

SEMI Europe
Recommendations to Grow Europe Semiconductor Ecosystem
Resilience and Competitiveness



Introduction

As foundation of disruptive innovation, semiconductors have set the world on a new path to progress and prosperity. It is at this time; Europe is presented with an opportunity to build on its success as world's leader in embedded electronics and become the global center of technological excellence and leadership for generations to come.

To secure our future, Europe must continue to invest and support the semiconductor industry in a targeted manner. Our existing strengths must be enhanced with a long-term, forward-looking semiconductor manufacturing strategy, supported through a strong regulatory environment that invites openness to innovation, reinforced by a diversified global network of suppliers and strengthened by strategic partnerships formed on the basis of mutual interest and individual strengths.

To pioneer the next generation of semiconductor innovations, the Alliance for Processors and Semiconductor Technologies and the announced European Chips Act, have a decisive role to play in ensuring access to funds, suppliers, and networks critical to Europe's semiconductor ecosystem.

As the world's largest semiconductor industry association and voice of the semiconductor supply chain, SEMI Europe sets out the following recommendations to increase the resilience and competitiveness of the semiconductor ecosystem in Europe:

Manufacturing

- Expand semiconductor manufacturing capacities with focus on end-sector needs to maintain leadership and market share globally.
- Advance Europe's leadership in international standardization of smart manufacturing technologies.
- Support the introduction of circularity strategies in semiconductor manufacturing.

Research and Innovation

- Create pan-European research, innovation and development roadmaps for advanced semiconductor technologies.
- Set up a European Semiconductor Technologies Innovation Observatory.
- Enhance protection of Europe's collective R&D data by introducing safeguards for sharing and transfer of knowledge between industry, academia and RTOs.
- European Semiconductor Fund: focus on scale-up of semiconductor innovation capacities in Europe.

Supply Chains

- Encourage the sharing of best practices and approaches to mitigate future supply chain risks.
- Develop common strategies on securing the semiconductor supply chain, including semiconductor equipment, materials, and raw materials.

Skills

- Set the Pact for Skills for Microelectronics as strong fundament for reskilling and upskilling of Europe's talent pool.
- Promote workforce development and mobility for better access to international technological know-how.



Laith Altimime
President, SEMI Europe



Luc Van den hove
SEMI Europe Advisory Board Chair
President and CEO, imec



"Semiconductors must remain at the core of Europe's industrial and technological ambitions. With the launch of the Industrial Alliance for Processors and Semiconductor Technologies and the announcement of the Chips Act, Europe has taken a pivotal step in securing supply chain resilience and future competitiveness of the microelectronics ecosystem."

Laith Altimime

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1. Semiconductor Manufacturing: Setting a Target to Steer Europe's Efforts

With the growing demand for advanced technologies, semiconductors have become a priority for governments globally. Due to their strategic importance, the capacity to manufacture application – specific semiconductors has become decisive in securing nation's technological leadership and industrial excellence.

Today, Europe continues to thrive as an important player in the global semiconductor ecosystem. As leading region for technological excellence, semiconductors 'made-in-Europe' attain high quality and trustworthiness, becoming first choice components for critical applications in manufacturing, automotive, healthcare, aerospace, telecommunications, transportation, energy management, military systems, and space to name a few.

To secure future leadership of our semiconductor industry, Europe must continue to build on its strategic strengths in a targeted manner. Our existing capabilities must be enhanced with a long-term forward-looking manufacturing strategy, with particular focus on high-performance electronics, MEMS, sensors, and imagers. Just as critically, new applications for semiconductors must be addressed.

As SEMI Europe, we strongly believe, the Industrial Alliance for Processors and Semiconductor Technologies and the announced European Chips Act are well positioned to bring manufacturing of semiconductors in Europe to the next level by:

A. Expanding semiconductor manufacturing capacities with focus on end-sector needs to maintain leadership and market share globally

Expanding Europe's growth of semiconductor production capacities must be guided by a clear, future-oriented approach. In view of the increasing demand for advanced semiconductor components in automotive, health, aerospace, telecommunications and defense industry, Europe's mid-term strategy to increase production capacities should be focused on end-user needs, in particular within sectors with strong presence in Europe. By focusing first on existing demand, Europe will have the opportunity to identify technological shortcomings, adjust roadmaps for future "leading edge" components, and drive the production of advanced semiconductors in line with technological progress and evolving needs of industries in Europe and globally.

In our long-term approach to secure 20% of global production capacities by 2030, Europe needs to focus on strategies advancing manufacturing of advanced technology nodes "at the edge." This approach should however not be limited to nodes below 2nm. Various types of semiconductors such as MEMS, sensors or power semiconductors can achieve "leading edge" by focus on their overall properties and performance potential. Europe's long-term strategy should focus on the semiconductor ecosystem as a whole and support manufacturing of components "at the edge" for key end-user industries (e.g., automotive and healthcare) without limiting itself to specific structure sizes nor technologies (including FDSOI).

