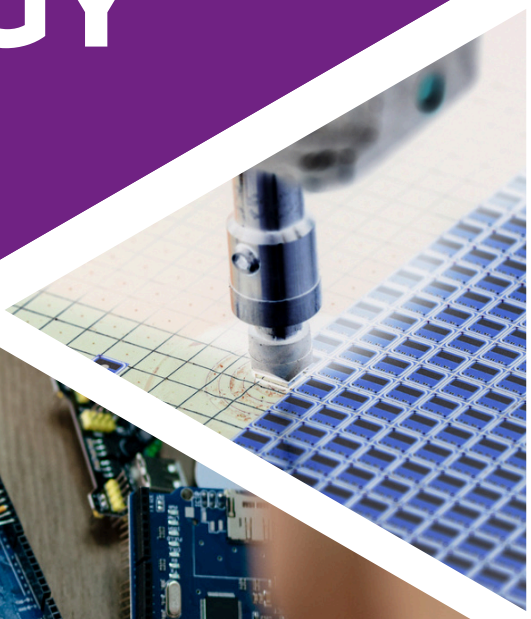
EUROPEAN CHIPS SKILLS ACADEMY

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DECISION ETUDES & CONSEIL

SKILLS STRATEGY 2026







UPDATE ON THE TALENT GAP IN THE EU SEMICONDUCTOR ECOSYSTEM

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EXECUTIVE SUMMARY

A) THE EU TALENT GAP: A STRUCTURAL CHALLENGE

The 2025 edition of the ECSA Skills Strategy estimated the EU27 semiconductor talent gap at around 65,000 skilled workers by 2030, an average annual shortfall of about 10,800 workers over 2024–2030. This figure revised the 75,400 projected in the 2024 Strategy, after the postponement or cancellation of four major investment projects (Intel in Magdeburg and in Poland, GlobalFoundries in Crolles, Wolfspeed/ZF in Saarland) and the 8% downturn of the European market in 2024. The gap stems from the ageing of the workforce, with 30% of employees expected to retire between 2024 and 2030, combined with industry growth, against a supply of graduates rising by only 1% a year. The quantitative assessment was not updated in 2026, and these figures remain the reference. However, the 2026 ECSA survey suggests an apparent easing of talent shortages, primarily driven by companies scaling back their hiring plans across Europe rather than by any structural improvement in the supply of skilled graduates.

Although the talent gap has narrowed and its onset delayed, it remains a structural challenge for Europe, given the long lead time required to expand the skilled workforce. Urgent action is needed – especially in the regions where demand is most concentrated: Saxony, Brainport Eindhoven, Ireland, Belgium, Grenoble, Catania, Northern Italy, Austria, Bavaria, and Baden-Württemberg.

Main Talent Gap Locations in 2026

Segment	Key Regions / Actors
Design, Test, Software	Most IDMs and fabless companies in Europe
Front-end	Germany, Ireland, Italy, Austria (ESMC, Intel, ST, Infineon, AMS…)
Back-end	Italy, Malta, Portugal, Bordeaux in France (Silicon Box, ST, Amkor, Tessalia)
Pilot Lines	Belgium, France, Italy, Germany, Spain
Equipment & Tools	The Netherlands, Germany (ASML and ecosystem…)
Materials	Mainly Italy and Finland (wafers), and Germany (gases and advanced chemicals)

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B) KEY FINDINGS FROM THE 2026 INDUSTRY SURVEY

The 2026 ECSA survey gathered **83 responses from 51 organisations across Europe,** with a balanced representation of SMEs, large companies, universities and RTOs.

Hiring intentions have weakened since 2025. 48% of respondents expect to maintain their hiring levels on EU soil (49% in 2025), 31% expect to hire more (36%) and 21% expect to hire less (14%). Those hiring more cite rising demand, including for AI chips, new fabs and R&D sites in Europe, the choice to locate activity in Europe to limit tariff and geopolitical exposure, and the replacement of retiring staff. Those hiring the same or less cite a shift of hiring towards Asia, weak automotive demand, heavy recruitment in 2025 that left fewer posts to fill, cautious planning that favors internal mobility and reskilling over new hires, and efficiency gains from AI.

Compared to 2025, fewer respondents report a worsening skills shortage, but the easing reflects lower hiring rather than more candidates. The share reporting a worsening shortage fell from 38% to 22%, while 54% report no change (42%) and 23% an improvement (20%). Where the shortage is said to have worsened, respondents point to retirements outpacing new entrants, competition from other industries for the same profiles (AI or security specialists, software engineers), and training that lags technological change. Where it is stable or improved, they attribute it to the economic slowdown and to recruitment already done in 2025. Experienced and cross-disciplinary profiles remain as scarce as before, and the easing is therefore likely to be cyclical.

More respondents report an impact of the investment wave and of the EU Chips Act on their recruitment policies than in 2025. 54% report an impact from at least one of the two (40% in 2025), 27% report no impact (28% in 2025), and 19% express no opinion (33% in 2025). Respondents credit the Chips Act with raising awareness of the sector and attracting talent, but many consider its direct effect on hiring limited: it has intensified competition for experienced engineers, and hiring follows mainly where new fabs are built.

Geopolitical tensions affect the recruitment policies of 61% of respondents (56% in 2025). The answers point to posts relocated towards Asia for some and kept in Europe for others, fewer hires and more uncertain workforce planning, restrictions on the countries candidates and suppliers may come from, growing demand for export-control, compliance and security skills, and visa changes, notably in the United States, that are reshaping where recruits are placed.

AI has changed how most respondents work and is starting to weigh on hiring decisions. 84% report that AI tools have changed their day-to-day work in the past 12 months, mainly in writing, analysis and coding, while domain expertise remains necessary to judge the output. 22% have considered using AI instead of recruiting for a specific role, mostly in design, software and support functions.

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New job roles continue to emerge, while the skills required for existing positions are evolving rapidly. 52% of respondents report the emergence of new job profiles since mid-2025, while 80% identify new skills needs. The gap between the two has widened from 19 to 28 percentage points. AI tops both lists (41% of new profiles and 58% of new skills needs), followed by system architecture, advanced packaging, cybersecurity and data analytics. Respondents identify the hybridization of job profiles as the main trend, with examples including AI-assisted design engineers, data-driven process engineers and security-by-design systems architects.

Software engineers, cybersecurity experts and system designers remain the most sought-after profiles, while system and analog designers remain among the hardest to recruit. Software engineers (55%), cybersecurity experts (53%), system design engineers (52%), design engineers (49%) and data specialists (49%) are cited by about half of respondents as most sought-after. On the shortage side, system design engineers come first (44%), followed by data specialists (37%, up from 26%), analog design engineers (34%) and cybersecurity experts (31%).

Over 2020–2026:

- Software engineers have ranked first or second every year. However, the shortage of software engineers appears to be easing in 2026, driven by AI-related productivity gains and a broader surplus of software engineers across the EU.
- Demand has risen most for cybersecurity experts, data specialists and machine learning engineers.
- Demand for manufacturing profiles, such as process engineers and maintenance technicians, has declined since 2023.

AI and machine learning are the most critical skills this year, ahead of system architecture. AI/ML is cited by 58% of respondents, system architecture by 52%, security by 39%, data analysis by 38% and knowledge of applications by 36%. System architecture, analog design and security are placed at master's level by a large majority; new materials carry the highest PhD requirement.

AI, security and Edge IoT/Edge AI remain the technologies with the greatest impact on skills needs (82%, 65% and 61%), and the ones whose skills are hardest to find. Respondents link them to the move of AI onto the chip, to security built into hardware and system design rather than added in software, and to the hardware–software co-design that edge systems require, which concentrates demand on system designers, embedded software engineers and machine learning engineers with semiconductor knowledge.

In summary, the European semiconductor skills gap remains structural and long-term. Although the recent market slowdown has temporarily eased pressure, Europe's ability to meet future industrial targets will depend on **sustained policy coordination, expanded training capacity, and effective mobility and attraction measures. Artificial intelligence is reducing the number of graduates needed while rising the need for upskilling the existing workforce in a large number of profiles.**

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C) POLICY RECOMMENDATIONS

1. Address the impact of Artificial Intelligence on the workforce

The European talent gap is driven by two structural factors: the ageing of the EU workforce and the insufficient number of graduates in semiconductor-related fields. Artificial Intelligence (AI) is the only emerging factor with the potential to structurally reduce the talent gap across several professional profiles, starting with design and software engineers.

However, AI's impact is multidimensional: while it can help alleviate talent shortages, it also drives the emergence of numerous new job profiles and tends to reduce demand for junior professionals, as AI agents increasingly support senior experts. This creates a long-term risk of weakening the talent pipeline needed to develop the next generation of senior professionals.

To anticipate and address AI's impact on the semiconductor workforce, the following actions are recommended:

- **Reassess the talent gap in light of AI adoption.**
  - Conduct an updated quantitative assessment of the talent gap, accounting for the impact of AI adoption on workforce demand, to better inform workforce planning and training development.
  - Update this assessment annually to capture the non-linear evolution of AI's impact on the talent gap.
  - Improve the granularity of the analysis to assess the specific impact of AI on individual semiconductor job profiles.
- **Expand and adapt education and training.**
  - Update curricula and VET training programmes in close collaboration with industry to equip future professionals with AI-relevant skills and competencies, as most profiles are being hybridized with AI (e.g., AI process engineers).
- **Upskill and reskill the current workforce.**
  - Address training gaps on AI and big data tools for technician and operator roles.
- **Mobilize available talent.**
  - Enable flexible work-based learning opportunities to ensure early career talent is nurtured despite potential impacts from AI.

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2. Short term

A) Upskill and reskill the current workforce

First, funding for upskilling and reskilling programmes is urgently required to address the evolving skill needs of the semiconductor and related industries.

Upskill initiatives should focus on:

- Training digital designers in analog or system design.
- Training a broad range of profiles in the use of artificial intelligence and data analysis tools: Software engineers, designers, data specialists, process engineers, test engineers, robotic engineers, application engineers, and maintenance technicians.
- Training operators to become technicians, as operators are increasingly being replaced by robots.

In parallel, reskilling initiatives should target workers from other industrial sectors, such as the automotive industry, in order to expand the talent pool available to the semiconductor ecosystem.

B) Mobilize available talent within and beyond Europe

Second, stakeholders call for stronger efforts to attract talent from countries with a labor surplus, both within and beyond the EU.

At the intra-EU level, countries such as Spain, Croatia, Romania, Bulgaria and Greece are identified as potential sources of skilled professionals.

At the extra-EU level, cooperation should be reinforced with India, Africa and Asia.

To support this objective, the panel recommends:

- Improve the recognition of qualifications and skills across Member States, including vocational qualifications, micro-credentials and work-based learning.
- Simplify and harmonize visa and immigration procedures for non-EU semiconductor specialists and students, including faster processing of work and residence permits.
- Provide scholarships for non-EU students in semiconductor-related fields, with co-sponsorship from industry.
- Facilitate student placements, graduate contracts and industrial PhDs through services connecting graduates with semiconductor companies and research centres.
- Facilitate temporary staff transfers between European sites of the same company by reducing administrative barriers.
- Increase salaries and/or provide housing assistance.
- Fostering international cooperation with the most relevant partner countries.

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3. Long term

A) Expand and adapt education and training

In 2026, as has been the case consistently since 2020, respondents have identified as a top priority the need to **increase training capacities in targeted fields**. Two specific actions are recommended in this regard:

- **System designers, analog designers, and cybersecurity experts.** The EU faces shortages of 3,300 system designers, 2,100 analog designers, and 2,600 cybersecurity experts by 2030[1]. These roles require highly specific training and experience, while the number of professionals to be trained remains relatively limited. The creation of specialised training hubs across the EU is essential to bridge this gap. The 2026 Chips JU calls focusing on stimulating chip design and establishing Hubs of Excellence appear to be effective ways to bridge the talent gap in this field.
- **Electrical and electronic engineers in specific locations.** By 2030, the EU faces a projected shortfall of 53,400 professionals[1] with electrical engineering backgrounds to support manufacturing, design, and testing. At the EU level, the main challenge is to attract existing STEM students to electrical engineering studies. However, in certain countries or regions (e.g. in France and Italy), training capacities in electrical engineering appear insufficient and/or are declining. There is an urgent need to expand these capacities in such areas. Short-term relief could also come from intra-EU mobility, leveraging countries with surplus graduates (Spain, Romania, Greece, Bulgaria, Croatia), and from extra-EU migration from regions such as India.

Respondents to the 2026 survey also emphasize the **need to strengthen the overall education and training ecosystem** for microelectronics across Europe.

- **Increase public education investment in microelectronics.** As education funding is being reduced in several Member States - directly affecting electrical engineering training capacities - stakeholders observe a parallel rise in "quick" or low-quality certificates aimed at short-term attractiveness. Such practices undermine the EU's ability to compete in an increasingly complex global environment. Coordination with national Ministries of Education is essential to ensure sustained public funding for electrical engineering and microelectronics programmes in targeted geographical areas.

[1] Figures from the 2025 edition of the European Chips Skills Strategy.

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This increased funding would also enable the development of modern digital and remote learning infrastructures -such as virtual classrooms, simulation environments, and collaborative online labs- that are indispensable for providing high-quality training across the EU.

- **Expand vocational training for semiconductor technicians and equipment specialists.** Strengthen VET pathways to meet industry's needs, including training that enables operators to progress into technician roles as semiconductor manufacturing becomes increasingly automated. Countries like the Netherlands, Germany, or Italy seem to face a challenge to scale VET trainings. The 2026 Chips JU call focusing on Pilot Federation appear to be an effective way to bridge the talent gap in this field.
- **Set up innovative training initiatives to support upskilling and reskilling.** Initiatives such as summer schools or accessible online training platforms, including recognized certification schemes, would enable professionals at different career stages to upskill or reskill efficiently.

B) Raise interest in semiconductor careers

The second major recommendation stresses the need to **raise awareness and strengthen guidance on education pathways** leading to careers in microelectronics. Beyond increasing training capacity, Europe must inspire young people from an early age to discover opportunities in the semiconductor and electronics industries.

- **Promote early engagement in STEM and microelectronics.** Efforts should start well before university, at primary and secondary school levels, by introducing pupils to science and technology through hands-on activities such as robotics and electronics labs, hackathons, and after-school clubs. Member States should integrate introductory microelectronics modules -covering electronics, programming, materials science, and emerging technologies- into school curricula to make technology more tangible and appealing. Coordination with national education ministries from Member States is crucial in this regard.
- **Train and support teachers.** Teachers are central to sparking students' interest but often lack the tools to do so. "Train-the-trainer" programmes and updated teaching materials are needed to familiarize educators with new technologies and help them deliver engaging STEM and microelectronics lessons. Industry placements for teachers, such as those offered by Intel in Ireland, can also provide first-hand exposure to semiconductor technologies and careers.
- **Create structured orientation and outreach programmes.** Establish accessible career-orientation platforms and public awareness campaigns highlighting the diversity of careers in microelectronics -from engineering and design to sustainability and digital innovation- and their role in Europe's technological sovereignty. Industry experts sharing their experiences via social media and outreach events can further inspire students and demystify technical professions.

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- **Promote diversity and inclusion in semiconductor careers.** Encourage greater participation by women and other underrepresented groups through targeted outreach and initiatives such as the European Chips Diversity Academy.

C) Build on existing semiconductor clusters

The panel emphasizes the importance of strengthening Europe's semiconductor industrial base by building on existing regional semiconductor clusters.

To this end, the following actions are recommended:

- **Strengthen existing semiconductor clusters** to consolidate industrial capabilities and reinforce links between companies, research organisations and education providers.
- **Foster cross-border cooperation between European semiconductor clusters**, including through joint networks, exchanges of expertise, and the sharing of training resources and infrastructure.

Initiatives such as the ECSA and the network of competence centers appears to be effective ways foster cooperation between European clusters.

D) Improve granularity of employment and graduates' data

Improve the availability, reliability and comparability of skills data at EU and Member State levels to better identify shortages and guide investments in education and training. Three priorities are recommended:

- **Improve employment data by occupation:** Increase the granularity of occupational employment statistics, which remains insufficient in existing Eurostat and Cedefop data, drawing on the example of the detailed Occupational Employment database of the U.S. Bureau of Labor Statistics.
- **Improve graduates' data by field of study:** Increase the granularity of data based on the International Standard Classification of Education (ISCED), drawing on the more detailed U.S. Classification of Instructional Programs (CIP).
- **Improve graduate tracking:** Build on the European Eurograduate survey to obtain more detailed information on graduates' fields of study and sectors of employment, and encourage approaches similar to Austria's ATRACK system, which uses administrative registers to track graduates' employment outcomes.

The European Commission should establish common data standards to improve comparability across Member States and support the use of these data in skills policymaking.

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INTRODUCTION

A) THE ECS ACADEMY

The European Chips Skills Academy (ECSA) is an Erasmus+ program aiming at bridging the gap between education, training, and industry to tackle Europe's skills and talent shortages in the semiconductor industry. ECS-Academy 1) implements and operationalizes the Pact for Skills 2) establishes the first-of-a-kind decentralized academy for microelectronics, linking industry, research, HE and VET currently operating in isolation 3) develops innovative training and curriculum to provide reactive and proactive response to the skills needs of the sector.

ECS-Academy is an Alliance of 18 partners, with 30+ organizations endorsing the project, covering the whole of the EU Educational Area and the entire value chain of microelectronics.

Work package 3 (WP3)

The objective of WP3 "European Chips Skills Academy: Skills Anticipation, Skills Strategy and Educational Programme" is to seamlessly connect the world of education and the world of work in microelectronics by bringing education, training, research, innovation, and industry together under the same roof. This is the first-of-a-kind decentralized academy for the microelectronics and chips sector, establishing territorial focal points (HEI, VET, industry) that are interconnected and operate in sync following guidelines and objectives co-created by the Pact for Skills and the Board established in WP2.

DECISION Etudes & Conseil is the leading partner of the consortium for the Deliverable D3.1 and D3.2 under the supervision of TU Graz.

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B) OBJECTIVE AND SCOPE OF SKILLS MONITORING IN THE ECSA

OBJECTIVES

In 2024, DECISION Etudes & Conseil developed and applied a methodology to quantitatively assess and forecast the semiconductor talent gap across 3 objectives:

- Assess current situation: tools, data, research models and assumptions to evaluate the state-of-the-art in semiconductor skills monitoring.
- Anticipate future needs: scenario-building to gauge and anticipate skills and competences.
- Monitor qualitatively and quantitatively the talent gap in the EU using a core methodology of Input/Process/Output between the world of education and the world of work.

This led to the European Skills Strategy 2024 report, published in October 2024.

Then, the European Skills Strategy 2025 report, published in October 2025, provided the latest update of the European talent gap.

For the 2026 and 2027 editions of the European Skills Strategy, the skills analysis focuses exclusively on qualitative aspects, based on the results of the ECSA Survey. These updates complement the quantitative baseline established in the 2024 and 2025 reports.

