MEUR (lab-to-fab, photonics) |
| **Spain** | R&D, automotive chips, packaging | No foundry capacity, limited investments | Economic independence, EU tech integration. | IMEC Málaga, startups | 12,25 BEUR (Perte Chip) |
| **Sweden** | Design, power semi-conductors, MEMS, photonics. | No front-end logic foundry, some talent shortage | Coorinate national R&D, pilot production. Design, power semi, photonics, RF. | Ericsson, Silex, Coherent, Mycronic, RISE. | <1 MEUR (Vinnova, VR, SSF) |
| **Switzerland** | MEMS, analog/ mixed signal IC design, vacuum tech. | No large fabs, low-volume manuf., fragmented ecosystem | Scale up design & pack-aging, foster national ecosystem. A niche R&D and high-precision semicon-ductor manufacturing hub. | STM, VAT Group, SCEM, EPFL, ETH | 100-200 MCHF in public-private-part-nership (Swiss-Chips, InnoSuisse). |

# Appendix B – Current financial opportunities for Swedish semiconductor companies

• Vinnova – "Innovativa Startups"
Provides early seed funding, currently up to 500 kSEK. The programme is domain-agnostic, meaning semiconductor startups compete with all other technology areas for funding.

• Strategic Innovation Programme (SIP) "Smartare Elektroniksystem"
Has been a key funding source for semiconductor R&D over the past decade, providing several million SEK to numerous startups and research projects. However, the programme has now ended and has not been replaced by any equivalent, targeted national funding initiative.

• Energimyndigheten (Swedish Energy Agency)
Offers funding for semiconductor companies whose technologies contribute to reduced energy consumption or lower $CO_2$ emissions. Initial grants are typically modest (300–500 kSEK), although larger funding rounds may be available in some cases.

• Incubators and science parks
Organisations such as Sting, Ideon, NOSP, KTH Ventures and Chalmers Ventures provide limited direct funding, but play an important role through access to networks of angel investors and venture capital.

• Chips Joint Undertaking (Chips JU)
As the main European implementation body of the EU Chips Act, Chips JU offers several funding opportunities for semiconductor projects. These calls are highly competitive and require substantial national co-funding for successful participation.

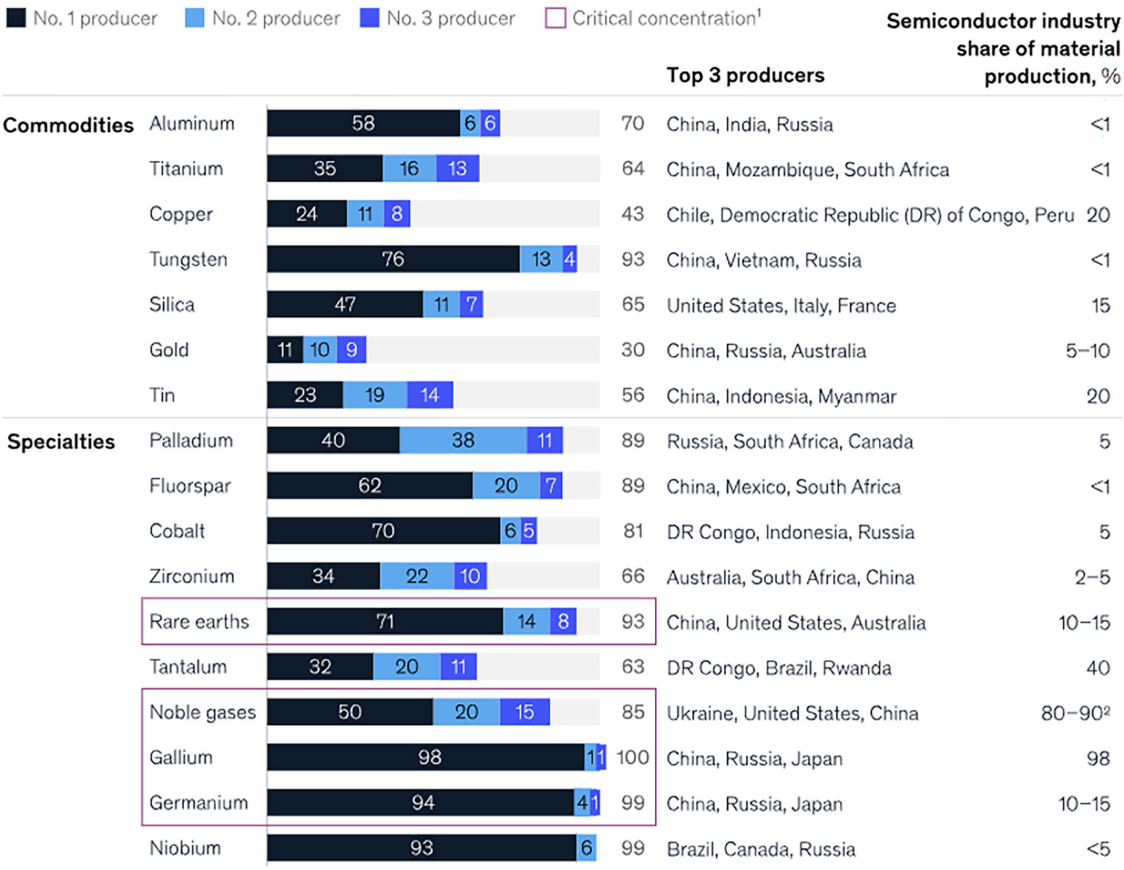
• European Regional Development Fund (ERDF)
The European Regional Development Fund provides co-financing for regional innovation, research infrastructure and industry development projects. In Sweden, ERDF funding is typically channelled through regional programmes and often requires collaboration between companies, universities and public actors. While the fund is not semiconductor-specific, it has supported several initiatives relevant to the sector, including innovation environments, competence development and infrastructure projects. Access to ERDF funding generally requires regional partnership structures and matching funding from national or regional actors.