Just as critically, future FABs established in Europe should support manufacturing of a diverse set of semiconductor technologies. Such approach would not only help Europe to achieve the target of 20% of global production capacities more efficiently, but secure leadership in emerging markets early on and attract additional investment for further industrialization.

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B. Advancing Europe's leadership in international standardization of smart manufacturing technologies

Standards are the universal language of the semiconductors manufacturing community. Instrumental to success, standards allow thousands of chip companies around the world to rapidly build and equip multi-billion fabs utilizing equipment and materials from numerous vendors, speeding facilities into operation, and ensuring compatibility of production tools, processes, and systems.

- **It is our recommendation for Europe to take the lead in setting standards used in the development and integration of smart manufacturing technologies. A creation of a joint, semiconductor standardization oversight committee would help to efficiently coordinate future standardization activities and facilitate a closer collaboration between industry-led standardization initiatives (e.g., SEMI Smart Manufacturing Standards) and international and European standardization organizations. Driven by industry, standard-setting activities should be market-oriented with a strong commitment to transparency, global stakeholder participation, and coordination.**

C. Supporting the introduction of circularity strategies in semiconductor manufacturing

Electronics industry players are working to transform their business models to conform to the principles of a circular economy. Manufacturers are rapidly moving away from the take-make-waste approach and investing in keeping materials, components, products, and waste useful and valuable at all phases of manufacturing. While each company's approach to implementing the circular economy principle may be as unique as the organization itself, the industry strives for a continuous development cycle that supports environmental protection, ongoing innovation, and business growth.

- **SEMI Europe strongly supports the introduction of a pan-European Sustainable Manufacturing Initiative. We encourage the European Commission to introduce a strategy for circularity in semiconductor manufacturing that builds on current approaches and best practices used across the industry. Such initiative would raise public awareness on ongoing circularity activities and help businesses to implement circularity in their manufacturing operations early on.**

2. Semiconductor Research and Development: A Key Driver of innovation and Resilience

Semiconductors are the raw material of innovation, enabling technological progress across numerous industries. Integrated into novel products or as technological basis for services, advancements in semiconductors enable solutions to critical societal and economic challenges globally.

In Europe, the semiconductor industry benefits extensively from a rich R&D ecosystem present across EU Member States. Because of the combined dynamism of our world-class R&D centers, education institutes, and key end-user industries, European innovation continues to be driven by long-term partnerships, symbiotic value-added chains, academic networks and collaborative projects forming together a productive research ecosystem.

To pioneer the next generation of semiconductor components and systems, the Alliance for Processors and Semiconductor Technologies, as well as the announced European Chips Act, have a decisive role to play in ensuring the right conditions and environment for Europe's semiconductor ecosystem are created. Only through coordination of technological capabilities of the semiconductor industry with the needs of end-user sectors in Europe, new potential can be harnessed, with capacities expanded towards leading-edge nodes. Following are strategic recommendations and objectives in relation to innovation, research, and development for the consideration of the European Commission:

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A. Create pan-European research, innovation and development roadmaps for advanced semiconductor technologies

The capacity to innovate remains a decisive factor in securing business leadership and competitiveness on markets globally. For Europe's key industries such as automotive, healthcare, and smart mobility, success in production and development of novel products and services largely depends on the capacity to access application-specific semiconductor components. It is of vital importance for Europe to approach research and innovation of semiconductors for end-user industries in a coordinated manner.

- **SEMI Europe encourages the European Commission to introduce innovation roadmaps defining objectives and steps for targeted research and development of next generation of semiconductor components and systems for key end-user industries. By utilizing the Alliance's broad membership, sector-specific working groups could form a basis for the development of clear strategies with ambitious targets for the next generation of cutting-edge semiconductors. With a clear vision, Europe can rapidly mature crucial innovations and advance the development of pilot line manufacturing capacities for the next generation of chips and other technologies.**

B. Set up a European Semiconductor Technologies Innovation Observatory

Keeping track of a vast range of innovations within the semiconductor ecosystem can be a challenge. With global advancements in key segments of the semiconductor industry such as materials, design, manufacturing equipment and processes, the potential to timely capture trends and innovations for a single company or policymaker can be decisive in securing future success.