SCOPE

The sectoral scope of the ECS Academy is the semiconductor value chain, as defined in the diagram below. As a consequence, the Skills Strategy focuses on the different sub-segment of this value chain:

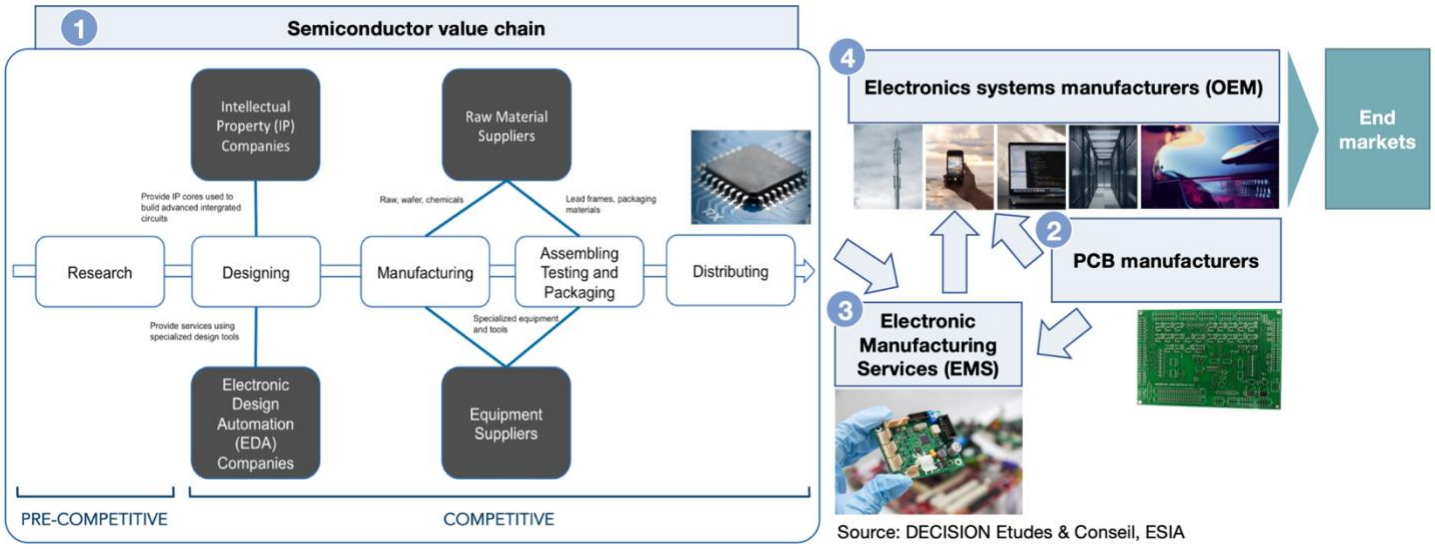
- Research & Developments (made by Research and Technologies Organizations)
- Design
- EDA & IP
- Manufacturing (Front-end, back-end)
- Equipment & tools
- Materials

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Additionally, the Skills Strategy focuses on semiconductor-related activities carried out by players other than those traditionally involved in the semiconductor value chain. These players are occasionally involved in semiconductor manufacturing or, more commonly, in semiconductor design:

- Original Equipment Manufacturers (OEMs).
- Electronic Manufacturing Services (EMS).
- Printed Circuit Board (PCB).
- End users in the automotive, industrial equipment and aerospace/defence/security sectors.

Figure 1: The semiconductor value chain



Source: DECISION Etudes & Conseil

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QUALITATIVE ANALYSIS – RESULTS FROM THE 2026 SURVEY

This qualitative analysis serves to enhance the understanding of specific professions at risk of shortages, which fall within the major categories identified in the quantitative analysis in the 2024 Skills Strategy report. Furthermore, it allows for a more nuanced exploration of the reasons behind the current tension in these professions.

This qualitative analysis was initiated in the METIS project and has been carried out since 2020 based on a questionnaire answered by key stakeholders of the EU ecosystem (large companies, SMEs, Research and Technology organizations, Universities, VET providers, industry associations, etc.). This year's survey follows the structure of surveys conducted in previous years, including those that have been carried out in the first edition of the Skills Strategy report as well as in the METIS project. This allows for continuous monitoring of the answers from the stakeholders involved to follow the trends on skills in the EU semiconductor industry. Annex 1 provides a comprehensive overview of the methodology employed in the online survey.

In 2026, 83 experts from 51 organizations across Europe participated in this work.

In 2026, two questions have been introduced to assess the impact of artificial intelligence. Results are presented and discussed in section *6) Focus on AI and its impact on the job market*.

A) KEY EVOLUTIONS IN 2026

1) WHAT NEW JOB PROFILES AND SKILLS ARE EMERGING IN THE EU SEMICONDUCTOR INDUSTRY IN 2026?

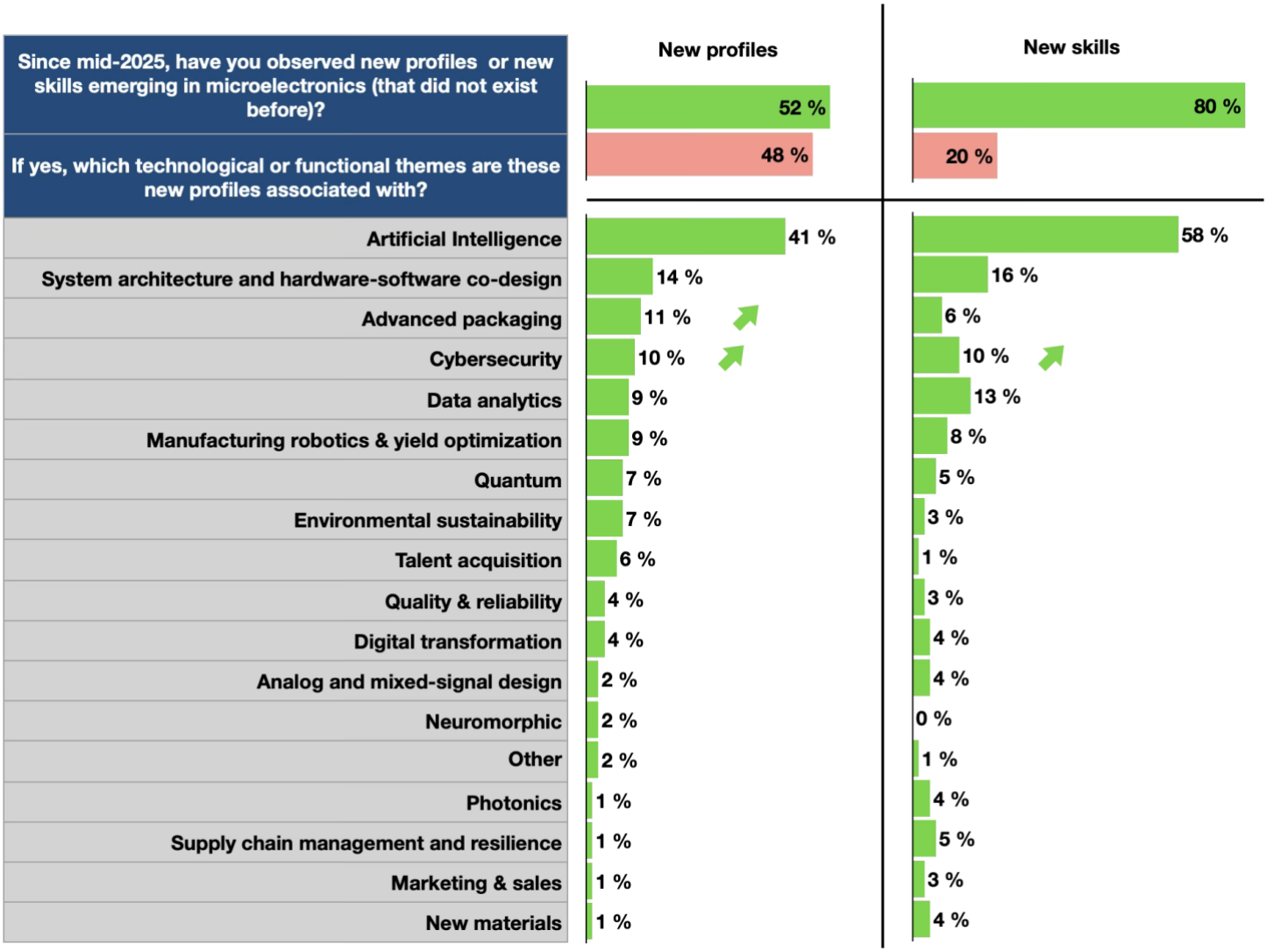
As every year since 2020, respondents were asked to identify and describe the new job profiles and/or skills they have identified during the year. The results are summarized in figure 2. In fact, no category (profile or skills) is totally new in 2026 in the EU ecosystem as the job profiles and skills listed here were already identified by our consortium during previous years[2]. However, these results provide a clear perspective on how EU stakeholders

[2] The only exception is open-source design, which appears for the first time in 2026 and is counted under "Other" in Figure 2.

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are encountering these profiles and skills emerging in their work environments in 2026. Professionals looking to remain competitive in the semiconductor industry should consider developing expertise in these areas.

Figure 2: New profiles and skills identified by stakeholders in 2026



Panel: 81 answers (left) and 79 answers (right)
The arrows indicate the evolution compared to 2025
Source: 2026 ECSA Survey, DECISION Études & Conseil

In 2026, 52% of respondents report the emergence of new job profiles in microelectronics, against 80% who report new skills needs. The gap between the two figures widened from 19 points in 2025 to 28 points in 2026.

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New profiles emerge mainly through hybridization. Respondents' comments point to the hybridization of job profiles as the dominant trend: as AI, data or hardware become central to a job, hybrid profiles grow out of it, such as AI-assisted design engineers, AI process engineers, hardware security engineers and chiplet architects. Many of these profiles already existed, but they are now increasingly recognized as distinct roles and explicitly targeted in recruitment.

ARTIFICIAL INTELLIGENCE (AI)

As in every edition since 2022, AI comes first for both profiles (41%) and skills (58%), well ahead of all other themes. It appears on two levels: as dedicated specialist roles, and increasingly as a competence expected within existing positions. Respondents report that AI experience is now a common selection criterion for engineering positions, with familiarity with AI required for most vacancies and that AI related skills are increasingly required across a wide range of roles.

- Machine learning engineers – Software engineers designing, training, and optimizing machine learning models, with a solid understanding of hardware constraints such as memory, latency, and energy efficiency. They ensure that AI algorithms can be efficiently deployed on target devices (CPU, GPU, NPU, or ASIC) and collaborate with hardware engineers to co-optimize models and architectures. This category includes AI algorithm engineers, hardware-aware AI/ML engineers, and specializations such as agentic and generative AI engineers and MLOps engineers, the latter focusing on model deployment, monitoring, and maintenance. Several profiles in Europe specialize in edge computing, including Edge AI / TinyML engineers.
- AI verifiers – ***New in 2026***: a profile created because AI generates outputs faster than humans can check them. Their role is to determine whether an output is contextually accurate and fit for use rather than to reproduce the task.
- AI hardware engineers – Specialists developing and implementing hardware solutions optimized for AI workloads. They design architectures and circuits enabling efficient acceleration of machine learning models, focusing on compute performance, data movement, and power efficiency. Also known as AI hardware specialists.
- AI applications engineers – Professionals integrating AI-based functionalities into semiconductor products to better address the requirements of specific end-user industries while balancing market and technical constraints.

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- Automatic Design Generation engineers – Engineers transforming traditional chip-design workflows by leveraging AI tools to accelerate and enhance design efficiency (e.g. training neural networks for electrical implementation or sizing). In 2026 most often named AI-assisted design engineers, and including the evaluation of AI-generated designs.
- AI system designers / AI architects – Senior professionals managing multidisciplinary teams responsible for the design, manufacturing, and material sourcing of complex chip systems (SoC, chiplet, ASIC) embedding AI capabilities.
- AI process engineers / AI manufacturing specialists – ***New in 2026***: engineers combining semiconductor manufacturing knowledge with machine learning to optimize yield, maintenance and production efficiency, also reported as AI-integrated yield engineers and semiconductor AI model engineers (defect detection, yield prediction, process optimization).
- AI transformation consultants – ***New in 2026***: Professionals supporting the adoption and integration of AI technologies across semiconductor organizations, identifying opportunities for AI-driven improvements in engineering, manufacturing, and business processes, and facilitating organizational transformation.
- New profiles continue to emerge to address the legal and governance aspects of AI (AI governance / responsible AI leads), extending the 2025 observation on legal experts in the ethics of emerging technologies, and the sustainability of AI chips.

Similarly, AI-related skills come in first position as emerging skills (58% of respondents). They are increasingly required across nearly all engineering and technical domains, as AI drives automation, simulation, and data-driven decision-making throughout the semiconductor value chain. Emerging AI skills include:

- AI Model Engineering and Deployment - Skills to design, train, and optimize machine learning and neural network models, including *AI-at-the-edge* deployment and *AI-SoC* integration. Engineers need to understand model architectures, inference efficiency, and hardware–software co-optimization. Generative and agentic AI tools are increasingly used here to accelerate model creation, testing, and refinement.
- AI-Assisted Design and Verification - Use of AI to automate and enhance hardware design workflows — from IP generation and RTL coding to analog/mixed-signal (AMS) design and verification. Engineers must master AI-based EDA tools, scripting, and data-driven exploration of design space. Generative AI supports automatic code and testbench generation, while agentic systems are emerging for iterative optimization and self-correcting verification cycles.

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- AI for Process and Manufacturing Optimization - Application of AI and machine learning to improve process stability, yield, and equipment performance. Includes predictive maintenance, fault detection, and the use of AI-powered simulation in process development. Generative models are used for synthetic data creation and simulation while agentic systems enable autonomous control and adaptation of production parameters.
- Data and AI Analytics - Mastery of large-scale data analysis, combining big data pipelines with machine learning models for quality, reliability, and performance optimization. This includes developing dashboards, anomaly detection, and predictive models for production and R&D.
- AI Literacy and Strategic Understanding - The transversal capacity to understand where AI provides efficiency or innovation gains -and where it introduces risks. This includes identifying relevant use cases, evaluating AI limitations (e.g. bias, energy cost, explainability), and integrating AI ethically into workflows. In 2026, respondents describe this literacy as expected at all levels, including leadership.
- Domain-grounded AI – ***First reported in 2026***: data scientists and ML engineers are increasingly expected to hold domain knowledge of semiconductor processes, devices and constraints, not generic AI skills alone.
- Prompting and verification of AI output – ***First reported in 2026***: respondents describe prompting as an evolving skill, materially different from a year ago, and the verification of AI-generated output as a competence in its own right, while noting that AI skills are being requested across roles before tools and methods are fully grounded.

In short, the ability to effectively use, adapt, and co-design AI tools and processes is rapidly becoming a baseline competence across both technical and non-technical roles in the semiconductor industry.

Annex 2 presents a detailed analysis of how AI affects the talent gap in the semiconductor industry, considering both the factors that widen and those that narrow the gap.

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SYSTEM ARCHITECTURE AND HARDWARE-SOFTWARE CO-DESIGN

In 2026, system architecture and hardware-software co-design ranks second among the leading emerging job profiles and skills, as shown in Figure 2. 14% of respondents globally reported an emerging need for system designers (also referred to as systems architects, SoC architects, 3D systems architects) in their working environments, against 21% in 2025. These professionals, typically holding a master's degree or PhD (EQF 7-8) and having at least five years of experience in semiconductor design, are at the forefront of designing increasingly complex systems that integrate a range of microelectronic components.

Systems designers are especially required in the EU to design the next generation of Cloud-to-edge IoT platforms, often (but not only) working at low-power and harsh environments: smart sensors for automotive ADAS, systems for zonal car units, industry 4.0, health & care, aerospace-defence, etc.

Emerging system-related profiles include:

- System Designers / System Architects – Experts responsible for defining overall system specifications and ensuring interoperability between hardware and software layers. Increasingly involved in AI-enabled architectures, chiplet-based systems, and system-in-package (SiP) integration. In 2026 also reported as system and technology co-optimization (STCO) engineers, combining SoC/SiP architecture, design trade-offs and application constraints, and as system architects for heterogeneous integration, connecting system-level constraints with SoC, SiP, chiplet, packaging, thermal and mechanical considerations.
- Edge Computing Architects / Engineers – Specialists developing low-latency, energy-efficient architectures for local data processing, bridging IoT nodes and cloud infrastructures.
- System-Level Verification and Validation Engineers – Professionals ensuring functionality and performance across complex SoCs, often using multi-domain simulation, hardware emulation, and AI-assisted verification tools.
- System-Level Verification and Validation Engineers – Professionals ensuring functionality and performance across complex SoCs, often using multi-domain simulation, hardware emulation, and AI-assisted verification tools.
- IP Integrators – ***First reported in 2026***: Engineers ensuring that reusable IP cores fit new designs, managing interfaces, compatibility and system validation, driven by modular SoC and chiplet design.

The main emerging system-related skills in Europe include:

- System and IC Co-Design – Ability to co-optimize hardware and software architectures to balance power, performance, and functionality.

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- Advanced Integration Technologies (Chiplet, 2.5D, 3D) – Technical expertise in the physical integration of multiple dies within a single system, addressing interconnect design, thermal management, and packaging constraints.
- System Software and Middleware Integration – Understanding of system-level software layers, driver development, and middleware integration for heterogeneous computing platforms.
- Low-Power and Edge Computing Design – Competences in designing and optimizing architectures for low-energy operation, real-time processing, and secure IoT connectivity.
- System-Level Verification and Emulation – Upskilling in verification techniques for large-scale SoCs, including FPGA prototyping, layout validation, and hardware/software co-simulation.
- System Robustness and Compliance by Design – Integration of reliability, fault tolerance, and safety-by-design principles at system level to ensure compliance with domain-specific standards (e.g. automotive, medical, aerospace).
- AI-specific hardware integration – ***First reported in 2026***: System and hardware architects are expected to master the integration of AI accelerators such as NPUs into system architectures.

In summary, system design is rapidly evolving toward multi-domain integration, where hardware, software, and network intelligence converge. Engineers with the ability to co-design across abstraction layers -from transistor-level logic to distributed edge systems- are becoming critical to Europe's semiconductor and digital-system competitiveness.

ADVANCED PACKAGING

In 2026, 11% of respondents globally report an emerging need for new packaging-related job profiles (7% in 2025), and 6% report an emerging need for packaging-related skills (8% in 2025).

Emerging profiles include advanced packaging technicians and engineers, and, more specifically in 2026:

- Chiplet Integration Engineers / Chiplet Architects – Designing and validating systems built from multiple interconnected chiplets, with system-level design and cross-domain verification responsibilities.
- Advanced Packaging Engineers – Covering 2.5D/3D packaging, fan-out wafer-level packaging, embedded die integration, and chip-package co-design.
- Packaging Engineers for photonic and heterogeneous integrated circuits.

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Emerging skills include:

- Mastery of 3D IC design, chip-package co-design, and thermal simulation.
- Understanding of heterogeneous process integration (SiC, GaN, photonics).
- Familiarity with new packaging materials and sustainability constraints.

Packaging has evolved from a back-end process into a strategic field of design innovation, with Europe now deploying significant industrial and pilot projects to secure strategic know-how in this domain.

CYBERSECURITY

In 2026, 10% of respondents report an emerging need for cybersecurity specialists (5% in 2025), and 10% report an emerging need for cyber-related skills (3% in 2025). Cybersecurity has become a core design requirement, embedded throughout the semiconductor product lifecycle. In 2026 respondents name the following profiles, consistently placed at hardware and system level rather than treated as a downstream software concern:

- Hardware Security Architects / Secure Silicon Engineers / Security-by-Design Engineers – Professionals integrating security-by-design principles at the silicon level, including secure boot, hardware root of trust, side-channel resistance, cryptographic protection and post-quantum readiness.
- Cybersecurity Specialists for industrial and production environments – Protecting highly automated fabs and intellectual property; also, firmware security specialists.