• Scale-up financing
Industrifonden and Navigare Ventures are two investment actors with experience in semiconductor-related investments. However, the number of such investments remains relatively limited, indicating a constrained availability of growth capital for semiconductor scale-ups.

(Source: RISE)

# Appendix C –
# Critical Raw Materials Concentration

**Concentration of materials in top 3 producers, %**

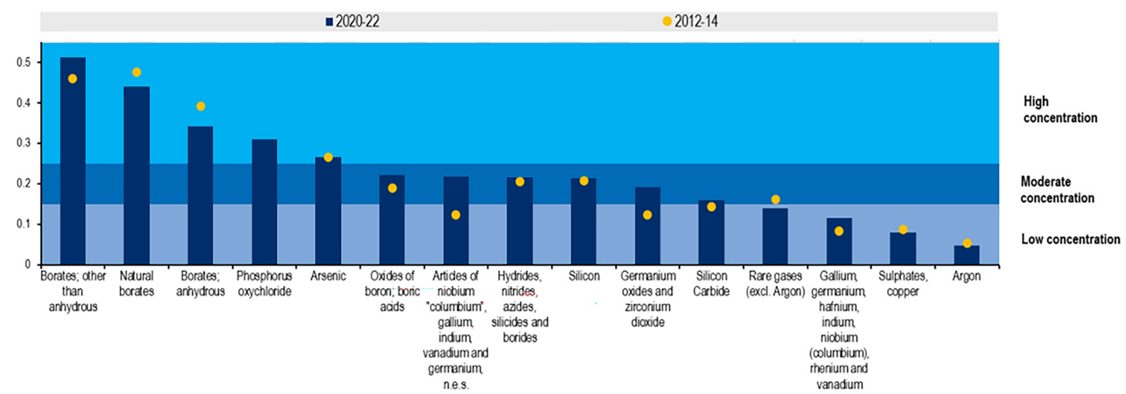



[1]Critical concentration is defined as a single producer accounting for greater than 50% of material production in a market in which semiconductor consumption accounts for at least 10–15% of the material's consumption.
[2]Reference for neon because it has the highest share of all noble gases.
Source: C. Reichl and M. Schatz, *World mining data 2024*, Austria Federal Ministry of Finance, 2024; World Population Review

Source: McKinsey

## Figure 3.3. Export concentration for raw materials

Herfindahl-Hirschman Index




Note: Data for phosphorus oxychloride prior to 2017 is not available.
Source: OECD calculations based on UN Comtrade database.