- **SEMI Europe suggests the creation of a European Semiconductor Technologies Innovation Observatory as a platform specifically focused on the monitoring of global technological innovations and R&D trends in semiconductor components and prototype manufacturing technologies. By mapping out key developments within the global semiconductor ecosystem, Europe can benefit from a comprehensive insight into the entire semiconductor innovation landscape and take account of technologies with varying levels of maturity. Such Observatory could further support monitoring of innovations delivered via EU-funded projects, further advancing the dissemination and exploitation of critical knowledge among Europe's companies, RTOs and academia.**

C. European Semiconductor Fund – focus on scale-up of semiconductor innovation capacities in Europe

A focused semiconductor R&D base and strong research and innovation funding are essential for Europe to maintain a competitive high-tech electronics ecosystem. Facing intense global competition, Europe's leading companies and RTOs pursue constant innovation in semiconductor materials, manufacturing equipment and systems in an effort to sustain the high revenues and competitiveness of Europe's leading industries. To meet the growing need for advanced innovations, Europe needs to invest in further raising maturity of existing R&D pilot lines, to extend capabilities and accelerate technology development of advanced nodes (up to 2nm and below). Just as critically, research and innovation in semiconductor materials, manufacturing equipment and systems needs to have a central role in the European Semiconductor Fund to meet the need of end-user industries and emerging markets.

- **To this end, the European Semiconductor Fund should be complementary to EU initiatives such as the upcoming KDT Joint Undertaking. Considering the increasing cost of R&D and growing complexity of technological innovation, we encourage the European Commission to introduce complementary synergies between funding instruments centered around semiconductors to create a resilient, well-funded, state-of-the-art R&D ecosystem. Such synergies could expand Europe's investment to raise maturity of existing R&D**

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pilot lines, to extend capabilities and accelerate technology development of advanced nodes (up to 2nm and below).

- SEMI Europe strongly supports the set-up of a specific 'strategic autonomy' program within the European Semiconductor Fund to support innovation and development of essential assets for manufacturing of critical electronic components, with a balance between industry policy (economic security) and a free and fair economic order. Such program should remain focused on low-power technology, sensor systems, power management for automotive and industrial automation, manufacturing equipment for advanced nodes, new semiconductor materials for power technology, leading to guaranteed access to secure and trusted semiconductors for Europe's strategic industries.

In addition, the Semiconductor Fund und should provide targeted incentives for European and foreign companies establishing regional R&D facilities and FABs in the form of direct capital support or tax credits to procure semiconductor equipment and other technologies, from suppliers with significant European presence (e.g., suppliers with R&D and production/assembly sites in Europe). Just as critically, to secure supply chain resilience the Fund should provide incentives to establish design, test and assembly houses across Member States.

- In addition, the European Semiconductor Fund should also include a Technology and Innovation Leadership program, driven by industry and key European RTOs. With a focus on extending new concept demonstration capabilities of the leading R&D pilot fabs, system integration and design infrastructure for future generations of semiconductor innovations, the program would significantly contribute to secure European intellectual property, strengthen patent portfolios and skills-capabilities of young and senior professionals to stay ahead of the competition in the coming decade.

3. Semiconductor Supply Chains – Global Partnerships for a Global Industry

The resilience and security of the semiconductor supply chain has vaulted to the forefront of policy considerations due to current chip shortages. With technological advances depending less and less on geometrical shrink and more on the design and manufacture of new, advanced transistor and interconnect structures using new innovative and complex material stacks, access to diversified and secure global supply chains has become critical.

As highlighted by the ongoing chips-shortage, semiconductor supply chains have little excess capacity available to absorb supply disruptions and unexpected demand, resulting in cascading effects throughout numerous adjected industries. Supply constraints, whether they be in devices, equipment, or materials, can lead to significant semiconductor shortages, which can result in ripple effects in Europe's digital economy.

For Europe's semiconductor industry, access to a diversified network of global suppliers for raw materials, manufacturing equipment, components and systems is critical. A key goal for EU's Processors and Semiconductor Technologies Alliance and the CHIPS Act should build on the success of the EU-U.S. Trade and Technology Council and introduce similar initiatives with partners globally to identify ways to ensure stronger, long-term resilience of supply chains that are essential for the microelectronics industry to withstand future crises. As supply of products and services from international trading partners is essential for Europe's microelectronics industry, the following should be considered:

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A. Encourage the sharing of best practices and approaches to mitigate future supply chain risks.

Many semiconductor businesses at various segments of the supply chain, work with a diversified network of suppliers across the globe. Given the number of locations where raw materials are sourced, equipment procured, and chips manufactured, monitoring and management of supply chain risks can become a challenge. Moreover, potential regional and global shocks resulting from natural disasters or geopolitical developments can create vulnerabilities that many companies may not be fully aware of in time.

- **Increasing awareness of supply chain bottlenecks in both the semiconductor industry and end-user sectors should be a central objective of the Alliance and the Chips Act. By developing mechanisms to share best practices on supply chain monitoring and bottlenecks mitigation, potential disruptions and risks could be timely identified, and alternative means of supply secured. Such mechanisms could further support the European Commission in developing multilateral policies and recommendations to international organizations such as World Trade Organization to secure greater transparency and understanding of global supply chains.**

B. Develop common strategies on securing the semiconductor supply chain, including semiconductor equipment, materials, and raw materials.