Emerging skills include:

- Understanding of hardware attack vectors and secure design principles.
- Knowledge of cryptographic algorithms and post-quantum security.
- Understanding of secure embedded software and edge-device protection principles.

DATA ANALYTICS

In 2026, 9% of respondents report the emergence of data analytics–related job positions in their working environments, stable against 9% in 2025 and well below the 24% recorded in 2024, while data-related skills are reported by 13% of respondents (11% in 2025).

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Data specialists typically include:

- Data Analysts – Professionals interpreting and visualizing data to support decision-making and performance monitoring.
- Data Engineers – Experts building and maintaining data pipelines, ensuring accessibility, quality, and security of large datasets.
- Data Scientists – Specialists developing and deploying advanced analytics, machine learning, and predictive models for semiconductor R&D and manufacturing.
- Data-Driven Process Engineers – ***First reported in 2026***: process engineers combining traditional process engineering with advanced data analysis and statistical modelling.

On the skills side, 2026 respondents range from data literacy for all staff and the use of dashboard tools in production and production control, to data engineering, traceability and industrial analytics across engineering and manufacturing roles.

MANUFACTURING ROBOTICS AND YIELD OPTIMIZATION

In 2026, 9% of respondents report new profiles in this area and 8% report new associated skills, against 5% and 14% respectively in 2025. Traditional equipment engineers are evolving toward roles combining robotics, AI, and data-driven process control, marking a shift toward fully automated and intelligent manufacturing environments.

Emerging ***profiles identified in 2026*** include:

- AI-Integrated Yield Engineers – Bridging traditional production with automated, data-driven decision-making.
- Automated Line Operators – Operators running load-and-go processing on automated tools. Respondents note that this profile requires a lower qualification level than before, since no manual interaction at the tool is necessary.

Emerging skills include:

- Understanding of AI tools for process optimization and predictive maintenance.
- Knowledge of advanced process control (APC), statistical process control (SPC), and Industry 4.0 systems.
- ***First reported in 2026***: software competences for traditional maintenance profiles, including PLC programming and work automation, and robotics and automatic material handling systems (AMHS) considered at whole-fab level.

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QUANTUM

In 2026, 7% of respondents report the emergence of quantum-related job positions in their working environments, as opposed to 21% in 2025, 9% in 2024 and 1% in 2023, and quantum-related skills are reported by 5% of respondents (14% in 2025)[3].

Emerging quantum-related profiles include:

- Quantum Computing Engineers / Quantum Semiconductor Engineers – Specialists developing quantum components and circuits, often with expertise in superconducting electronics, cryogenics, and quantum-classical interface control.
- Quantum Materials and Device Engineers – Experts working on diamond-based, spin-based, and photonic quantum devices, focusing on material synthesis, defect control, and system reliability.
- Quantum Algorithm and Software Engineers – Professionals designing quantum algorithms, quantum programming models, and hybrid quantum–classical software stacks for simulation and control.
- Post-Quantum Security Architects – Engineers defining quantum-resistant cryptographic schemes and ensuring secure hardware and communication infrastructures in the post-quantum era.
- Quantum Sensing and Metrology Engineers – Specialists developing quantum sensors, leveraging atom-based, spin-based, or diamond technologies for ultra-precise measurements.

The main emerging quantum-related skills include:

- Quantum physics and mechanics fundamentals – Understanding of quantum phenomena underpinning device operation, including superposition, entanglement, and tunnelling effects.
- Quantum algorithms and programming – Mastery of quantum algorithm design, quantum machine learning (QML), and hybrid quantum-classical architectures for computing and simulation.
- Quantum materials and device physics – Expertise in the physics and characterization of new materials and post-Moore devices (e.g. diamond, topological, or spintronic systems).

[3] We consider the decrease in the percentage of respondents identifying quantum-related job profiles and skills as emerging in 2026 compared to 2025 to be due to inconsistencies in survey sampling between the two years, rather than reflecting a meaningful trend.

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- Quantum hardware and circuit design – Skills in the design, modelling, and testing of superconducting, photonic, or semiconductor-based quantum circuits, with practical knowledge of cryogenic systems and low-noise electronics.
- Hybrid quantum–classical systems integration – Ability to co-design and integrate quantum and classical components within the same architecture, ensuring interoperability, data flow, and control between quantum processors and conventional semiconductor systems.
- Post-quantum security and cryptography – Expertise in designing and implementing cryptographic and hardware security solutions resilient to quantum attacks, including quantum-resistant encryption algorithms and secure communication protocols.

In summary, quantum-related skills in Europe are moving from academic research to industrial application. They remain mostly associated to R&D and PhD-level profiles. The most critical competencies now lie in translating quantum theory into manufacturable devices, integrating them into the broader semiconductor ecosystem, and preparing for post-quantum transitions in computing and security.

SUSTAINABILITY / ENVIRONMENTAL-RELATED JOB PROFILES

In 2026, 7% of respondents globally report an emerging need for new environmental-related job profiles (9% in 2025), and 3% report an emerging need for sustainability-related skills in their working environments (11% in 2025).

Emerging profiles include:

- Sustainability Specialists / ESG Experts (EQF 6-7) – Professionals ensuring that environmental objectives are integrated throughout semiconductor production and product design.
- Lifecycle Analysts (EQF 7) – Experts evaluating the environmental impact of components across their lifecycle.
- Electronic Waste Recycling Engineers (EQF 7-8) – Specialists developing sustainable recovery and recycling methods for microelectronic components.
- PFAS and Materials Compliance Experts – Engineers monitoring the elimination or reporting of restricted substances in manufacturing.
- Renewable Energy Managers – Responsible for reducing carbon emissions and integrating renewable energy sources in production sites.

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Emerging skills include:

- Knowledge of sustainable manufacturing and energy efficiency practices (ISO 50001).
- Competence in eco-design, green materials, and circular economy principles.
- Ability to assess lifecycle impacts and implement waste minimization strategies.
- Understanding of ESG frameworks, social responsibility, and diversity and inclusion aspects linked to sustainability.

In summary, sustainability is no longer peripheral but a design and production requirement across the European semiconductor value chain.

TALENT ACQUISITION

In 2026, 6% of respondents globally report an emerging need for new profiles associated with talent acquisition, against 9% in 2025. On the longer term -since 2021- companies increasingly invest in global recruitment and in-house skills development. In 2025, firms emphasize long-term workforce strategies combining international hiring, continuous training, and education outreach.

Emerging profiles include:

- Global Talent Acquisition Managers – Coordinating international recruitment beyond the EU to attract specialised talent.
- Skills Development Managers – Designing internal training programmes and partnerships with universities.
- Semiconductor Education Outreach Coordinators – Promoting the field among younger students (ages 12–17) to build future talent pipelines.
- Hybrid Work and Training Facilitators – Managing remote engineering collaboration and hybrid workforce integration.
- XR Learning Experience Designers – ***First reported in 2026***: designing immersive (VR/AR) training scenarios for in-fab training centres.

The HR function in semiconductors is evolving from administrative support to a strategic pillar of competitiveness and innovation.

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SOFT SKILLS

While technical expertise remains essential, many respondents highlight the critical importance of soft skills in the semiconductor industry. As projects grow in complexity and interdisciplinarity, success increasingly depends on collaboration, adaptability, and communication.

Thus, collaboration and communication stand out as the most sought-after skills. They encompass the ability to work effectively across teams and disciplines, share knowledge, and resolve conflicts constructively — as well as the capacity to explain complex technical topics to non-specialists by selecting and prioritizing the most relevant information and issues.

Other key soft skills include:

- Adaptability and Agility – Comfort with iterative development, feedback-driven improvement, and changing technologies.
- Creative and Critical Thinking – Capacity to analyse complex challenges, propose innovative solutions, and make data-informed decisions.
- Leadership and Mentoring – Guiding teams, fostering learning, and maintaining motivation in high-pressure environments.
- Systems Thinking – ***Added in 2026***: the capacity to reason across end-to-end processes and interdisciplinary boundaries.

In short, the ideal semiconductor professional combines deep technical expertise with strong interpersonal and adaptive skills -a balance increasingly decisive for innovation and project success.

The other domains, identified by less than 5% of respondents, are described and analyzed in Annex 3.

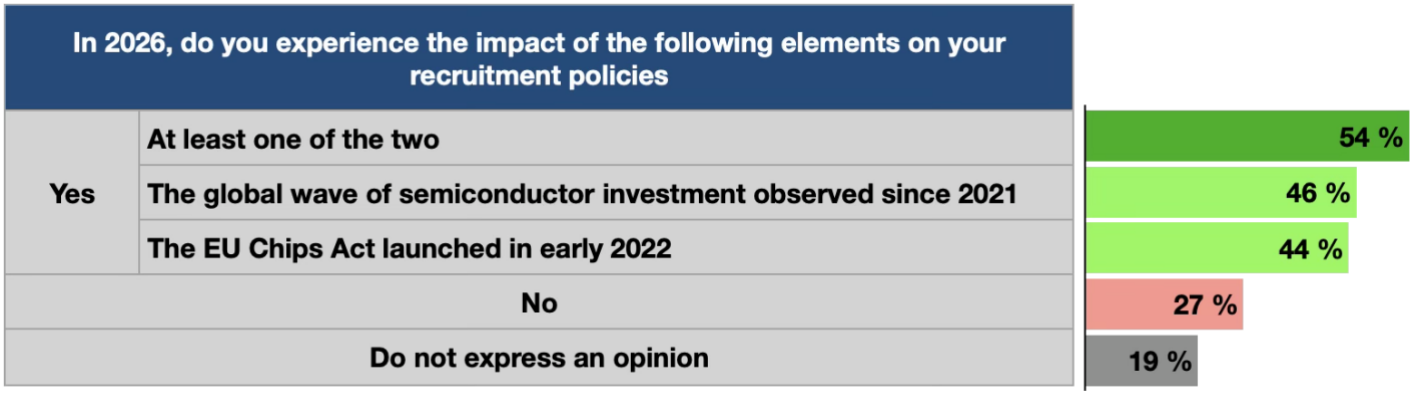
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2) IMPACT OF THE GLOBAL WAVE OF INVESTMENT AND OF THE EU CHIPS ACT ON HIRING PLANS IN EUROPE

As in previous surveys conducted since 2021, respondents were asked whether they experienced any concrete and significant impact on their hiring plans in Europe in relation to two key factors:

1. The global wave of semiconductor investment observed since 2021.
2. The EU Chips Act, launched in early 2022.

Figure 3: Share of stakeholders whose recruitment policies have been affected by: (1) the global wave of semiconductor investment observed since 2021, or (2) the EU Chips Act launched in early 2022.



Panel: 79 answers
Source: 2026 ECSA Survey, DECISION Études & Conseil

More respondents report an impact of the investment wave and of the Chips Act in 2026 than in 2025. In 2026, 54% of respondents report an impact on their recruitment policies from at least one of the two factors, up from 40% in 2025. The global investment wave is cited by 46% (38% in 2025) and the EU Chips Act by 44% (32% in 2025), with most respondents citing both. The share reporting no impact is stable at 27% (28% in 2025), while the share not expressing an opinion has fallen from 33% to 19%. The increase in reported impact therefore largely mirrors the decline in the share of respondents expressing no opinion, rather than a decrease in those reporting no impact.

Market landscape and investment trends

The global investment surge of 2021–2023 initially fueled a sharp increase in talent demand across Europe. By 2025, macroeconomic headwinds and slower market growth had tempered hiring momentum. In 2026, the landscape remains mixed, with AI driving strong global market growth, while other verticals continue to face significant challenges, further intensified by growing competition from Asia.

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The EU Chips Act

The EU Chips Act also plays a nuanced role. It is widely recognized for raising public and academic awareness of semiconductors and for attracting scientific and engineering talent to the sector. Yet many respondents consider its direct impact on hiring volumes limited.

Pillar 1, while strengthening Europe's innovation capacity, has also intensified competition for highly skilled professionals in emerging fields such as advanced processors, new materials, and advanced packaging, without necessarily expanding the overall talent pool. Competition is particularly strong for experienced engineers, while early-career recruitment appears less challenging, supported by growing student interest in microelectronics.

Pillar 2 has so far not generated sufficient momentum to offset the challenging market conditions facing Europe's semiconductor industry. Where new capacity is built under Pillar 2, recruitment follows locally. However, most respondents report little overall change in recruitment volumes.

Many respondents describe local initiatives that are still at an early stage, with no visible impact yet anticipate stronger effects from a revised Act.

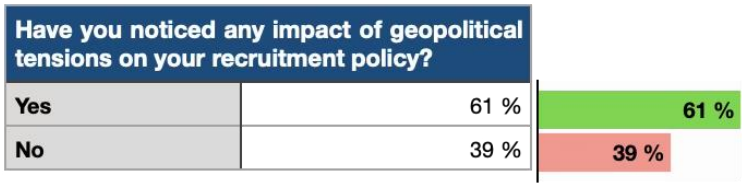
Finally, many respondents report a closer collaboration with universities and training initiatives through initiatives such as the ECSA or the national competences centers.

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3) IMPACT OF GEOPOLITICAL TENSIONS ON RECRUITMENT POLICIES

Geopolitical instability is becoming an increasingly influential factor in semiconductor workforce planning. Since 2021, tensions such as the U.S.–China technology rivalry, export control regimes, and reshoring policies have reshaped hiring strategies across Europe. The 2026 ECSA Survey asked stakeholders whether these tensions have affected their recruitment policies, as shown below.

Figure 4: Share of stakeholders whose recruitment policies have been affected by geopolitical tensions



Panel: 72 answers
Source: 2026 ECSA Survey, DECISION Études & Conseil

More respondents report a geopolitical effect on recruitment in 2026 than in 2025. 61% of respondents report that their recruitment policies have been affected by geopolitical tensions, against 56% in 2025. The effects most often described concern where posts are located, hiring volumes, which nationalities can be hired, and the skills in demand.

Geopolitical Uncertainty Driving Hiring Slowdowns

Geopolitical tensions continue to affect recruitment volumes in the European semiconductor industry. As in 2025, respondents report hiring freezes and reduced recruitment activity due to economic uncertainty. In 2026, several respondents also point to higher costs and lower revenues, leading companies to narrow job profiles or relocate positions to lower-cost sites.

Beyond immediate hiring decisions, geopolitical instability is making long-term workforce planning more difficult. In addition to market fluctuations, companies must increasingly account for unpredictable political developments when forecasting talent needs and deciding where to allocate new positions. However, a minority of respondents report the opposite trend, with recruitment accelerating in strategic and sensitive technology areas to secure talent ahead of competitors.

Export Controls Driving Restrictions on Talent Mobility

Geopolitical tensions continue to impose restrictions on international talent mobility, particularly through export controls and nationality-based hiring requirements. As in 2025, respondents report limitations on recruiting candidates from certain countries, with recruitment increasingly focused on pre-defined countries of

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origin. These restrictions are also influenced by customer requirements, including requests to exclude specific countries from manufacturing and supply chains.

Changes in immigration policies are also reshaping international recruitment patterns. Respondents report that changes to US H-1B visa policies are prompting multinational companies to reconsider where new recruits are based. The United States has become less attractive to international talent, creating new recruitment opportunities for European companies. Brexit continues to reduce the pool of candidates willing to relocate to the UK. Finally, recruitment and retention difficulties also persist at sites in Ukraine.

Increased Hiring Security and Compliance Requirements

Geopolitical tensions continue to reinforce security and compliance requirements in semiconductor recruitment. As already observed in 2025, respondents highlight the growing importance of export-control compliance and intellectual property protection. In 2026, these requirements extend to a broader range of skills, including cybersecurity, supply-chain resilience, regulatory compliance and international trade expertise. Companies increasingly seek versatile profiles combining technical expertise with risk-management capabilities and international experience, enabling them to operate in a more fragmented and heavily regulated environment.

Changing Composition of Applicants

Despite these constraints, the semiconductor sector continues to attract strong interest from non-EU candidates. Respondents report a noticeable increase in applications from India, Africa, Ukraine, and Russia, as well as from the United States, reflecting both global workforce mobility and Europe's perceived stability in the sector.

However, additional vetting and compliance requirements lengthen recruitment timelines, particularly for positions involving sensitive technologies.

Geographical Relocation of Semiconductor Jobs

Geopolitical tensions are also reshaping the geographical distribution of semiconductor jobs, although companies are adopting different strategies. Some respondents report relocating engineering and design positions to Asia, closer to local production facilities, reflecting the development of regionalized supply chains and increasingly autonomous operations across Europe, China and South-East Asia. In some cases, companies favor additional hires in Asia over equivalent positions in Europe.

Conversely, other respondents report efforts to retain core technological expertise in Europe, limiting Asian operations to support functions or maintaining EU-based engineering teams to meet contractual requirements.

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Summary

Overall, geopolitical tensions are increasingly shaping recruitment strategies across the European semiconductor industry. While hiring slowdowns, restrictions on international talent mobility and stricter compliance requirements remain important challenges, the 2026 survey also highlights a growing regionalization of recruitment and workforce planning.

In response, companies and public authorities are placing greater emphasis on strengthening European technological sovereignty and developing local talent pipelines. Respondents report longer-term workforce planning, earlier engagement with students and efforts to reduce dependence on international recruitment.

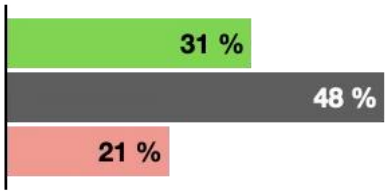
However, these efforts coexist with contrasting corporate strategies. While some companies seek to retain strategic expertise in Europe, others are relocating engineering and design positions to Asia, closer to production facilities and regional markets. This raises questions about the extent to which corporate recruitment strategies align with the EU Chips Act's objective of strengthening Europe's semiconductor capabilities and talent base.

4) HIRING TRENDS

Compared to 2025, fewer respondents plan to increase hiring in 2026, and more plan to reduce it. 48% of respondents expect to maintain their current hiring levels on EU soil, stable compared with 2025 (49%), while the share planning to reduce recruitment has risen from 14% to 21% and the share anticipating an increase has declined from 36% to 31%.

Figure 5: Distribution of the hiring strategy of stakeholders in 2026 compared to 2025

In 2026, do you expect to hire more or less on EU soil compared to 2025?	
Hire more	31 %
Remain the same	48 %
Hire less	21 %



Panel: 77 answers
Source: 2026 ECSA Survey, DECISION Études & Conseil

Those expecting to hire more cite rising demand, new sites in Europe and tariff exposure. Among the 31% of respondents expecting to expand their workforce, the reasons reported are:

- **The EU Chips Act 1.0.** The materialization of factory and R&D projects in line with the EU Chips Act 1.0.

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- **The European economic security.** The need to strengthen the European workforce to support economic security amid growing geopolitical tensions. In particular, limiting exposure to tariffs and geopolitical risk.
- **Strong needs in specific domains.** Rising demand for skills in specific domains such as AI, AI chips, data analytics, and design. For instance, Universities and training providers in this group report hiring to cover new courses at the intersection of AI and hardware for which existing teaching staff lack the expertise.
- **Replacement of retiring employees.** The need to replace employees reaching retirement age and ensure the continuity of skills and expertise.