# Appendix D –
# Methodology of Strategy Development

The development of Sweden's National Semiconductor Strategy was conducted through a structured, inclusive and evidence-based process, combining industrial input, expert analysis and broad ecosystem engagement.

## Data collection and ecosystem engagement

The project was informed by extensive qualitative and quantitative input from across the Swedish electronics and semiconductor ecosystem. Ten roundtable discussions were conducted in different regions of Sweden and more than 30 interviews with stakeholders from different parts of the ecosystem, both digitally and in physical meetings. These dialogues captured perspectives from system companies, SMEs, suppliers, competence centres and academia, ensuring representation across value-chain positions and technology domains.

In parallel, a national survey was distributed to a broader group of actors within the Swedish electronics and semiconductor ecosystem that helped validate patterns identified through interviews and workshops, particularly regarding capability gaps, priorities and perceived barriers.

### Roundtables were facilitated:

- Roundtables 1 and 2 in Göteborg September 4, 2025
- Roundtables 3 and 4 in Stockholm September 25, 2025
- Roundtable 5 in Stockholm October 7, 2025
- Roundtable 6 and 7 in Linköping, October 10, 2025
- Roundtables 8 and 9 in Lund, October 16 and 17, 2025
- Roundtable 10 digitally on December 4, 2025

Interviews were performed during October-December 2025.

## Core project team workshops and analysis

### The core project team conducted a sequence of structured workshops focused on:

- Global and European semiconductor trends
- Sweden's positioning in the international value chain
- Technology trends and strategic capability gaps
- Objectives and strategic priorities
- Proposed actions

Technology trends and value-chain gaps were compiled, analysed and discussed within these workshops, combining international benchmarking with Swedish industrial realities. This iterative process ensured coherence between strategic ambition, industrial relevance and realistic implementation pathways.

## Strategy formulation and validation

Based on the collected inputs and analyses, the strategy was progressively developed through successive drafts. Throughout this process, the project group were used to test assumptions, refine priorities and ensure alignment with industrial needs, policy frameworks and European initiatives.

### The process was designed to balance:

- Bottom-up industrial input
- Strategic analysis
- Top-down coherence in vision, structure and actions

## Authorship and review

This strategy report was compiled integrating inputs from interviews, roundtable discussions, workshops, and written feedback. The content was reviewed and refined based on comments from the reference group and the project group, consisting of representatives from industry, academia and relevant ecosystem actors.

### The methodology ensured that the strategy is:

- Grounded in real industrial and system-level needs
- Informed by broad ecosystem participation
- Aligned with European developments
- Structured to support practical implementation and long-term impact.

## Core Project Group Participants

The project group consisted of representatives from industry, public authorities, research organisations and national innovation initiatives, contributing expertise, review and feedback throughout the strategy development process.

# Appendix E – Participants in roundtable discussions, interviews and reference group

This strategy has been informed by roundtable discussions, interviews and reference group with representatives from across the semiconductor ecosystem, including industry, academia, research institutes and public organisations. We are grateful to all participants for their time, insights and constructive engagement throughout the process.

The perspectives shared through these interactions have been carefully considered and have helped shape the analysis, as well as the needs and challenges reflected in the recommendations presented in this report.

The individuals listed below contributed to the strategy process through one or more of these formats. Responsibility for the final analysis and recommendations rests with the authors. Listing does not imply endorsement of the report's findings or responsibility for its content. Some contributors requested not to be named and are therefore not included.

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Löfgren, Anneli – Lunds Universitet
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Luthman, David – Mycronic
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Sundelin, Martin – Scanditron Sverige AB
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Svensson, Lars – Chalmers
Svensson, Lennart B.M – PhotonicSweden
Söderlund, Torbjörn - AMD/Xilinx
Thelin, Lisa – IVA
Tillman, Fredrik – Ericsson AB
Tollstoy, Joachim – TekSiC
Törmänen, Markus – BeammWave AB
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Tyagi, Shridha – OnSemi
Valroy, Mala – Industrifonden
Wadefalk, Niklas – Low Noise Factory
Wengström, Sara – FAB Support AB
Wikander, Robert – Packet Architects AB
Zaring, Carina – KTH
Åström, Irina – Ericsson AB
Åström, Jonas – Altera
Östling, Mikael – KTH

# Appendix F:
# Glossary of Key Semiconductor Terms

### APT (Assembly, Packaging and Test)
A term used in some industry reports to describe back-end semiconductor processes; corresponds broadly to OSAT.