For the past decades, the multilateral trade order has created opportunities for faster technological development and production possibilities for the microelectronics industry. The flexible use of global production capacities, combined with a focus on core competencies, has become key to a competitive advantage for electronics companies. Such capability, however, requires an increasingly diversified supplier network, which must be optimized and controlled to provide reliable, fast and flexible services. A key goal for EU's priorities should be to identify ways to ensure stronger, long-term resilience of supply chains that are essential for the microelectronics industry to withstand future crises.

It is equally critical to coordinate approaches with respect to export controls on semiconductor manufacturing equipment. Export controls are powerful security tools that are best used strategically, in a manner that is integrated in a unified strategy with other tools of national and regional policy, narrowly tailored to address security concerns, safeguard existing advantages, and implemented multilaterally with other semiconductor-producing countries.

- **It is our key recommendation the Alliance and Chips Act play a critical role in the development of strategic trade instruments on export control to secure the global supply of essential raw material and components for the semiconductor industry. Equally, the implementation of assistance programs for enhanced extraction, processing, and supply of raw materials should be supported by via both initiatives. By linking the needs of Europe's semiconductor industry with development policy objectives, European Commission can foster social and economic progress in developing countries, while accelerating the supply and production of critical electronic components at home.**
- **SEMI Europe also recommends the European Commission to take a strong, multilateral approach to export control regulation. Specifically, the European Commission could leverage the broad, international membership of the Alliance to identify key bottlenecks and formulate recommendations to serve as a basis for the coordination of the multilateral export control regime with like-minded partners.**

4. Upskilling and reskilling as a fundament for the Alliance and the CHIPS act

In Europe, acute skills challenge and lack of qualified personnel are present across industries. The number of open positions for engineers and technicians is growing at an alarming rate. The blistering pace of technology calls for rapidly evolving skills in R&D, design, manufacturing, specific applications, AI ethics, cybersecurity, and energy-efficiency. The involvement of women in electronics education and employment is low. Learners often do not have access to state-of-the-art design and manufacturing equipment used by the industry, and they are not trained on real-life business problems. Workforce mobility across Europe's regional clusters and globally is limited. COVID-19 has been detrimental to on-site training, apprenticeships, and traineeship programs, and exacerbated the need to invest in new technologies and everything digital including online training, virtual teams, and remote services.

To that end, EU's Industry Alliance and the European CHIPS Act will be fundamental to enhance reskilling and upskilling efforts for a stronger and more competitive European industry.

A. Set the Pact for Skills for Microelectronics as strong fundament for reskilling and upskilling of Europe's talent pool.

For Europe's semiconductor industry, access to a highly skilled workforce, distributed across European nations encompassing knowledge on advance semiconductor manufacturing, design, materials and supply chain, is critical. A key goal for the Alliance on Processors and Semiconductor Technologies and the CHIPS Act must be the identification of gaps in required skills and the development focused programs on national as well as regional level to ensure a strong, well-skilled workforce becomes a fundament for Europe's future competitiveness.

- **It is our recommendation for the Alliance and the Chips Act to develop strong links with the Pact for Skills for Microelectronics as fundament for the development of long-term skills strategies and support of EU ambitions in advanced node manufacturing and design. As a concrete step, the Alliance and the Chips Act need to support the development of a European e-learning platform, to provide unrestricted access to knowledge and education to already active workforce (e.g., engineers) as well as students and young professionals regardless of their location across Member States.**
- **In addition, the Alliance and CHIPS Act need to build on the accomplishments and deliverables of existing initiatives such as the MicroElectronics Training, Industry and Skills project (METIS) that served as a catalyst for the launch of the Pact for Skill.**

B. Promote workforce development and mobility for better access to international technological know-how

The technology challenges we face are immense, stretching from design, manufacturing, application of new materials, to building cost-effective and resilient supply chains. Deepening our cooperation on technology programs by more intensely sharing and at the same time protecting our advanced knowledge will make both EU and its partners stronger. The most effective way to benefit and learn from each other's skills is to have experts across Europe actively working together on advanced technology programs, preferably through initiatives such as European Pact for Skills on Microelectronics.

- **We recommend establishing a pan-European workforce development group within the Alliance to set up effective mobility programs between the EU and its partners. These programs must be also supported via the Chips Act and focus on the development of skills among students and workers, focusing on disruptive technologies.**

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Conclusions

SEMI welcomes the opportunity to discuss the recommendations with the European Union. The microelectronics sector is a key enabler and remains ready to work together with all interested stakeholders to develop new avenues of growth to maintain the transatlantic technological leadership.

Following SEMI Europe Advisory Board Members Endorse SEMI Priorities