Those expecting stable or lower hiring point to the shift to Asia, weak automotive demand and fewer vacancies. 48% of respondents expect to maintain their current workforce and 21% anticipate reducing hiring. The 5 main reasons reported are:

- **Weak demand from user industries.** Weak or flat demand in automotive and traditional industrial segments, with order volumes reported as unchanged or softer.
- **An insufficiently attractive investment framework in Europe.** As in 2025, several companies report a shift of hiring towards Asia, mainly due to the European automotive industry downturn and the lower employment costs in Asia.
- **Automation and AI reducing hiring needs while increasing reskilling needs.**
    - Greater fab automation is reducing the need for new technicians, especially operators.
    - The adoption of Artificial Intelligence is decreasing demand for new engineers -particularly in software, design, and test.

  In parallel, these trends are increasing the need to reskill existing staff to use these new tools effectively.
- **Fewer vacancies after a strong 2025**. Several organisations say they hired heavily in 2025, leaving teams more complete and less to fill in 2026.
- **Cautious, cost-driven planning amid uncertainty**. A volatile economic and geopolitical outlook is said to prompt more selective hiring, focused on strategic skill areas and on internal mobility and reskilling rather than headcount growth.

Universities and public training providers also point to fixed budgets, reduced national funding and procurement rules as reasons their hiring capacity cannot grow, even where demand for training is rising.

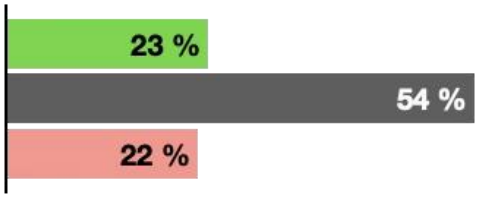
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5) SKILLS SHORTAGE EVOLUTION

Respondents report an improvement of the situation in 2026 compared to 2025. The share reporting that the shortage has worsened fell from 38% to 22%, while the share reporting it has remained the same rose from 42% to 54% and the share reporting an improvement edged up from 20% to 23%.

Figure 6: Distribution of the perception of stakeholders towards skill shortage in 2026

In 2026, the skills shortage within your organization has	
Improved	23 %
Remained the same	54 %
Worsened	22 %



Panel: 81 answers
Source: 2026 ECSA Survey, DECISION Études & Conseil

Where the shortage is reported to have worsened, retirements and competition for the same profiles are the reasons given. The 22% of respondents reporting a worsening shortage cite:

- **Workforce ageing and retirements**: departures, including early retirements linked to cost-reduction programmes, are said to outpace the entry of new talent, with demographic effects offsetting gains from training and outreach.
- **Intensifying competition for talent**: Many industries are reported to be competing for the same pools (AI, software, automation, cybersecurity).
- **Conditions in engineering and production roles**: respondents report that pay, career prospects and working conditions near production discourage people from entering or staying in these jobs, and that willingness to travel, to be flexible and to keep training is declining, particularly among older staff.
- **Technological change outpacing training**: the skills needed (AI, cybersecurity, advanced digital engineering) are said to evolve faster than curricula and than workers can realistically keep up with alongside work and family commitments.

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Universities and training providers in this group point to hardware and electronics programmes being cut in favor of AI and cybersecurity, and to reduced funding for some institutions, leading to reduced training capacities for classic electrical engineering profiles.

Where the shortage is reported as stable or improved, respondents attribute it to lower hiring, not to more qualified candidates. The perceived shortage measures the gap between open positions and available candidates: when hiring slows, the gap narrows even if the supply of skills is unchanged. The 54% reporting no change and the 23% reporting an improvement cite:

- **An economic slowdown reducing hiring across the industry**: with respondents, their competitors and their customers all recruiting less, fewer organisations are said to compete for the same candidates, and more experienced professionals are open to a career change as some companies restructure.
- **Heavy hiring in 2025 that left fewer posts to fill in 2026**.
- **More candidates available**: larger companies releasing older engineers, increased hiring of foreign candidates, and a general rise in technical graduates are reported to have expanded the pool, with the improvement said to be concentrated among young engineers while experienced profiles remain as scarce as before.
- **Increased investment in education and training**, including from EU-supported projects, but also from companies internal training programs.
- **Improved attractiveness of the sector**.

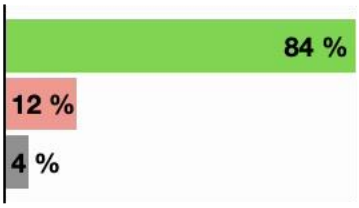
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6) FOCUS ON AI AND ITS IMPACT ON THE JOB MARKET

AI tools have changed day-to-day work for most respondents, in writing and analysis first. 84% of respondents report that AI tools have changed how they perform their job in the past 12 months, while 12% report no change. The uses most often described are writing (documents, reports, email, minutes, translation) and analysis (research, trend and root-cause work, summarizing). Engineers report code generation, debugging and prototyping; respondents in training roles report preparing course and exam material. Several describe a shift in their own role, from producing drafts to reviewing AI output.

Figure 2: Share of stakeholders whose day-to-day work has been changed by AI tools in 2026

In the past 12 months, have AI tools changed how you perform your job on a day-to-day basis?	
Yes	84 %
No	12 %
Not applicable	4 %



Panel: 73 answers
Source: 2026 ECSA Survey / DECISION Etudes & Conseil

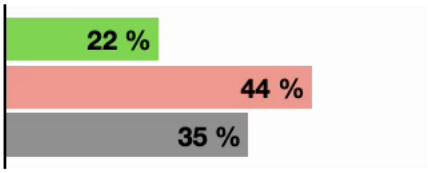
AI is reported to accelerate writing, analysis and coding, while domain expertise remains necessary. Respondents consistently say that AI speeds up these tasks but that judging and validating the output still requires expertise, and several describe the gains as real but modest, with more automated workflows expected later. Recruitment work in particular is said not to have been affected yet. The few reporting no change do not question AI's usefulness: the constraint described is organizational, such as the absence of in-house AI expertise to set up tools for identified use cases, rather than the tools themselves. Two workforce effects are raised: higher productivity of senior engineers reducing the need for juniors, and AI-driven process change accompanied by uncertainty about the future.

22% of respondents have considered replacing a position with AI. In the past 12 months, 22% of respondents report having considered AI systems instead of recruiting for a specific role, while 35% respondents indicated they are not involved in hiring decisions. One employer in five weighing AI against a hire is already a significant share, and as the tools mature the proportion is likely to rise, with a direct effect on the number and type of positions opened to the labor market.

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Figure 8: Share of stakeholders who have considered using AI systems instead of hiring in 2026

In the past 12 months, have you considered using AI systems (software tools or AI-enabled machines/ robots) instead of hiring someone for a specific role?	
Yes	22 %
No	44 %
Not applicable	35 %



Panel: 78 answers
Source: 2026 ECSA Survey / DECISION Etudes & Conseil

The main positions concerned are in design, software and support functions. Design and digital design roles are the most frequently cited, followed by software and app development, marketing and finance. Manufacturing positions (process engineers, maintenance engineers), are also affected, as agentic AI systems are being explored for production monitoring, production planning and scheduling, and root-cause analysis of equipment failures.

Routine work is reported to be replaceable, core engineering is not. Those considering AI instead of a hire describe repetitive or data-intensive tasks that would otherwise have required an additional person, with the people already in post redirected to expert, creative and system-level work. Respondents across both groups say AI can reduce time spent on documentation, basic coding and first-level analysis, but cannot take on system-level judgement, accountability or safety-critical work. Universities report using it for teaching and research rather than in place of staff. A stronger view is also expressed, namely that the general need for engineers at all levels is falling as efficiency rises.

Respondents who have not considered AI say their data is not yet ready for it and that human supervision remains necessary. They do not question what AI can do, but report that substituting it for a hire requires data that is structured and accessible, which many organisations do not yet have, and staff able to set up, supervise and correct the systems. Demand is therefore reported to be rising for people who combine implementation skills with a positive attitude to AI and to change.

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B) MOST CRITICAL JOB PROFILES

1) DEMAND AND SHORTAGE ON THE JOB MARKET IN 2026

As in the previous ECSA skills strategy report, stakeholders have been asked to identify:

- The job profiles that are the most sought-after by the industry (high demand).
- The job profiles that are the most difficult to fill (high shortage).

A) PROFILES THE MOST SOUGHT-AFTER

Software engineers, cybersecurity experts and system designers are cited by more than half of respondents. Software engineers (55%) and cybersecurity experts (53%) lead the ranking, followed closely by system design engineers (52%), design engineers as a whole (49%) and data specialists (49%). The order has shifted slightly since 2025, when software engineers led at 57% and cybersecurity experts ranked third at 47%.

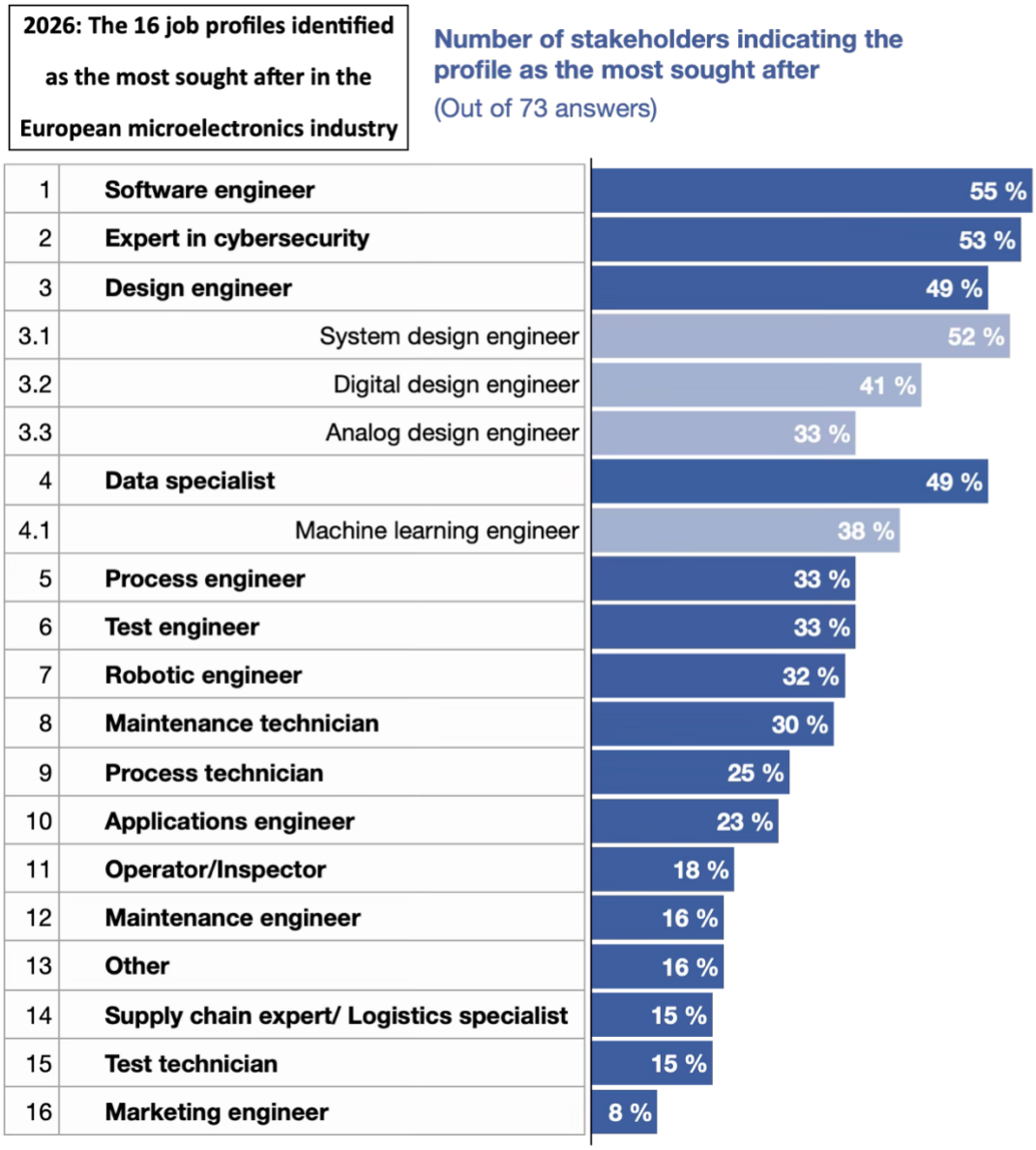
Software engineers remain the most sought-after professionals. The continued strong demand for software engineers since 2020 reflects the increasing importance of software in the value added of semiconductors:

- **Semiconductor companies increasingly offer complete solutions**, combining chips, firmware and software, rather than selling standalone chips. This shift creates additional demand for software development capabilities.
- **In-house software development** is expanding as companies seek to develop proprietary solutions rather than rely on off-the-shelf software.
- **Hardware–software co-design** is becoming more complex as semiconductor components must be increasingly optimized for the requirements of the electronic systems in which they are integrated.

Cybersecurity experts rise to second place. Survey answers show growing cyber risk and customer security requirements driving demand for cybersecurity experts. The rise of this profile is linked to geopolitical and espionage risk, greater exposure from automation and connected systems, and customer-imposed information-security certifications that oblige suppliers to demonstrate data protection, compounded by legacy software still in use and a pool of qualified specialists reported to remain far below what is needed.

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Figure 9: Ranking of the job profiles indicated as the most sought-after in 2026



For this question, all the stakeholders were not limited in their choice of answers and could choose between several job profiles. This is why the totals exceed 100%.

Panel: 73 answers

Source: 2026 ECSA Survey / DECISION Etudes & Conseil

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Designers rank third, remaining among the top three most sought-after profiles.

- The strong demand for **system design** engineers reflects the shift from chip-level to system-level solutions and the rise of SiP/SoC and chiplets integrating ML-based features. Respondents also highlight increasing competitive pressure as companies develop more complex products to differentiate themselves from lower-cost Chinese alternatives. Declining ASIC costs are also making custom chips economically viable across a broader range of sectors, further expanding the market for system-level solutions.
- The EU continues to experience strong demand for **analog designers**, driven by sensing and power applications, although the field is perceived by students as less attractive than digital design. Along with system designers, the analog designer role represents the most difficult talent gap to address, as it requires a rare combination of design and programming skills, together with at least five years of field experience.

Data specialists remain in strong demand (49%) as digitalization generates more data to manage. Up from 42% in 2025, demand is driven by the volume of data generated across the value chain. Machine learning engineers (38%, down from 44%) are singled out within this group, with ML applied across design, process optimization and manufacturing, and demand tied to ML expertise combined with semiconductor domain knowledge rather than to generic skills.

Manufacturing profiles are cited by a fifth to a third of respondents. Process engineers (33%), robotic engineers (32%), maintenance technicians (30%), process technicians (25%), and operators/inspectors (18%) follow.

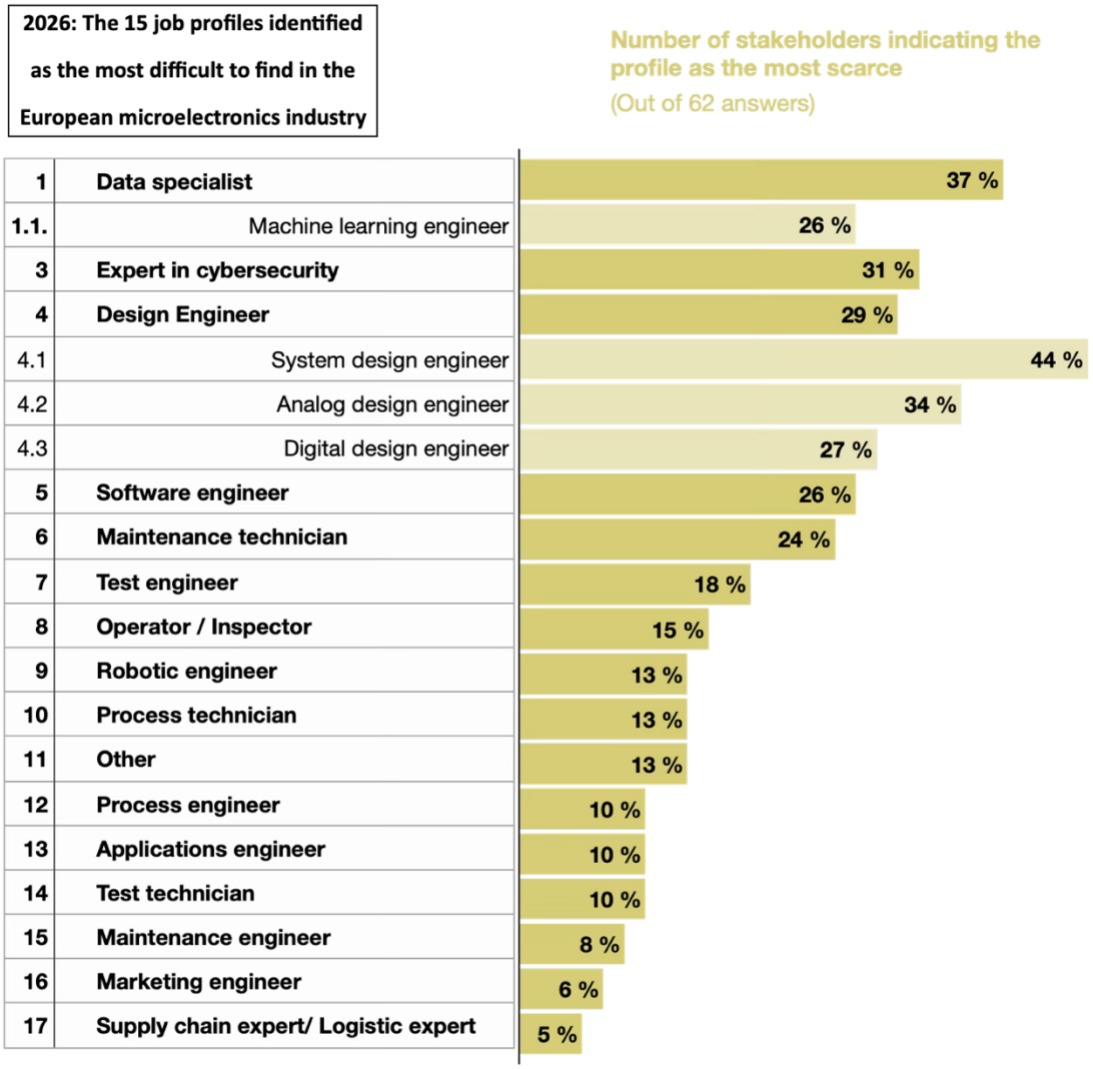
The "Other" category (16%) points to specialised profiles not captured elsewhere, including mechanical engineers for MEMS-based or high-vibration applications.

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B) PROFILES THE MOST DIFFICULT TO SOURCE

System designers remain the hardest profile to recruit, while data specialists are becoming harder to find every year and rank second in 2026. System design engineers are cited as hard to fill by 44% of respondents, followed by data specialists (37%, up from 26% in 2025), analog design engineers (34%) and cybersecurity experts (31%).

Figure 10: Ranking of the job profiles indicated as the most difficult to fill in 2026



For this question, all the stakeholders were not limited in their choice of answers and could choose between several job profiles. This is why the totals exceed 100%.

Source: 2026 ECSA Survey / DECISION Etudes & Conseil

Panel: 62 answers

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Designers, particularly system designers, remain the most difficult profiles to recruit. As in previous years, the shortage of designers is primarily attributed to a lack of training programmes across the EU. Respondents also point to declining student interest in hardware-oriented fields in favor of software, as well as insufficient depth in university curricula.

Overall, **in 2026, the shortage of designers appears to be shifting towards senior profiles** requiring interdisciplinary expertise spanning architecture, technology and application domains. Analog design is singled out as the most acute case: a very small, ageing talent pool, few students choosing this specialization as experienced designers retire, and a role that, unlike digital design, cannot be scaled through automation.