### Advanced packaging
Technologies used to integrate one or multiple semiconductor dies into a single package, including 2.5D/3D integration, chiplets and heterogeneous integration. Advanced packaging strongly influences performance, energy efficiency, reliability and system integration.

### Analog and mixed-signal (AMS)
Semiconductor circuits that process continuous signals (analog) or combine analog and digital functions (mixed-signal). Critical for power management, sensors, interfaces, RF systems and industrial electronics.

### Automotive-qualified
Refers to semiconductor components and manufacturing processes that meet the stringent quality, reliability and lifetime requirements of the automotive industry, including certification standards and long-term supply commitments.

### Back-end (assembly, test and packaging)
The stages after wafer fabrication where semiconductor devices are packaged, tested, calibrated and qualified for use in systems. Back-end processes are decisive for reliability, lifetime, security and system-level performance.

### Chip architecture
The high-level organisation and functional structure of a semiconductor chip, defining how different components interact to deliver performance, energy efficiency, security and system behaviour.

### Chiplet
A small, specialised semiconductor die designed to be combined with other chiplets within a single package. Chiplet architectures enable modular design, improved yield, cost efficiency and reduced dependence on leading-edge manufacturing nodes.

### CPO (Co-Packaged Optics)
CPO (photonics) allows for connecting optical fibers directly to the chip, which is already a breakthrough in terms of speed and energy consumption.

### EDA (Electronic Design Automation)
Software tools used to design, simulate, verify and validate semiconductor chips. Advanced EDA tools and design IP are essential for modern chip development and are strategically important assets.

### Fabless
A semiconductor business model where companies focus exclusively on chip design and outsource all manufacturing, packaging and testing to external foundries and OSAT providers.

### Fab-light
A business model where companies retain limited in-house manufacturing or pilot production capabilities while outsourcing most volume manufacturing to external foundries, often to preserve process know-how or flexibility.

### Foundry
A semiconductor manufacturing facility that produces chips on behalf of external customers. Pure-play foundries provide open-access manufacturing services across multiple technologies and customers.

### Front-end fabrication
The wafer-level manufacturing processes where semiconductor devices are formed on silicon or compound semiconductor substrates. Front-end fabrication is capital-intensive and technologically specialised.

### Heterogeneous integration
The integration of different semiconductor technologies (e.g. logic, memory, RF, photonics, power and sensors) within a single package or system. A key enabler for system-level optimisation beyond transistor scaling.

### IDM (Integrated Device Manufacturer)
A semiconductor company that designs, manufactures and sells its own semiconductor products, integrating chip design and fabrication within the same organisation.

### Leading-edge nodes
The most advanced semiconductor manufacturing process nodes available at a given time, typically used for high-performance logic, processors and advanced computing. Leading-edge nodes are capital-intensive, highly concentrated globally and economically viable primarily at very large volumes.

### MEMS (Micro-Electro-Mechanical Systems)
Miniaturised devices that combine mechanical and electronic components on a semiconductor substrate. MEMS are widely used in sensing, actuation and timing applications.

### Mature nodes
Semiconductor manufacturing process nodes that are no longer leading-edge but remain essential for industrial, automotive, power, RF and long-lifecycle applications (e.g. 90–180 nm and beyond).

### OSAT (Outsourced Semiconductor Assembly and Test)
Companies specialising in semiconductor packaging, testing and qualification services for external customers. Sometimes referred to as Assembly, Packaging and Test (APT) in industry reports.

### Photon
A photon is a quantum of the electromagnetic field, such as light. It's the carrier of the electromagnetic force. Photons emitted during energy transitions have energies from gamma rays to infra-red spectrum. Photons are massless and travel at the speed of light. Key properties include wavelength, direction, polarization and phase.