The shortage of data specialists seems to intensify, with data specialists reported as the second type of profile the most difficult to source in 2026 (fourth in 2025). This worsening of the situation is attributed to competition with other sectors to attract data specialists. Machine learning engineers (26%, from 22%) are reported as increasingly hard to recruit given the hybrid combination of AI, software and semiconductor domain expertise required, and the need for continuous upskilling as AI technologies evolve.

Software engineers, the most sought-after profile, **are identified as difficult to recruit by only 26% of respondents**, down from 36% in 2023 and earlier editions. This easing of recruitment pressures reflects AI-driven productivity gains among existing software engineers, combined with an increased supply of junior software engineers in the EU labor market. Software shortages are reported to persist for experienced profiles while junior software talents are widely available and increasingly easy to attract.

The strong shortage of cybersecurity specialists remains. The rapid growth in cybersecurity needs has outpaced the development of adequate training programs, while the semiconductor industry faces strong competition from other sectors for qualified graduates. Moreover, the industry requires specific expertise in hardware and connectivity security -skills that are difficult to find even among graduates with cybersecurity degrees.

Manufacturing profiles are less often cited, and for the same reasons as in previous years. The main reasons behind the shortage of manufacturing profiles (especially maintenance technicians), are the limited semiconductor-specific vocational training offering across Europe, the difficulty of attracting workers to manufacturing jobs with specific constraints (on-site work and shift schedule), and a demographic effect, with experienced technical staff retiring while younger generations prefer office-based careers.

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2) FROM 2020 TO 2026: EVOLUTION OF THE DEMAND OF JOB PROFILES ON THE EUROPEAN JOB MARKET

The figure below compares the responses collected each year since 2020 to the question "Indicate the job profiles that are the most sought-after on the EU job market."

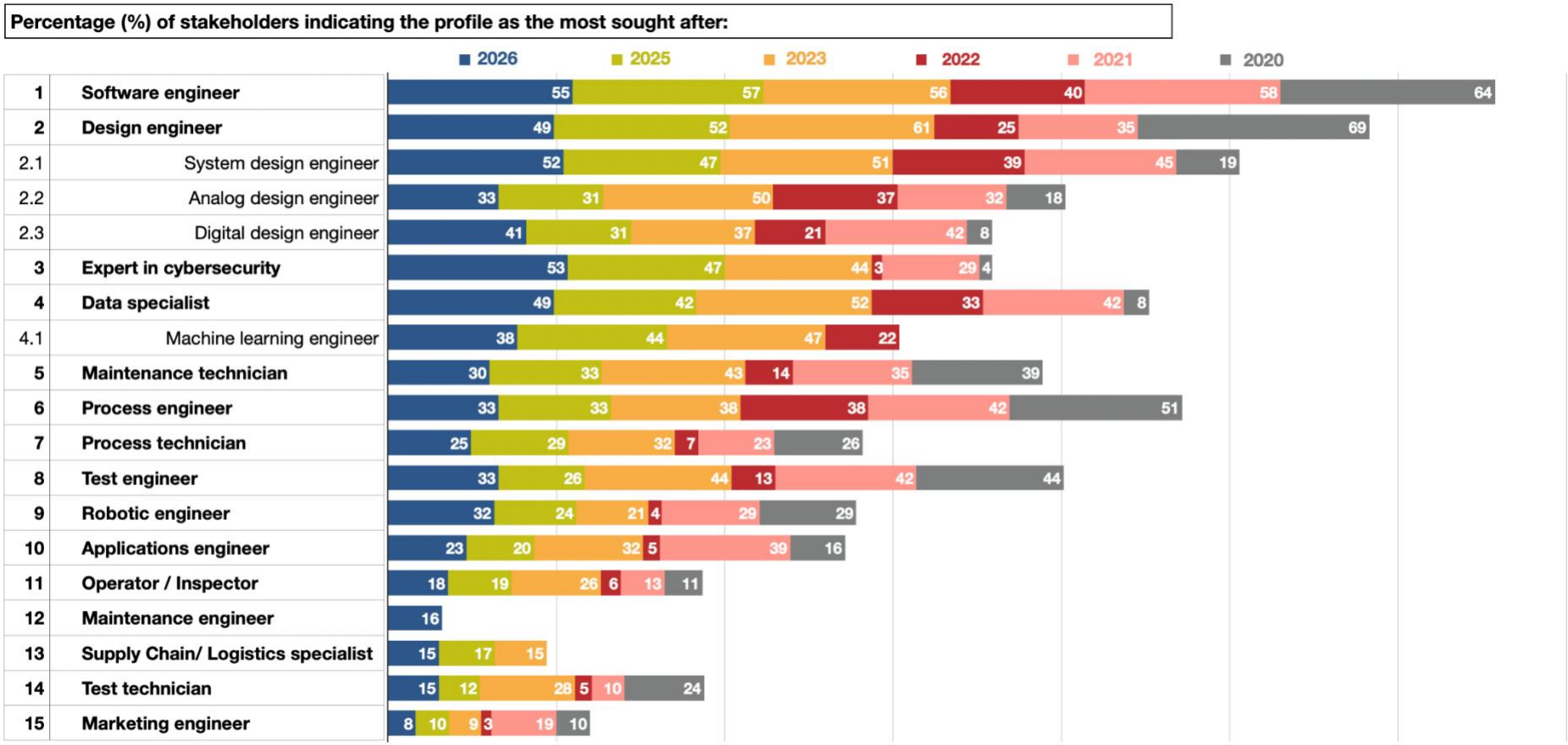
Design engineers and **software engineers** have consistently ranked among the three most in-demand profiles since 2020.

Demand for **manufacturing profiles** has declined since 2020 and has not recovered. Process engineers, cited by 51% of respondents in 2020 and 66% in 2023, have stabilized at 33% since 2025; maintenance technicians fell from 43% in 2024 to 30% in 2026, and test engineers from 44% in 2024 to 33%. The absence of a recovery since then is consistent with the delay or cancellation of several manufacturing investments announced under Pillar 2 of the Chips Act.

By contrast, demand for **data specialists, machine learning engineers and cybersecurity experts** has grown steadily over the 2020-2024 period, underscoring the rising integration of AI, big data, and advanced analytics in semiconductor manufacturing, as well as the need for secure systems and solutions in the face of increasing cyber threats, including those linked to AI. Since 2024, demand for data specialists and machine learning engineers appears to have plateaued, while cybersecurity specialists have continued to climb in the rankings, reaching second place in 2026.

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Figure 11: Share of the stakeholders over the past years indicating the profiles as one of the most sought after



For this question, all the stakeholders were not limited in their choice of answers and could choose between several job profiles. This is why the totals exceed 100%. Some categories have been added over the years, thus being unobserved data earlier. For instance: Machine learning engineer in 2022, or Supply / Logistics specialist in 2023.

Source: 2026 & 2025 & 2024 ECSA Survey / METIS Yearly Monitoring Reports 2020-2023 / DECISION Etudes & Conseil

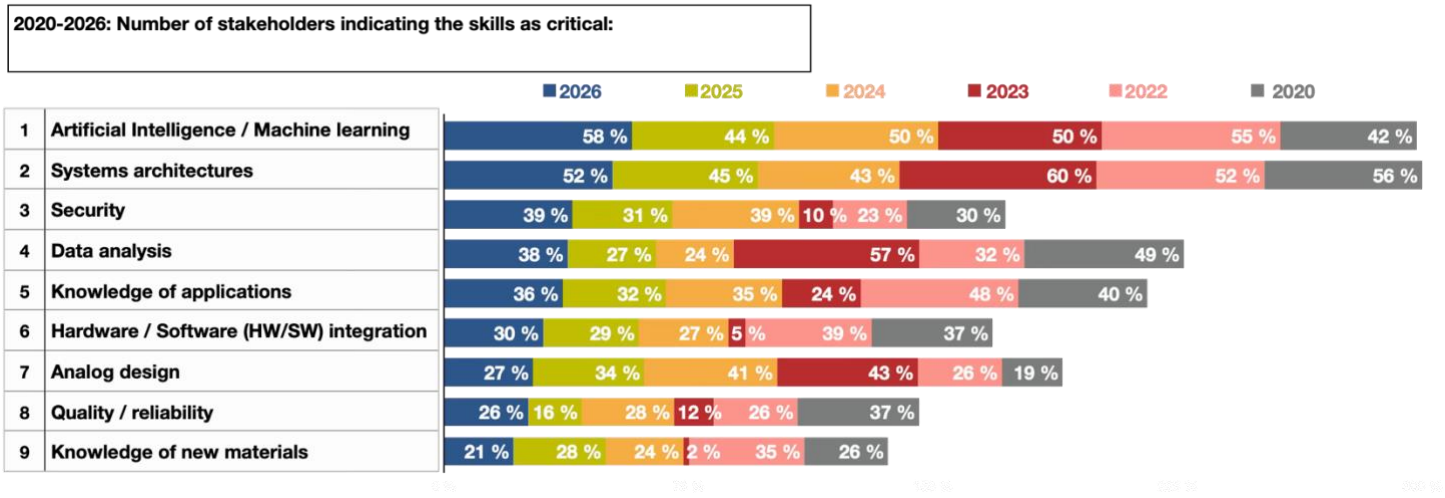
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C) MOST CRITICAL SKILLS

1) TECHNICAL SKILLS

This chapter summarizes the skills identified as most critical for the European microelectronics industry between 2020 and 2026. Critical skills are defined as both the most sought-after and the most difficult to find on the job market.

Figure 12: From 2020 to 2026: Share of stakeholders indicating the profile as one of the most critical



For this question, all the stakeholders were not limited in their choice of answers and could choose between several job profiles. This is why the totals exceed 100%.

Source: 2026 & 2025 & 2024 ECSA Survey / METIS Yearly Monitoring Reports 2020-2023 / DECISION Etudes & Conseil

AI and machine learning overtake systems architecture as the most critical skill. The impact of AI on skills is discussed in detail in Section A)1) (pages 16–18) and Annex 2.

System architecture and analog design rank second and seventh among the most critical skills. Both system architecture design and analog design require:

- Cross-disciplinary expertise
    - System architecture: Hardware-software co-design and integration, system-level modeling and simulation, signal processing and control theory, interaction with packaging, thermal management, and reliability engineering…

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    - Analog design: Beyond digital design skills, expertise in noise, power management, and signal integrity; mixed-signal and sensor interface integration, and consideration of packaging and system-level constraints…
- A master's degree followed by 5 to 10 years of experience.

Since 2020, Europe has lacked specific training programs to develop such profiles. While the number of required talents is relatively limited (less than 1,000 graduates per year across the EU), establishing dedicated training programs is essential to replace an aging workforce and preserve the EU's competitiveness in analog and system design.

Respondents report that security is a hardware- and system-level requirement. Security-by-design is increasingly required at hardware and system level, but expertise in secure architectures and hardware security is said to remain limited in Europe. Demand is reported for experts able to protect intellectual property, comply with evolving security regulations and ensure resilience across the full technology lifecycle.

Hardware/software integration shortages are reported on the software side. Driven by embedded and intelligent systems, software as a product differentiator and the co-design demands of edge AI, automotive and industrial applications, the gap is described specifically as software engineers lacking hardware knowledge, together with too few students entering embedded software.

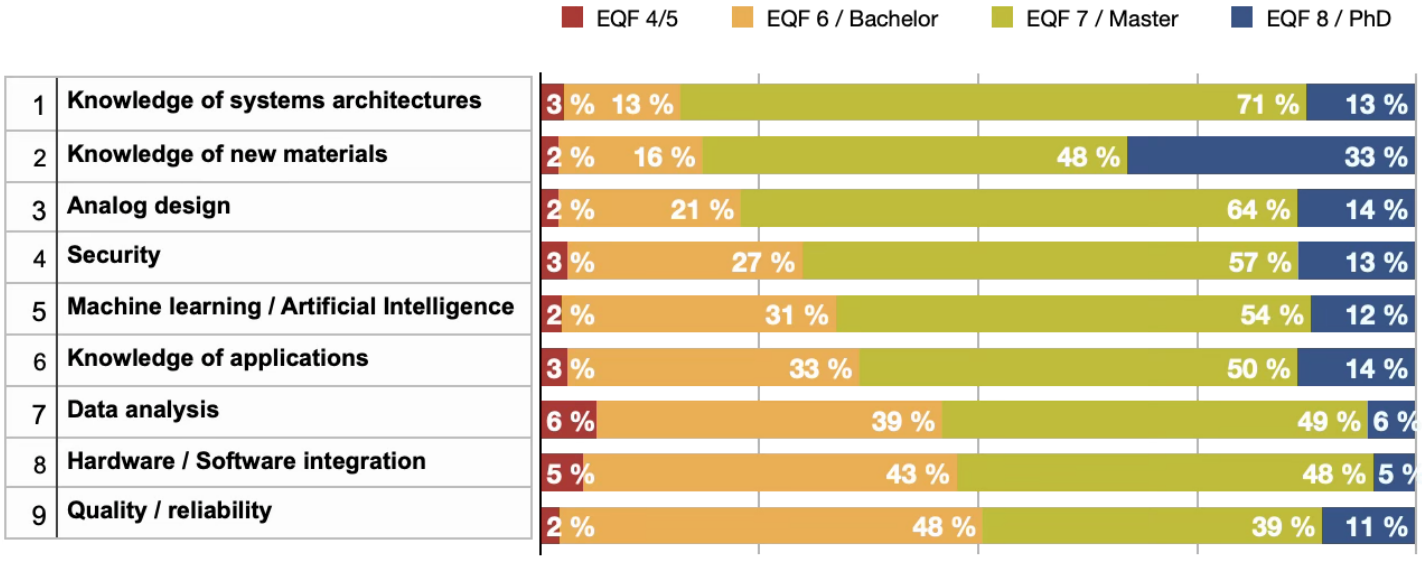
Knowledge of applications ranks fifth, reflecting the persistent difficulty of finding talent -especially junior profiles- who are not only able to master technical fields related to design, manufacturing, or materials, but also capable of linking them to the needs of user industries.

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2) MINIMUM EDUCATIONAL LEVEL

The figure below presents the share of stakeholders indicating the minimum educational level from which each skill is required. Because the number of answers in a single year is limited, the results aggregate the responses collected in the surveys from 2022 to 2026.

Figure 13: Share of stakeholders indicating the minimum educational level from which the skill is required (%)



Aggregated answers from the 2022–2026 ECSA Surveys.
Source: 2022–2026 ECSA Surveys, DECISION Études & Conseil

Knowledge of systems architecture has the highest share of master's and PhD responses. 84% of respondents place it at master's level (71%) or PhD level (13%), and only 16% at bachelor's level or below. This reflects the nature of the role: designing a SoC, SiP or complex ASIC requires optimizing across design, technology, packaging, power and application constraints at once, which presupposes a solid grounding in several engineering disciplines before the years of practice that the role also demands. It supports the continued need for dedicated master's programmes in system architecture.

Knowledge of new materials has the highest share of PhD responses. A third of respondents (33%) place it at PhD level, well above any other skill, and a further 48% at master's level. Work on wide-bandgap materials, 2D materials or advanced dielectrics sits close to research and draws on materials science, physics and chemistry at a depth rarely reached before doctoral level. It calls for research-track master's and doctoral pathways.

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On the topic of new materials, dual curricula (Bachelor and Master) combining electrical engineering with biology and chemistry are consistently requested, although only a limited number of such profiles will be needed at the EU level by 2030 (~200 graduates per year across Europe).

Analog design and security are also predominantly master's-level skills. Analog design is placed at master's or PhD level by 78% of respondents (64% and 14%) and security by 70% (57% and 13%). Analog design requires working at the level of device physics and circuit behaviour, with little support from automation, while hardware and system security combines cryptography, secure architectures and knowledge of attack techniques. In both cases the theoretical base is generally acquired at master's level, with a minimum of 5 years of work experience before the graduates become fully productive. This points to the need for dedicated master's programmes in analog design and hardware security.

Data analysis and hardware/software integration still lean toward master's level, but nearly half of respondents consider a bachelor's degree or less sufficient. Data analysis is placed at master's or PhD level by 55% of respondents and hardware/software integration by 53%, yet 45% and 48% respectively place them at bachelor's level or below, the highest shares after quality/reliability. Both rely on skills widely taught in engineering and computer science bachelor's programmes (programming, data handling, embedded systems), which also explains why they are the skills most often placed at EQF 4/5 (6% and 5%).

Quality/reliability has the highest share of bachelor's-level and below responses. Half of respondents (50%) place it at bachelor's level (48%) or EQF 4/5 (2%), against 39% at master's and 11% at PhD level.

3) DETAILED DESCRIPTION OF CRITICAL SKILLS

A detailed description of the most critical skills is provided in Annex 2.

4) IMPACT OF EMERGING TECHNOLOGIES ON SKILLS NEEDS

The figure below ranks ten technological fields according to the answers of the stakeholders surveyed in 2026 to two questions:

- Does the technology impact the skills required for the microelectronics workforce?
- Are the associated skills and knowledge currently difficult to find on the European job market?

Artificial intelligence, security and Edge IoT/Edge AI remain the three technologies with the greatest impact on skills needs, as in 2025. AI is cited by 82% of respondents, security by 65% and Edge IoT/Edge AI by 61%.

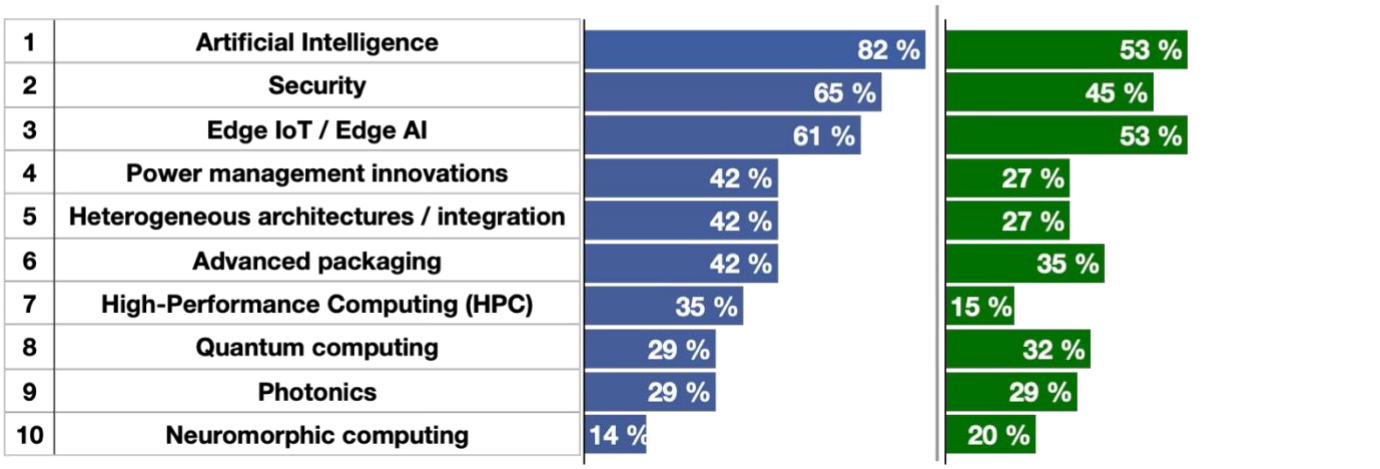
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They are also the fields whose skills are most often reported as difficult to find: AI and Edge IoT/Edge AI by 53% of respondents each, and security by 45%.

- **Artificial intelligence** is reported to affect almost every engineering profile. Respondents name machine learning engineers, data specialists, software engineers and system architects most often, and point to the need to adapt AI models to hardware constraints and to combine AI expertise with semiconductor domain knowledge. Several note that every process is now being assessed for AI-driven gains in time, quality or cost, which extends the impact to all engineering roles.
- **Security** is described by respondents as a requirement at hardware and system level rather than a software add-on. They point to security-by-design, post-quantum cryptography and the protection of data handled by AI agents, and to the need to secure the link between IT and production systems (IT-OT). Cybersecurity experts, system design engineers and software engineers are named as the profiles the most affected.
- **Edge IoT and Edge AI** are reported to increase system complexity, as AI moves from the cloud onto connected objects. Respondents point to the need for tight hardware–software co-design, low-power optimization and new dedicated edge architectures, and note that Neural Processing Units (NPUs) skills are missing. Designers, software engineers, application engineers, and machine learning engineers are named as the profiles the most affected.

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Figure 14: Technologies Shaping Skills Needs and Hiring Challenges in the EU Microelectronics Industry



Source: 2026 ECSA Survey / DECISION Etudes & Conseil
Panel: 66 answers

Power management ranks fourth. Respondents link power innovations mainly to analog and system design engineers, pointing to power efficiency as a critical constraint for edge, automotive and industrial applications and to high-power needs in data centres and electric vehicles.

Neuromorphic computing (14% impact, 20% shortage) is described as requiring non-conventional, analog-heavy architectures supported by a limited trained workforce, and as still far from practical application.

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D) RECOMMENDATIONS

1) ADDRESS THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE WORKFORCE

The European talent gap is driven by two structural factors: the ageing of the EU workforce and the insufficient number of graduates in semiconductor-related fields. Artificial Intelligence (AI) is the only emerging factor with the potential to structurally reduce the talent gap across several professional profiles, starting with design and software engineers.

However, AI's impact is multidimensional: while it can help alleviate talent shortages, it also drives the emergence of numerous new job profiles and tends to reduce demand for junior professionals, as AI agents increasingly support senior experts. This creates a long-term risk of weakening the talent pipeline needed to develop the next generation of senior professionals.

To anticipate and address AI's impact on the semiconductor workforce, the following actions are recommended:

- **Reassess the talent gap in light of AI adoption.**
  - Conduct an updated quantitative assessment of the talent gap, accounting for the impact of AI adoption on workforce demand, to better inform workforce planning and training development.
  - Update this assessment annually to capture the non-linear evolution of AI's impact on the talent gap.
  - Improve the granularity of the analysis to assess the specific impact of AI on individual semiconductor job profiles.
- **Expand and adapt education and training.**
  - Update curricula and VET training programmes in close collaboration with industry to equip future professionals with AI-relevant skills and competencies, as most profiles are being hybridized with AI (e.g., AI process engineers).
- **Upskill and reskill the current workforce.**
  - Address training gaps on AI and big data tools for technician and operator roles.
- **Mobilize available talent.**
  - Enable flexible work-based learning opportunities to ensure early career talent is nurtured despite potential impacts from AI.

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2) PRIORITY RECOMMENDATIONS ISSUED BY THE PANEL IN 2026

In 2026, 45 of the 83 respondents formulated recommendations. Their priorities are presented below under the themes of the recommendation's framework summarized in Figure 15. It updates the framework presented in the ECSA Skills Strategy 2024, built on inputs gathered from more than 400 stakeholders since 2020

The quantitative estimates cited in these chapters come from the talent-gap assessment carried out for the 2024 and 2025 editions of the Skills Strategy; no update of this quantitative exercise was planned for the 2026 edition, and the figures are therefore reproduced as established in 2025.

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Figure 15: Summary of main recommendations – ECSA Skills Strategy 2026

Table below presents Stakeholders 2026 recommendations categorized by:

- Recommendations that are new or substantially extended in 2026 survey
- Recommendations present both in previous editions and in 2026 survey
- Recommendations kept from previous editions but not raised in 2026 survey

Time horizon	Theme	Actions
Short term	Upskill and reskill the current workforce	Offer short modular and industry-led courses for engineers and technicians in work
		Co-fund industry-led reskilling programmes for workers from automotive, software and defence
		Grant tax incentives to companies that train their workforce and personal training accounts to workers
		Set EU quality standards for continuing VET, building on EQAVET
	Mobilise available talent (within and beyond Europe)	Harmonise visa and work-permit procedures for semiconductor specialists across Member States
		Establish mutual recognition of qualifications and micro-credentials across Member States
		Fund EU mobility programmes for students and professionals and talent-sharing schemes between company sites
		Co-fund scholarships for non-EU students in critical fields, with industry sponsorship
		Set up placement services linking graduates with semiconductor companies and research centres
		Offer tax relief and housing assistance to graduates who stay in EU clusters
Long term	Expand and adapt education and training	Increase VET funding to train more technicians, operators and maintenance staff
		Fund additional electrical engineering and microelectronics programmes in universities and technical schools
		Create master's degrees and training hubs in system design, analog design and cybersecurity
		Update curricula to chiplets, advanced packaging, AI hardware, cybersecurity and photonics
		Add data science and software practices to all engineering curricula
		Co-develop curricula with industry and expand apprenticeships, internships and industrial PhDs
		Invest in teaching laboratories, pilot lines and digital learning platforms for students
		Give students access to open-source chip-design platforms and process design kits
		Grant incentives to companies that host trainees and apprentices
		Offer more English-taught programmes
	Raise interest in semiconductor careers	Launch gender-diversity initiatives in STEM and semiconductor education
		Promote early engagement in STEM and microelectronics
		Introduce electronics and programming in school curricula
		Publicise open positions and career paths in semiconductors to students and graduates
		Run train-the-trainer programmes and incentives for teachers in STEM
		Organise career fairs, summer schools and mentoring with industry professionals
	Strengthen ecosystems and the industrial base	Fund start-ups and scale-ups beyond their first development phase
		Fund joint academia–industry research projects
		Organise cross-border conferences and exchanges between national clusters
		Establish national Chips competence centres offering training and access to infrastructure
	Improve granularity of employment and graduates' data	Enhance granular data on employment
		Enhance granular data on graduates

Source: 2026 ECSA Survey / DECISION Etudes & Conseil

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3) SHORT TERM RESPONSE: ADDRESSING THE CURRENT WORKFORCE NEED BY OPTIMIZING THE USE OF THE AVAILABLE LABOR SUPPLY

1. UPSKILL AND RESKILL THE CURRENT WORKFORCE

Reskilling and upskilling programmes can significantly reduce talent shortages in the short term in the EU semiconductor industry by quickly enhancing the skills of existing employees, allowing them to fill critical roles immediately. These programmes can be tailored to address specific industry needs, making them a more efficient solution than waiting for new graduates. Furthermore, reskilling and upskilling can facilitate workforce sharing within the semiconductor value chain, allowing labor to be temporarily utilized in more dynamic segments during periods of reduced activity in other parts of the industry. Workforce transfers can also come from other sectors experiencing reduced activity (e.g., the automotive industry). Additionally, offering adult learning opportunities can improve employee satisfaction and retention, as workers are more likely to stay with a company that invests in their development.

Promote adult learning. Continuing formal education, such as courses and certifications, or informal learning, like on-the-job training and self-directed study are not well integrated into EU education systems, with low participation rates and uneven progress across Member States. The underperformance of adult learning systems is mainly due to informational frictions and poor coordination among semiconductor companies, workers, and training organizations. Key issues include: (i) Mismatch in Skills Demand: Formal education systems, such as vocational schools and universities, do not have precise information about the skills companies need; (ii) Lack of incentives for semiconductor industries: Companies may know their skill requirements but are reluctant to invest in training workers, fearing that these skills will benefit other companies; (iii) Challenges for Training Providers: High costs and insufficient information about the quality and effectiveness of training programmes discourage the development and scaling of high-quality training initiatives. A number of measures could be taken to stimulate adult learning in EU countries:

- Ensuring the participation of semiconductor companies in the adult learning strategy: This can be achieved by ensuring sufficient funding from both public and private sources, offering tax incentives to companies, and improving the design and delivery of training programmes by actively engaging employers in their development, implementation, and financing. Initiatives such as Infineon's 'WeGrowOurselves', which provides employees with the opportunity to engage in continuous training at their own pace, should be encouraged.

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- Improve information and access to adult learning programmes: Obstacles to training should be removed at the EU level by making information on adult learning programmes more easily accessible, clearly explaining funding opportunities, and offering flexible learning formats such as part-time, evening, weekend, online courses, or "Designer in Residence"/" Specialist in Residence" in summer schools, etc.
- Promoting Personal Training Accounts: These funds could be used to allocate credits to meet personal training needs, giving EU citizens the freedom to choose appropriate programmes. France, for example, has a Personal Training Account (CPF) available to citizens, which automatically accumulates credits during periods of employment. The EU can support these initiatives through funding, technical assistance and by facilitating mutual learning between Member States.

Promote continuing Vocational Education and Training (cVET). Training systems differ widely among EU Member States, resulting in limited coordination and alignment. These programmes are inherently local, with distinct regional characteristics that vary from one Member State to another. cVET are organized differently across the EU, as is the extent of semiconductor companies' involvement in vocational training. The level of participation in cVET programmes is generally low across EU member States and sometimes, cVET programmes do not align with the needs of the semiconductor industries. Some measures could be implemented to encourage employees to engage with cVET:

- Harmonize cVET quality across Member States: This could be achieved by sharing best practices and strengthening the implementation of the existing European Quality Assurance Reference Framework for Vocational Education and Training (EQAVET), while allowing for regional specificities.
- Enhance Attractiveness: Increase the appeal of cVET programmes for employees, employers, and society through targeted campaigns and partnerships.
- Incentives to encourage employees and semiconductor industry participation: Offer scholarship, grant, and tax benefit programmes to make cVET more financially attractive for employees and employers.

2. MOBILISE AVAILABLE TALENT WITHIN AND BEYOND THE EU

Facilitating intra-EU labor migration from Member States with surplus training capacities to EU countries where the demand is most urgent. Currently, over a third of EU graduates in semiconductor-related fields of study are located in Member States without significant semiconductor industry and 40% are outside the main semiconductor players (Germany, Netherlands, France, Italy, Ireland, Belgium, and Austria). Among countries with a relatively limited semiconductor ecosystem, Spain has the highest number of students in semiconductor-

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related fields, though other sectors strongly compete for these graduates. It is followed by Romania, Greece, Bulgaria, and Croatia.

- Improve and harmonize skills certifications: This involves an EU-wide recognition of diverse learning pathways, vocational training, and work-based learning. Certifications should be flexible, less dependent on formal education, and include micro-credentials (short, focused learning experiences that allow individuals to gain specific skills or knowledge in a particular area) and digital badges (badges that contain metadata providing details of the skills acquired through the micro-credentials).
- Assessing Member States' (MS) regulated professions systems: While the professions in the semiconductor industry are less regulated than in other industries (aeronautics, energy, pharmaceuticals, etc.), some MS have regulations in place for specific roles, including chemical engineer, electrical engineer, and electromechanical engineer[4]. These regulations may be crucial for ensuring personal safety, but they can also act as a barrier to entry for workers from other MS. It is, therefore, essential to assess the necessity to uniformize these regulations.
- Facilitate talent sharing across European sites of the same company. Reducing administrative barriers and facilitating temporary staff transfers between company sites across the EU could help make better use of the existing European talent pool.

Attracting more highly skilled workers from outside the EU. EU Semiconductor companies already employ a significant number of non-European workers to address the shortage of skilled professionals in Europe and to leverage the benefits of a diverse and inclusive work environment. As previously stated, in 2023, 39% of ASML employees in the EMEA region were non-EMEA nationals. China, India and the United States are the countries with the most STEM graduates, with the EU, but competition is intense as these countries are also developing their semiconductor industries. To a lesser extent, other countries also have a large pool of STEM graduates, where competition is perhaps less intense. These include Russia, Indonesia, Brazil, Mexico, and African countries. The following measures have been proposed to attract non-EU skilled workers:

- Simplify visa process for experts and students: One potential solution would be the introduction of a specialized EU-wide entry visa for graduates, researchers and experts in the semiconductor field. This visa

[4] https://ec.europa.eu/growth/tools-databases/regprof/professions/generic

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should feature clear eligibility criteria and a streamlined application process, minimizing bureaucratic obstacles.

- Streamlined immigration for skills workers: This includes the acceleration of visa processing, and the issuance of residence permits to qualified professionals. It is asserted by respondents that these pro-immigration policies be combined with the protection of critical technologies (ITAR, export controls). This also encompasses the facilitation of installation for new arrivals, including housing options, and the formulation of a plan to assist and/or train spouses/husbands in securing employment in the destination country.
- Providing scholarships to non-EU-students in semiconductor fields of study: Scholarships should be structured to address both merit and financial need. Encouraging private companies to co-sponsor these scholarships will ensure that the funding aligns with industry requirements, fostering a mutually beneficial relationship between academia and the private sector.

Retain local talent in highly skilled occupations. Over the years, Europe has become a major exporter of talent. It is estimated that around 10% of graduates in semiconductor related fields of study choose to work outside the EU either immediately after completing their studies or in the near future. Based on the model used previously to estimate the talent gap, it is estimated that retaining the talent currently leaving the EU after their studies would result in a 20% reduction in the talent gap over the period 2024-2030. Surveys of expatriate engineers show that the main reasons for choosing to work outside the EU are a better quality of life and working environment, a more open market and better opportunities, and higher salaries.

- Facilitating student placements and graduate contracts within semiconductor companies: To retain skills and talent in Europe from the early stages of their careers, student placements, graduate contracts and industrial PhDs in semiconductor companies and research centres need to be facilitated across the EU. This requires placement services to link graduates with companies and research centres.
- Raising remuneration: Beyond salaries, additional incentives to stay in the EU could be considered, including tax incentives and housing assistance. The shortage of affordable housing is particularly acute in technological clusters.

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4) LONG TERM RESPONSE: ANTICIPATE FUTURE INDUSTRY NEEDS

1. EXPAND AND ADAPT EDUCATION AND TRAINING

Increase training capacities in semiconductor-related studies

It is anticipated that communication campaigns[5] could lead to an increase in the number of students pursuing studies in semiconductor-related fields (currently only 28% of STEM students graduate in this area). This would require an expansion of the number of initial education programmes in selected semiconductor-related fields of study. However, the results from the quantitative analysis and online survey demonstrate that additional training capacities are already required in hardware engineering -the primary contributor to the talent gap- and especially electrical engineering.

Increase training capacities in targeted fields:

An increase in training capacities in the EU is necessary in two key areas:

1. Electrical engineering. By 2030, the semiconductor industry in the EU will face a shortfall of nearly 53,400 graduates from electrical engineering programs. This talent gap could be alleviated if demand from other industries for electrical engineering graduates decreases by 2030. However, under the more likely scenario where this demand remains stable, the only solution to address the shortfall is to expand training capacities in electrical engineering. Feedback from universities in France, Italy, Ireland, and Belgium suggests that, so far, no such expansion is occurring overall. Instead, training capacities have remained stable or even declined, while the workforce of professors continues to age. Immediate action is essential to close the EU's talent gap in this critical field.
2. Specialized Degrees for the Semiconductor Industry. Current training capacities for certain specialized roles within the semiconductor industry are significantly below the sector's needs. For these profiles, which require high educational levels (EQF 7-8), and work experience to become productive, there is an urgent need to set up specific training hubs. The following three profiles are of particular concern:
    - System designers. By 2030, the EU will face a shortage of 3,300 system designers. These professionals must be trained in electrical engineering, semiconductor design, and system design (SoC, SiP, complex ASICs). Proficiency in data science and machine learning would be an advantage.

[5] See recommendation 3)2.

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- Analog designers. By 2030, the EU will lack 2,100 analog designers. These professionals need training in electrical engineering, RF, digital semiconductor design, and specifically, mixed signal/analog semiconductor design. Proficiency in data science and machine learning would also be beneficial.
- Experts in cybersecurity. The EU will face a shortfall of 2,600 cybersecurity experts by 2030. These professionals must possess expertise in electrical engineering, semiconductor hardware and software, and cybersecurity to address security-by-design in semiconductors and develop secure hardware and software architectures.

Expand vocational training capacities for technicians and operators. In addition to engineering graduates, the European semiconductor industry needs a sufficient supply of technicians, equipment specialists, maintenance personnel and skilled operators. Training capacities in vocational education and training (VET) should be strengthened to address these needs, with particular attention to pathways enabling operators to progress into technician roles. In 2025 and 2026, the Netherlands experienced a significant increase in demand for vocational training.

Develop interdisciplinary STEM curricula: The demand for new skills is growing rapidly in fields like data science and machine learning, creating opportunities for interdisciplinary joint curricula (Bachelor, Master) combining Electrical Engineering with these and other disciplines. The table below ranks these potential joint curricula based on projected job demand in the EU semiconductor industry by 2030.

For example, graduates with a joint degree in Electrical Engineering and Data Science could meet a demand of 70,000 jobs in the EU semiconductor sector by 2030. In contrast, joint programs combining Electrical Engineering with fields such as Marketing/Sales/Communication (2,200 job openings) or Biology/Natural Sciences (1,700 job openings, primarily in R&D, material, or application engineering) are projected to see much lower demand by 2030.

Figure 16: Proposals for interdisciplinarity or joint degrees in microelectronics

FIELD OF STUDY	PROPOSALS OF JOINT DEGREE					TOTAL demand for such profiles on EU soil 2024-2030 (number of job positions)
	1	2	3	4	5	
Microelectronics / Electro engineering / Mechanics / Mechatronics	V	V	V	V	V	
Data science / Software / Informatics / Data engineering / Data analysis	V					70 000

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Artificial Intelligence / Machine Learning		V				**70 000**
Chemistry / Material science (Polymer etc.)			V			**29 400**
Marketing / Sales / Communication				V		**2 200**
Biology / Natural science					V	**1 700**

Source: 2025 ECSA Skills Strategy / DECISION Etudes & Conseil October 2025

Adapt training capacities

- Incorporate transversal skills into the regular STEM curriculum: Developing skills such as communication, teamwork, problem-solving, creativity, adaptability, resilience and emotional intelligence, and entrepreneurship education.
- Ensuring that curricula include international and corporate experience: This can be achieved by facilitating student rotations abroad through simplified regulations, assisting companies in offering internships with mentorship and funding for bachelor's and master's students, aligning curriculum and internship constraints with industry requirements (preferably for four to six months), and making internships a mandatory part of the university curriculum.
- Regularly update curricula to reflect technological developments: Universities and vocational training providers should adapt their programmes more rapidly to evolving industry needs, particularly in areas such as chiplets, advanced packaging, photonics, power devices, embedded systems and AI hardware.
- Expand access to hands-on training and semiconductor infrastructures: Strengthen practical learning through teaching laboratories, chip-design tools, open-source process design kits (PDKs), and projects covering the full design-to-fabrication process. Where appropriate, leverage the infrastructure and expertise developed under the Chips for Europe Initiative, including pilot lines and national semiconductor competence centres, to facilitate access to advanced technologies and practical training opportunities for students and trainees.
- Offer more English-speaking training programs: In order to facilitate workers mobility during their working lifetime.

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2. RAISE INTEREST IN SEMICONDUCTOR CAREERS

As demonstrated for many years in the European Chips Skills Strategy, the EU does not face a lack of STEM students overall. Within STEM studies, the number of graduates in semiconductor-related fields of study[6] is also overall more than sufficient to meet the needs of the semiconductor industry, in particular in ICT, benefiting from a strong growth in new graduates and training capacities[7].