### Photonics
Photonics, is the science and technology of manipulating light for sensing, imaging, communications and manufacturing. Photonics enables many of the technologies (such as semiconductor production, medical diagnostics, solar cells, and Earth observation) driving today's innovation economy. Major components include lasers, LEDs, optical fibers, photodetectors, solar panels, imaging sensors, and displays.

### PIC (Photonics Integrated Circuits)
PIC is a microchip that integrates multiple miniaturized optical components (lasers, waveguides, modulators, detectors) onto a single substrate to generate, process, and transmit information using photons rather than electrons. PICs are the driving technology behind next-generation, miniaturized and high-performance devices.

### RF (Radio Frequency)
Semiconductor technologies used for wireless communication, radar and sensing applications. RF performance is strongly influenced by materials, packaging and system integration.

### SiC (Silicon Carbide)

A wide-bandgap semiconductor material used primarily in power electronics. SiC enables higher voltage operation, higher efficiency and improved thermal performance compared to silicon.

### Silicon photonics

Silicon photonic devices can be made using existing semiconductor fabrication techniques, and because silicon is already used as the substrate for most integrated circuits, it is possible to create hybrid devices in which the optical and electronic components are integrated onto a single microchip.

### GaN (Gallium Nitride)

A wide-bandgap semiconductor material used in power electronics and high-frequency RF applications. GaN enables high power density, high efficiency and operation at high frequencies.

### System-on-Chip (SoC)

A semiconductor device integrating multiple system functions (e.g. compute, memory and interfaces) on a single chip. Increasingly complemented or replaced by chiplet-based architectures.

### Test, validation and qualification

Processes used to verify that semiconductor devices meet functional, performance, reliability and safety requirements over their intended lifetime. Particularly critical for automotive, defence and industrial systems.

### Wide-bandgap semiconductors

Semiconductor materials with a larger bandgap than silicon, such as SiC and GaN, enabling high-power, high-frequency and high-efficiency applications.