However, only a limited percentage of graduates in semiconductor-related disciplines opt to enter the European semiconductor industry upon completing their studies. Many of these graduates redirect their engineering expertise towards unrelated sectors, such as the production of loaded electronic boards, electrical products, computer and optical devices, as well as industries like electricity and gas supply and wired telecommunications.

Additionally, a significant number pursue careers outside traditional engineering roles, venturing into fields such as finance, marketing, and communications.

As a consequence, in 2022, it was estimated that only about 9% of EU graduates specializing in semiconductor-related fields would join the semiconductor industry within the EU. Notably, the growth rate of graduates in semiconductor disciplines has remained relatively stagnant over recent years, particularly when contrasted with the broader trends observed in STEM fields. This trend raises concerns about the industry's ability to attract and retain talent in a rapidly evolving technological landscape.

The percentage of graduates from semiconductor-related fields entering the European semiconductor industry is influenced by market size but also by the industry's perception and appeal. A significant number of respondents to online surveys have highlighted that the volume of talent moving into the semiconductor sector correlates with market size and enhancing the sector's competitiveness could indeed lead to more graduates choosing this career path. However, this is not the only factor at play. Many STEM graduates may lack awareness of the opportunities available within the semiconductor industry, which may not be marketed as effectively as

[6] Electronics and automation, mechanics, chemical and process, software and application developments, and database and network design and administration.

[7] In terms of training capacities, the main concern relates to electrical engineering, where the growth of graduates is not sufficient to meet the needs from the semiconductor industry. For this type of studies, communication campaigns will not be sufficient and expanding training capacities is also a need (see recommendation 3)1)).

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other tech fields like software development or data science. Furthermore, technical roles, especially in manufacturing, can be demanding, often requiring long hours and operating in high-pressure settings. As a result, graduates might prefer industries that offer better work-life balance and more flexible arrangements. Additionally, the analytical and problem-solving skills honed during STEM studies are highly applicable to non-technical positions, allowing graduates to feel confident that their technical training can lead to success in diverse fields, including business and communication.

Attract students to semiconductor fields of study. Efforts to attract more students to semiconductor-related fields of study should combine early engagement, teacher training, career guidance and targeted com munication. The following actions are recommended:

- Promoting early engagement in STEM and microelectronics: Awareness-raising initiatives should begin at primary and secondary school levels, well before students choose their higher education pathways. Hands-on electronics and robotics activities, hackathons and after-school programmes could help pupils discover semiconductor technologies and related careers. Integrating introductory microelectronics topics into school curricula, in cooperation with national education ministries, would further support these efforts.

- Train the teachers: Develop dedicated training and industry internship programmes for primary and secondary school teachers, enabling them to gain hands-on experience with semiconductor technologies and bring practical STEM activities into their classrooms. Partnerships between semiconductor companies, schools and education authorities could help scale successful initiatives across Member States, drawing on experiences such as Intel Ireland's STEM Teacher Internship programme.

- Informing on educational pathways and support: Provide clear information on educational pathways, including relevant degree programmes, certifications, and training initiatives. Emphasizing available financial assistance options, like scholarships for semiconductor studies, to help reduce economic barriers and empower students to envision a future in this dynamic field with confidence.

- Emphasizing the field's contribution to society: Highlight the industry's crucial role in driving innovation and shaping future technologies, including artificial intelligence, the Internet of Things, and renewable energy. Showcasing diverse career opportunities to inspire students to pursue fulfilling careers that contribute to global advancements.

Encourage graduates to enter the semiconductor industry. Communication campaigns to encourage graduates to enter the semiconductor industry should focus on the following thematic areas:

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- Emphasis on Work-Life Balance and Flexibility: Encourage graduates to enter the semiconductor industry by emphasizing the sector's focus on work-life balance and employee well-being. Showcasing companies that offer flexible work arrangements and sharing testimonials from current professionals to counter the myths of high-pressure roles and highlight fulfilling career experiences.

- Emphasizing the field's contribution to society: Present success stories of thriving companies, illustrating the significant contributions the semiconductor sector makes to technological advancements and societal improvements. This approach will inspire graduates by demonstrating the potential impact of their work in this dynamic field.

- Promote career opportunities: Emphasizing the increasing demand for skilled professionals in the industry and highlighting the industry's commitment to continuous learning and career advancement. This message will encourage graduates to explore various paths that align with their interests and skills. Communication campaigns should also highlight the diversity of available positions, from operators and technicians to engineers and researchers, and provide concrete information on recruitment opportunities in the semiconductor industry.

Launch events and networking opportunities. Promote networking opportunities and events (workshops, career fairs, summer schools…), that connect students and graduates with industry professionals, offering insights into real-world applications of their education. Furthermore, introducing mentorship programmes that pair students with seasoned experts would provide valuable guidance as they navigate their career paths in the semiconductor industry.

- Promote cross-border exchanges between European semiconductor ecosystems. Encourage conferences, student exchanges and networking initiatives connecting educational institutions, industry professionals and semiconductor clusters across Member States. Such initiatives would increase students' exposure to career opportunities throughout Europe and strengthen links between regional semiconductor ecosystems.

Attract women and under-represented groups to semiconductor careers. Dedicated outreach initiatives should encourage more women and people from under-represented groups to consider education and careers in microelectronics. These efforts could include targeted awareness campaigns, role models and partnerships with schools, universities and industry to broaden participation and diversify the sector's talent pool. The European Chips Diversity Academy is already contributing to these efforts and provides an example of an initiative that could be replicated or expanded across the EU.

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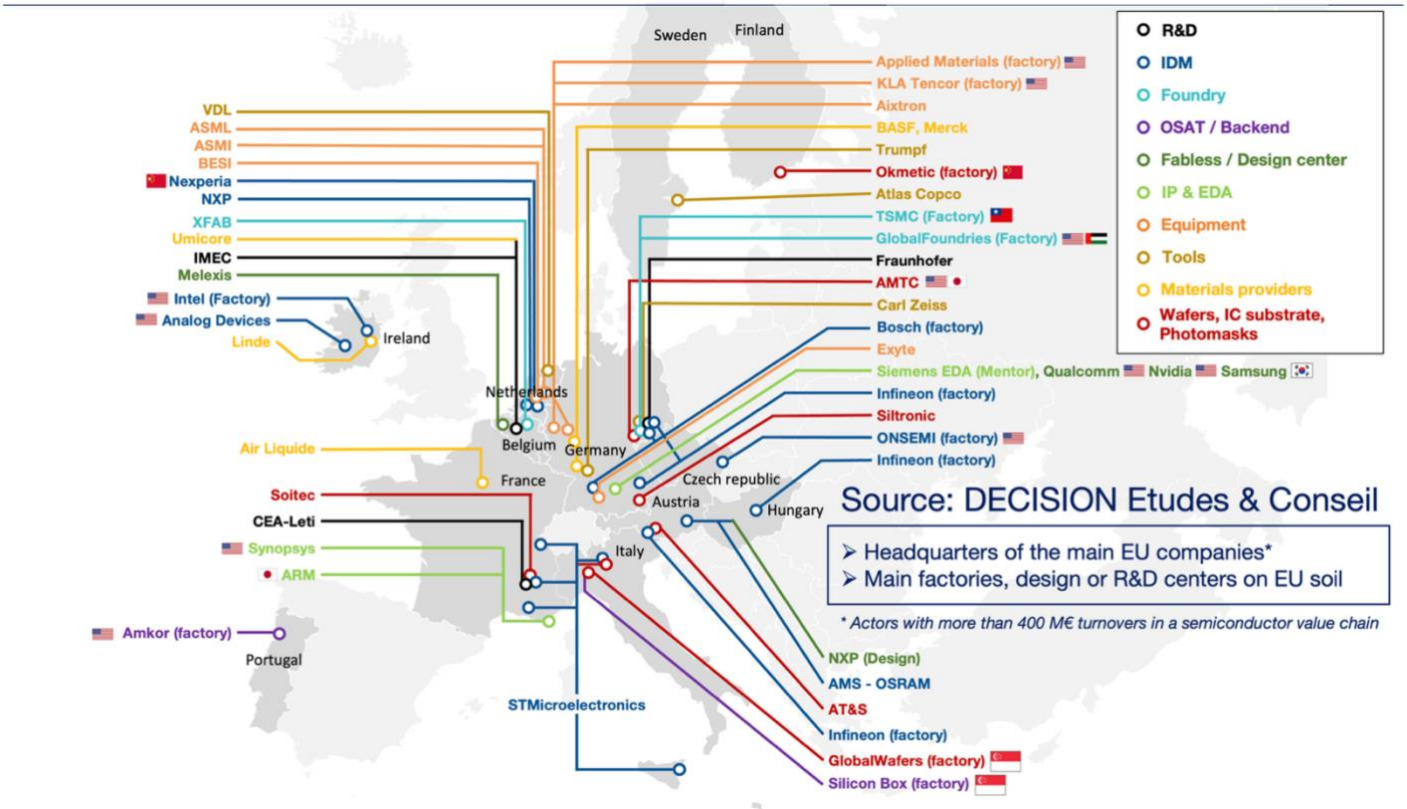
3. STRENGTHEN ECOSYSTEMS AND THE INDUSTRIAL BASE

Especially when addressing the topic of skills, positive synergies emerge from the coexistence in the same geographical area of a complete semiconductor ecosystem, involving not only large companies, but also mid-cap and SMEs, research labs, Universities and VET providers.

Develop existing clusters:

The figure below presents the main semiconductor clusters in the EU.

Figure 17: The main semiconductor clusters in the EU



As shown on the map, the main clusters on EU soil are the following: the axis Brussels-Amsterdam (Belgium – the Netherlands), the Dresden area / Saxony (Germany), the Munich area (Germany), the Grenoble area (France), the Dublin area (Ireland), the axis Graz-Vienna (Austria), and many more of medium size such as the Helsinki area (Finland).

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Clusters are crucial for decreasing the talent gap as they concentrate resources, enhance collaboration between universities and companies, and foster innovation and knowledge sharing. They attract talent by offering numerous professional opportunities and support SMEs by providing access to training and development resources. Such environment fosters collaborative approaches such as sharing best practice, scaling common skills (e.g. AI, data engineering) …

The EU policy to address the talent gap should be structured around the main EU clusters, addressing their specific needs at the regional / local levels.

Cooperation between semiconductor clusters across Member States should also be encouraged, notably through professional networks, exchanges of expertise and the sharing of training resources and infrastructures. Such cooperation would help smaller ecosystems benefit from the capabilities developed in more established clusters and strengthen the European semiconductor skills ecosystem as a whole.

Supporting SME: SMEs and startups often flourish in existing clusters. Providing SMEs with access to resources, mentorship, continuous learning opportunities and advanced manufacturing tools at reasonable costs appears crucial and is already a goal of the EU Chips Act's pilot lines and competence centers.

4. IMPROVE GRANULARITY OF EMPLOYMENT AND GRADUATES' DATA

To create effective skills policies, it is vital to enhance the availability and reliability of skills data both at the EU level and within Member States (MS). Such data is crucial for identifying skills shortages and strategizing funding for training programmes, enabling governments to make informed investment choices. While new data sources are emerging, their adoption in policymaking is still limited. To tackle this, an EU-wide initiative should be launched to gather and standardize skills information, collaborating with private sector entities for accurate insights. The initial focus should be on data collection at the Member State level, with the Commission establishing a common standard to facilitate comparability and usability for local policymakers. Additionally, local organizations must be trained to effectively utilize this data in planning skills policies. Key priorities for any data enhancement initiative should include:

Enhancing granular data on employment by occupation at EU and MS levels: Eurostat produces employment data by industry but not by occupation. Cedefop has made efforts in this direction, but the disaggregation by occupation is not yet sufficiently detailed. The availability of disaggregated data varies greatly from one MS to

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another. The U.S. Bureau of Labor Statistics provides a good example to follow, with a very detailed Occupational Employment database which, to our knowledge, does not exist in any MS at such a detailed level[8].

Improving the granularity of graduates' data and undertaking graduate tracking surveys: The data on graduates and students at the European level is based on the International Standard Classification of Education (ISCED). While this classification already provides a high level of granularity by field of study, there is potential for further improvement. To provide an example, the ISCED offers a four-digit breakdown of academic disciplines, while the Classification of Instructional Programs (CIP) from the National Center for Education Statistics (NCES) in the United States provides a six-digit disaggregation.

Graduate tracking is also essential to identify the sectors in which graduates actually find employment, a key parameter for estimating the semiconductor talent gap. Existing European and national initiatives provide useful foundations for further progress. At the European level, the Eurograduate survey covered more than 100,000 graduates across 18 EU/EEA countries in its 2022 edition, tracking their situation one and five years after graduation. Its next round takes place in 2026, with results expected in 2027. Greater granularity by field of study, together with information on graduates' sectors of employment, would make this initiative particularly valuable for monitoring semiconductor-related career paths.

At the national level, Austria's ATRACK system provides an example of register-based graduate tracking. Developed by a consortium of 35 higher education institutions in cooperation with Statistics Austria, it links graduates' labor-market status, income and sector of employment to their field of study without relying on surveys. Extending similar approaches to other Member States could significantly improve the availability of data on graduates' transitions into the semiconductor industry.

[8] https://www.bls.gov/oes/current/oes_nat.htm

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ANNEXES

ANNEX 1 – METHODOLOGY NOTE OF 2026 EDITION OF THE ECSA SURVEY

The qualitative analysis was carried out based on the results of the 2026 edition of the ECSA Survey. This survey follows the structure of past years surveys that have been carried out in the ECSA and METIS projects. This allows for a continuous monitoring of the answers from the stakeholders involved to follow the skills trends in the EU semiconductor industry. As previous years, the stakeholders were invited to answer questions on:

- New emerging profiles and skills that they identified.
- The impact of specific events on the hiring policies (EU Chips Act, Fabs investments…).
- Specific job profiles that are sought after and/or in shortage.
- Specific skills that are critical to find.
- Emerging technologies and their impact on the skills market.
- The stakeholders' hiring plans compared to the previous year.
- The perception of the skills shortage compared to the previous year.

In 2026

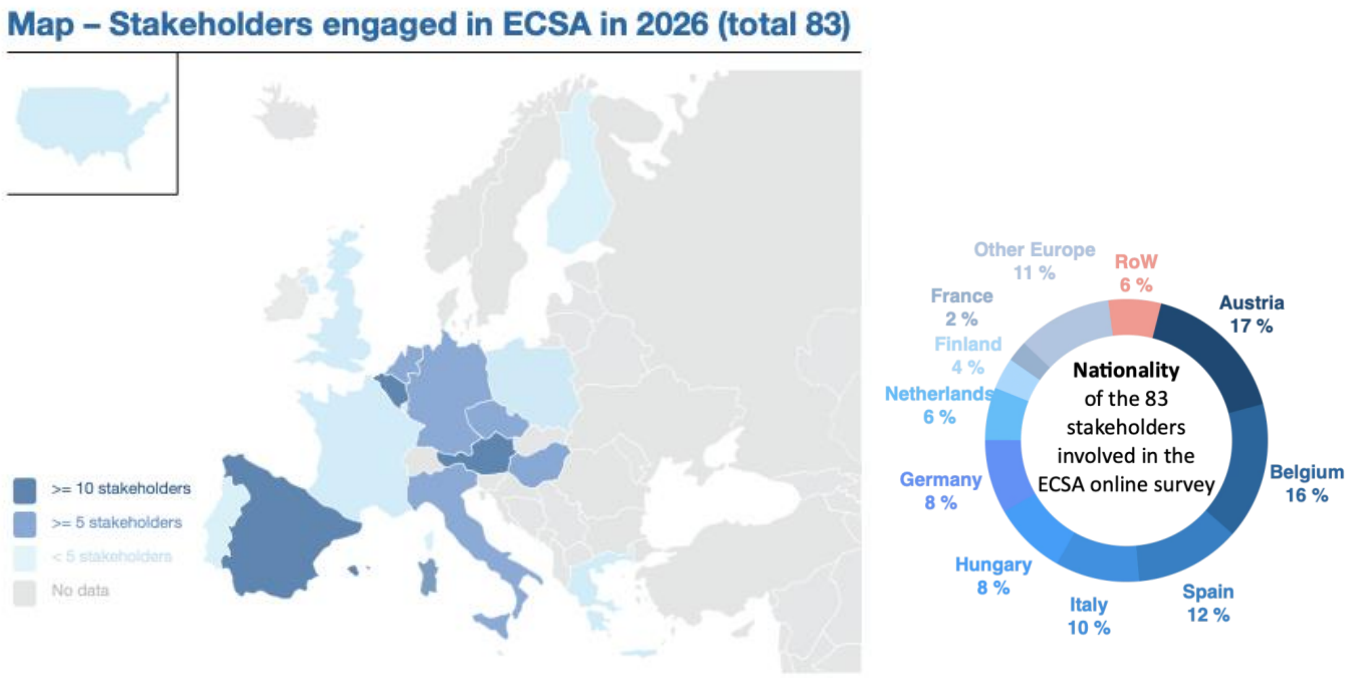
- 83 stakeholders from 16 different countries participated in the survey. The number of respondents to the survey has decreased compared to 2025 and 2024 due to the setting up of surveys devoted to skills intelligence at national level organized by the European competence centers. From 2027 onwards, the ECSA will aim for further coordination with the competence centers to address this issue.
- Two questions have been introduced to assess the impact of AI on day-to-day tasks and hiring.

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The statistics on the geographic location of the stakeholders is given in the figure below. The survey has covered 12 member-states alongside the UK in Europe, as well as a few respondents from the US, India and China (6% of the total).

In 2026, as was the case in 2022 and 2023, the geographic distribution of the survey is not optimal. While Belgium and Austria are overrepresented, fewer than 10 respondents answered the survey in both Germany and Italy. Only two respondents answered the survey in France. Finally, no responses were received from Ireland, Eastern Europe or Scandinavia.

Figure: Geographic distribution of stakeholders engaged in the 2026 ECSA Survey



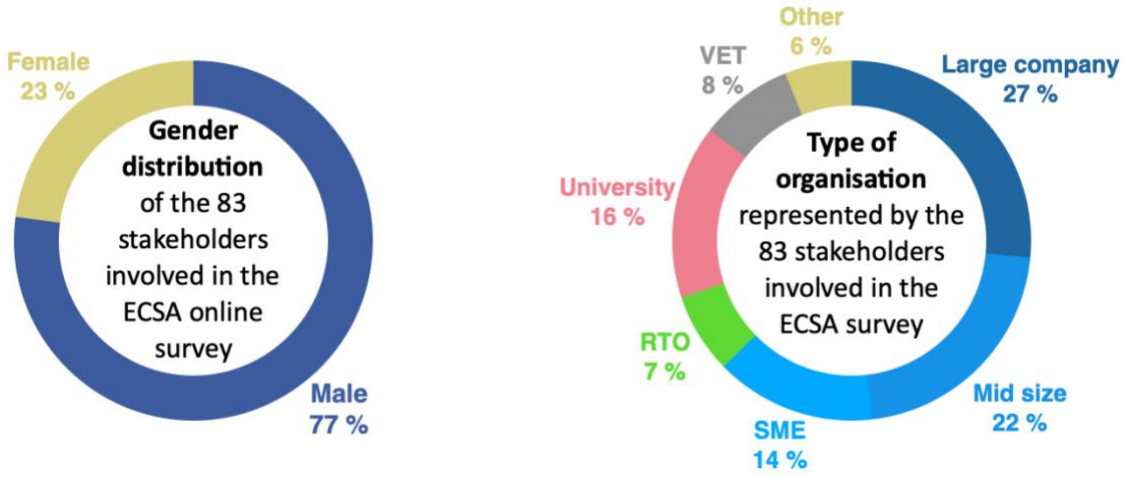
Source: DECISION Etudes & Conseil

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This year's survey gathered responses from 51 different organisations. SMEs, mid-sized companies and large companies were relatively evenly represented and together accounted for around two-thirds of all participating organisations. The remaining third consisted of universities, RTOs, VET providers and other types of organisations, with universities representing the largest share within this group.