# Appendix G – References

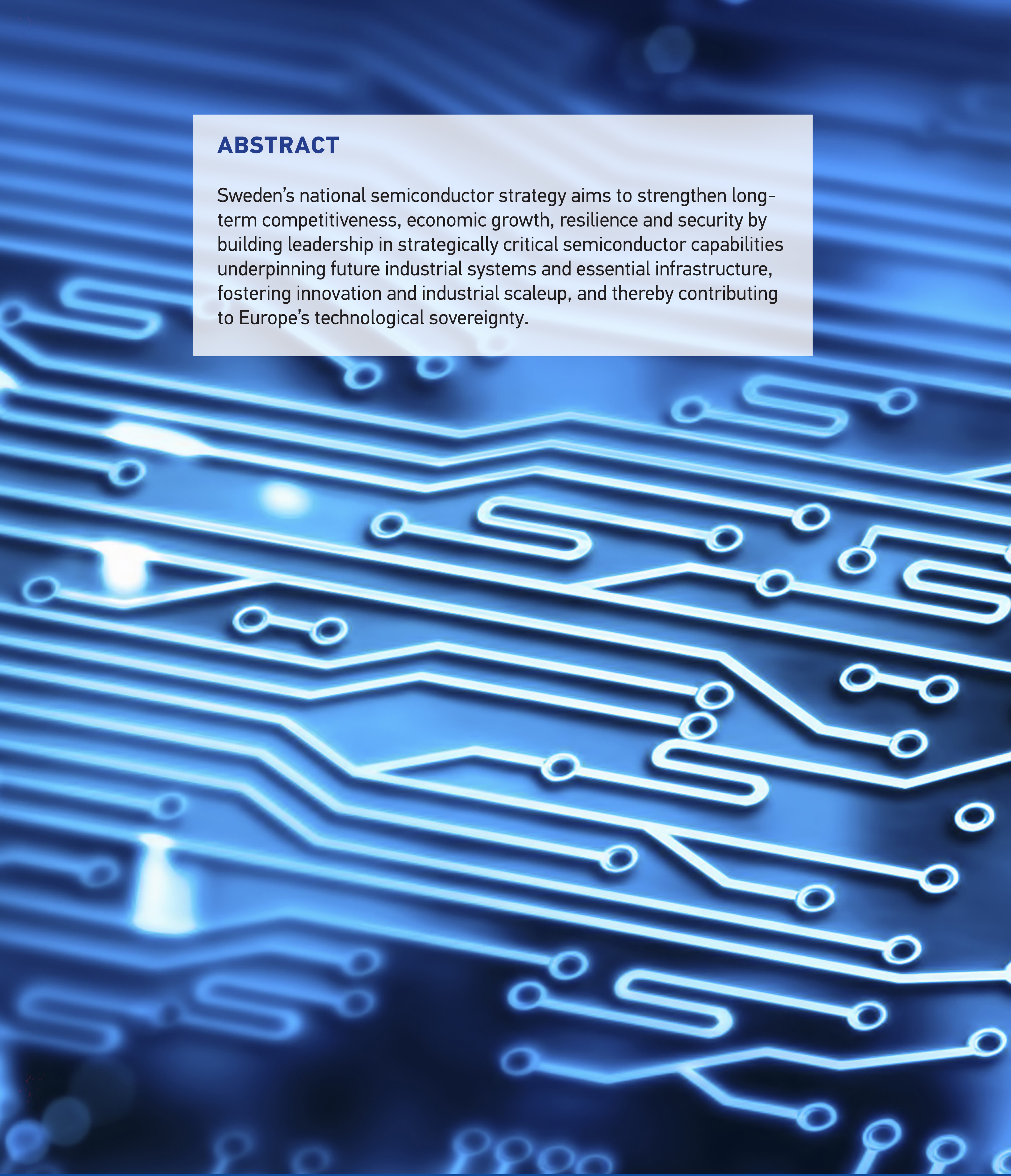

## A. National semiconductor strategies and policy documents
• Government of Finland (2024). Chips from the North – Semiconductor Strategy for Finland.
• Government of Ireland (2023). Silicon Island – A National Semiconductor Strategy.
• UK Government (2023). UK National Semiconductor Strategy.
• Federal Government of Germany (2023). Mikroelektronik-Strategie der Bundesregierung.
• Government of the Netherlands (2025). ChipNL – National Innovation Programme.

## B. European Union policy, regulation and evaluation
• European Commission (2023). The European Chips Act.
• European Court of Auditors (2025). Special Report 12/2025: EU Industrial Policy on Semiconductors.
• European Commission (2024). Position Paper on the EU Chips Act – Implementation and Outlook.
• RISE (2024). European Chips Act – Implications for Sweden.

## C. Swedish policy, strategies and public reports
• Regeringskansliet / Tillväxtverket (2024). Halvledaraktens tillämpning i Sverige.
• Vinnova (2024). Viktiga tekniker för Sverige – Slutrapport 2024–01501.
• FMV (2022). Teknisk prognos – Halvledarteknik.
• IVA (2025). Sweden’s Competitiveness and Investment Priorities.
• RISE (2023). Sverige i halvledarvärlden.
• Teknikföretagen et al. (2025). Industrin – vårt bästa försvar.

## D. Industry, market and value chain analysis
• McKinsey & Company (2024). The Semiconductor Decade: A Trillion-Dollar Industry.
• PwC (2026). Semiconductors and Beyond – Global Outlook.
• OECD (2024). Global Semiconductor Fabrication Capacity.
• BCG & Semiconductor Industry Association (SIA) (2024). Emerging Resilience in the Semiconductor Supply Chain, as referenced in European Court of Auditors, Special Report 12/2025.
• McKinsey & Company (2024). Opportunities in Networking Optics and Data Centres.
• Nordic Innovation (2025). Nordic Chip Collaboration Report.
• Skåne Region (2024). The Semiconductor Value Chain in Southern Sweden.
• “AI desperately needs photonics” Study by TEMATYS, Published Nov-2025 by Photonics21 – European Technology Platform


## F. Consultations and primary input
Roundtable discussions, interviews and reference group consultations conducted within the framework of this strategy (2025). Participant list provided in Appendix E.



## ABSTRACT

Sweden's national semiconductor strategy aims to strengthen long-term competitiveness, economic growth, resilience and security by building leadership in strategically critical semiconductor capabilities underpinning future industrial systems and essential infrastructure, fostering innovation and industrial scaleup, and thereby contributing to Europe's technological sovereignty.

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