An in-depth analysis of the stakeholders is given in the pie charts below.

Figure: Distribution of the gender and type of organization involved in the 2026 ECSA Survey

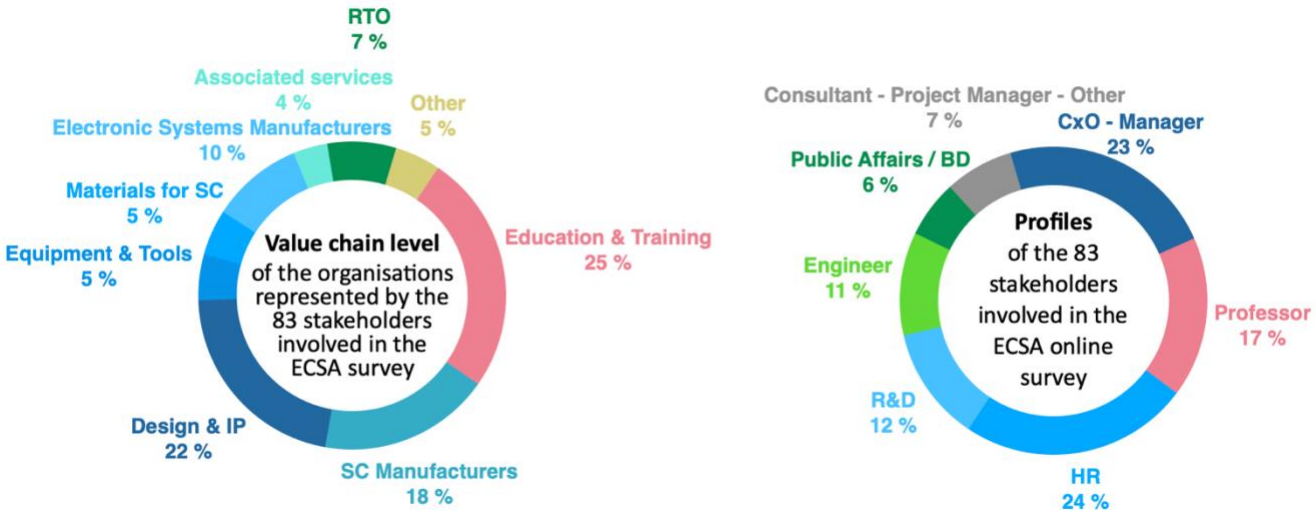


Source: 2026 ECSA Survey, DECISION Études & Conseil

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The 2026 ECSA survey includes stakeholders from the entire semiconductor value chain: 49% semiconductor companies (IDMs, fabless & IP, equipment and tools, or materials), 25% respondents related to Education & Training, 10% respondents from end-user electronics systems or services, 7% semiconductor Research & Technology Organizations (RTO), and 9% from other organizations.

Figure: Distribution of the organization's position in the value chain and profiles of the stakeholders participating in the 2026 ECSA Survey



Source: 2025 ECSA Survey, DECISION Études & Conseil

Finally, in terms of profiles of respondents: 24% Human Resources, 23% are CxO, 17% professors, 12% researchers, 11% engineers, 6% public affairs / Business Development, and 7% others (consultants, project managers…).

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ANNEX 2 – HOW ARE ARTIFICIAL INTELLIGENCE, AUTOMATION AND DATA ANALYSIS IMPACTING SKILLS IN THE SEMICONDUCTOR INDUSTRY?

The 2026 survey confirms the central place of AI. It is the theme most often associated with new skills (58% of respondents) and new profiles (41%), the most critical skill (58%, ahead of systems architecture), and the technology with the greatest impact on skills needs (82%). However, AI is reported to have a dual impact on the EU talent gap in the semiconductor industry: it creates demand for new profiles and skills, while productivity gains reduce the number of professionals needed in some existing roles.

AI increases the talent gap by:

- **Rising demand for chips.** The expansion of data centres across the cloud-to-edge continuum, driven by AI applications, increases global demand for chips. Although this effect remains limited in Europe, where most players are not strongly positioned in AI-related products or downstream user industries, growth in AI-related markets is the most frequently cited reason for planned increases in hiring by respondents in 2026.
- **Emergence of new AI-related job profiles.** The growing use of AI and data analytics is creating new professional categories that are increasingly sought after by the semiconductor industry, including:
  - Data specialists (analyst, engineer, scientist, machine learning engineer) – managing, analyzing, and interpreting large datasets generated throughout design, manufacturing, and testing processes. They are increasingly hard to recruit: 37% of respondents report them as difficult to fill in 2026, against 26% in 2025 and 19% in 2024, as all sectors compete for them and the industry needs data skills combined with process and device knowledge.
  - Machine learning engineers – Software engineers designing, training, and optimizing machine learning models, with a solid understanding of hardware constraints such as memory, latency, and energy efficiency. They ensure that AI algorithms can be efficiently deployed on target devices (CPU, GPU, NPU, or ASIC) and collaborate with hardware engineers to co-optimize models and architectures. Also referred to as *AI algorithm engineers, generative and agentic AI engineers*, *MLOps engineers, or semiconductor AI model engineers*. Several European profiles specialize in edge AI / TinyML.
  - AI verifiers – ***first reported in 2026***: a profile created because AI generates outputs faster than humans can check them, whose role is to judge whether an output is contextually accurate and fit for use rather than to redo the task. They are particularly in demand to support design engineers, test engineers, and process engineers in semiconductor fabs.

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- AI hardware engineers – Specialists developing and implementing hardware solutions optimized for AI workloads. They design architectures and circuits enabling efficient acceleration of machine learning models, focusing on compute performance, data movement, and power efficiency. Also known as *AI hardware specialists*, or *hardware-aware AI/ML engineers*.
- AI applications engineers – Professionals integrating AI-based functionalities into semiconductor products to better address the requirements of specific end-user industries while balancing market and technical constraints.
- Automatic design generation engineers – Engineers transforming traditional chip-design workflows by leveraging AI tools to accelerate and enhance design efficiency (e.g. training neural networks for electrical implementation or sizing). Also known as *AI-assisted design engineers*, *AI-assisted EDA specialists* or *agentic CAD engineers*.
- AI system designers / architects – Senior professionals managing multidisciplinary teams responsible for the design, manufacturing, and material sourcing of complex chip systems (SoC, chiplet, ASIC) embedding AI capabilities.
- AI process engineers / AI manufacturing specialists – ***first reported in 2026***: process engineers trained in machine learning to optimize yield, maintenance and production efficiency. Also reported as *AI-integrated yield engineers*.
- AI transformation consultants – first reported in 2026: professionals supporting the adoption of AI across semiconductor organisations, identifying where AI can improve engineering, manufacturing and business processes, and facilitating organizational change.
- New profiles are also emerging to address the legal and governance aspects of AI (legal experts in the ethics of emerging technologies, AI governance and responsible AI leads), and the sustainability of AI chips.

By enhancing productivity, AI reduces overall workforce needs but intensifies upskilling requirements.

Conversely, AI tools enhance productivity across many existing profiles, reducing the total number of professionals required while increasing the need for upskilling. The 2026 survey measures this effect for the first time. 84% of respondents report that AI tools have changed their day-to-day work in the past year, mainly in writing and summarizing, research and analysis, and code generation and debugging. Domain expertise remains

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necessary to judge and validate the output. 22% have considered using AI instead of recruiting for a specific role, mainly in design, software development and support functions such as marketing and finance.

The profiles currently most affected by this transformation include:

- **Software engineers**, who increasingly rely on AI-assisted coding and debugging tools.
- **Chip designers**, using AI-enhanced EDA (Electronic Design Automation) software to accelerate and optimize design flows.
- **Test and verification engineers**, leveraging AI-driven solutions for automated test generation, fault detection, and reliability analysis.

However, manufacturing-related roles are also increasingly being reshaped by the introduction of AI-powered automation and predictive analytics:

- **Process and automation engineers and technicians**, now responsible for managing intelligent production systems. In 2026, these profiles are increasingly transformed by AI. Job offers often refers directly to “AI process engineers”.
- **Quality and reliability engineers**, using AI to monitor process variations and improve yield prediction.
- **Operators**, the job category most at risk as across both Front-end and Back-end processes, the industry is progressively reducing operator roles through automation. Consequently, operators increasingly need to upskill toward technician-level positions, supervising and maintaining automated manufacturing tools.

The table below summarizes the direction and intensity of AI’s impact across key job profiles in the semiconductor industry.

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Job profile impacted		Nature of the impact
Data specialist	Data specialist	Data specialists emerged within the course of 2010s as a set of job profiles including data scientists, data analysts, data engineers and machine learning engineers. They are today involved in most aspects of engineering and manufacturing tasks and work with the vast majority of engineers and a rising number of technicians. In 2026, data specialists have become harder to recruit every year (reported as difficult to fill by 19% of respondents in 2024, 26% in 2025 and 37% in 2026), as all sectors compete for them and the industry needs data skills combined with process and device knowledge.
	Data analyst	Focuses on analyzing data, creating visualizations, and generating insights that inform business decisions. They work extensively with statistical tools, visualization software, and often perform exploratory data analysis. Typically holds a bachelor's degree.
	Data engineer	Builds and maintains data pipelines, data architectures, and ETL (Extract, Transform, Load) processes. They ensure data is structured and accessible for analysis and machine learning tasks, optimizing data flows and system performance. Typically holds a bachelor's degree.
	Data scientist	Responsible for developing statistical models and performing complex data analysis to make data-driven predictions. They work on identifying patterns, building predictive models, and often play a crucial role in strategic decision-making. Typically holds a master's degree, sometimes a PhD.
	Machine learning engineer	Emerged in the early 2020s as a job profile required in the semiconductor industry. Skilled in algorithms, data modeling, and software engineering with a focus on building, deploying, and optimizing machine learning models. Typically holds a master's degree, sometimes only a bachelor. Data scientists can be machine learning engineers. In 2026, the category also includes hardware-aware AI/ML engineers, generative and agentic AI engineers and MLOps engineers, and several European profiles specialise in edge AI / TinyML; respondents stress the need for domain knowledge of semiconductor processes and devices rather than generic AI skills.
Software engineer		Software engineers continue to gain importance in the semiconductor industry. Of course, it is one of the profiles the most impacted by AI. In addition to machine learning skills, the industry increasingly requires embedded software / firmware programming skills and coding skills in languages such as: Python, Git, Bash… A rising number of companies are involved in RISC-V development, requiring more compiler specialists. In 2026, respondents report software engineers moving towards embedded and edge AI, with AI-assisted coding and debugging now part of daily work, and growing security requirements at firmware level.
Application engineer		Existing applications (automotive, industrial, health…) are being disrupted by AI capabilities. Semiconductor application engineers are at the forefront of this revolution and need to build a deep understanding of AI capabilities for end-user industries, as well as the technical constraints linked to AI in semiconductor design, processes, and materials used. **New profile: AI applications engineer**: AI is impacting the profile of application engineer to the extent that a new profile of AI application engineer is emerging as a sub-profile of application engineer. AI application engineer works with software engineers, designers and data scientists, advising on when AI solutions are suitable, which AI algorithm to chose, on which suitable HW platform, to support a specific end-user application (automotive ADAS…).
Designer	**Designer**	AI is revolutionizing the way chips are designed: generative AI is used to support design, generating automatically building blocks and/or IP blocks. AI tools can interface with typical IC design tools (e.g. Cadence Virtuoso software). AI engineers or designers write parametrizable generator scripts that automatically generate entire layouts and schematics, perform the layout-versus-schematic (LVS), post-layout extraction (PEX) and automatically optimize the design. This implies that AI technics increase the re-usability of past design. **New profile: AI hardware designer**. Designers have to design specialized AI chips, leading to a new profile: AI hardware designer or engineer / Edge AI designer. These engineers focus on designing and optimizing hardware architectures specifically for artificial intelligence and machine learning applications (neural network accelerators…). They have the knowledge of AI and ML algorithms but are specialized in implementing them on hardware platforms. In 2026, AI-assisted design engineers are the most frequently cited new AI profile.
	Analog designer	**New profile: Automatic Analog Design Generation engineer**. This profile merges in-house Analog IC Design experience with advanced software skills and Artificial Intelligence to build state of the art analog circuits automatically.
	Systems designer	**New profile: AI system designer / architect**. Corresponds to a senior profile capable of managing a team of ML engineers and designing the whole architecture of a complex AI microelectronics system.
Test & verification engineer		Since the early 2010s, test engineers have needed increasingly more software engineering skills while maintaining strong foundational skills in electrical engineering. As more functionality is integrated into a single device, these devices become increasingly complex and, consequently, more challenging to test efficiently. Test programs for semiconductors can now consist of hundreds or thousands of individual tests implemented in tens of thousands of lines of software code. To better manage and optimize these complex test programs, test engineers are also developing AI skills enabling them to leverage AI for more efficient and accurate testing processes.
Process / robotics / maintenance Engineers & technicians		AI tools are increasingly integrated with big data technologies to enhance computer vision, advanced real-time statistical process control and optimization, as well as predictive maintenance. **New profile in 2026: AI process engineer.** In 2026, respondents this new profile, also named AI manufacturing specialist and AI-integrated yield engineer, as well as data-driven process engineers.
Quality & reliability engineers		This category encompasses profiles such as reliability engineer / functional safety engineers, failure analysis engineers, and quality experts. AI-powered inspection systems can detect defects in wafers or components at a level of precision far beyond traditional methods. This helps quickly identify and address defects that could affect yield.
Process technicians & operators		Modern fabs are reaching such a degree of automation that even fab operators work increasingly with automated tools and need the associated skills. One research institute notes that operators of fully automated lines require a lower qualification level than before, since no manual interaction with the tools is needed.
Material engineers		Material engineers are impacted by edge AI as they need to develop new class of materials for more efficient AI at the edge.
Quantum experts		Combining quantum with AI technologies opens new doors for innovation.
Transversal (all profiles)		First reported in 2026: the ability to prompt AI tools and verify their output, with AI verifiers emerging as a dedicated profile, and AI governance and responsible AI roles. Respondents caution that AI skills are being requested across roles before tools and methods are fully established.

Source: DECISION Études & Conseil

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ANNEX 3 – DESCRIPTION OF EMERGING JOB PROFILES AND SKILLS

This annex described the job profiles and skills which emerged in 2026, as reported by less than 5% of respondents. It complements chapter A)1) of the qualitative analysis.

Digital transformation expert

In 2026, 4% of respondents report new roles emerging to drive the digitalization of semiconductor production and R&D processes, supporting automation, connectivity, and data integration, against 5% in 2025.

Emerging profiles include:

- Digital Twin Engineers – Developing virtual replicas of production lines and equipment.
- IoT Integration Specialists – Deploying connected systems for monitoring and predictive control in fabs.
- Digital Transformation Leads and Business Process Analysts - ***First reported in 2026***: Connecting manufacturing operations, automation, data science and business strategy.

Digital transformation profiles bridge traditional process engineering and the data-driven paradigm of Industry 4.0. Their presence illustrates that even front-end fabs -long considered among the most automated in the world- continue to find new margins for optimization in Europe through enhanced digitalization and intelligent data integration.

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Photonics

In 2026, 1% of respondents globally report an emerging need for new photonics-related job profiles (7% in 2025), and 4% report an emerging need for photonics-related skills in their working environments (10% in 2025)[9].

Emerging profiles include:

- Photonic Integrated Circuit (PIC) Engineers – Designing, simulating, and testing integrated photonic circuits and components across a variety of applications, from optical interconnects to sensing and quantum systems.
- Process and Integration Engineers – Managing fabrication flows combining photonic and electronic components.
- Test and Characterization Engineers – Performing optical testing, reliability analysis, and yield optimization for photonic devices.

Emerging skills include:

- Understanding of optoelectronic principles and integrated photonics design.
- Expertise in chiplet-enabled photonic integration and hybrid optical–electrical packaging.
- Knowledge of simulation tools, optical alignment, and post-Moore device concepts.

Supply Chain Management

Supply chain management has become a strategic concern across the semiconductor industry since the COVID-19 crisis and the subsequent chip shortage and is reported in 2026 by 1% of respondents for profiles and 5% for skills. Companies continue to strengthen their logistics and procurement capabilities to secure supply, manage export-control compliance, and improve resilience. Sustainability and circularity are now also integral parts of supply-chain operations, with growing attention to materials traceability, packaging waste reduction, and carbon footprint monitoring.

[9] We consider the decrease in the percentage of respondents identifying quantum-related job profiles and skills as emerging in 2026 compared to 2025 to be due to inconsistencies in survey sampling between the two years, rather than reflecting a meaningful trend.

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Marketing and Sales

A small but consistent number of respondents (1% for profiles, 3% for skills) report the growing need for business development and marketing engineers able to navigate the increasingly complex market for advanced components.

These profiles bridge technical and commercial domains: they translate product specifications into market value, support strategic partnerships, and anticipate regulatory and industrial shifts such as those induced by the EU Chips Act. The traditional boundaries between marketing, application engineering, and business strategy continue to blur as commercial roles become more technically proficient.

Open-Source Design and Test

Reported for the first time in 2026 by 2% of respondents for profiles and 1% for skills (shown as "Other" in Figure 7).

Emerging profiles include:

- Open-Source Chip Designers.
- Open-Source Verification Engineers – Building Continuous Integration / Continuous Delivery (CI/CD) pipelines for hardware testing and ensuring reliability across tools and environments, driven by the growth of open-source hardware.

Emerging skills centre on open-source EDA tooling. Although marginal in volume, the appearance of this category is consistent with European interest in reducing dependence on proprietary design toolchains, and respondents credit EU funding with making open-source EDA tools more available.

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ANNEX 4 – DETAILED DESCRIPTION OF CRITICAL SKILLS

1) Artificial Intelligence / Machine learning

Knowledge and skills associated with machine learning are increasingly required for the majority of the profiles of the microelectronics industry today and will become more and more important, especially in line with the development of I4.0. These are especially important for software engineers that must be trained to a diversity of AI tools so that they have a wide view of the topic. The main coding languages that are suitable for AI-related applications and technologies: Python, Java, C++, and Julia. These languages particularly involve libraries like Scikit-learn, Keras, TensorFlow, Torch, etc.

Educational level (EQF): Trainings to be provided from EQF 6 to EQF 7.

Associated job profiles:

- Main profiles concerned: Software engineers and Data scientists/ Machine learning engineers/ etc.
- But overall, every job profile listed earlier is impacted by this skill.

Content / sub-skills and sub-knowledge:

- Ability to identify/ select/ implement the machine learning toolsets for manufacturing (design, automation, etc.), and/or ERP.
- Mathematical knowledge in probability theories and statistics, which is the foundation for machine and deep learning, and AI models in general.
- General introduction course on AI (at EQF 4-5): Fundamental knowledge and understanding of AI tools.
- Understanding how to replace basic skills in production by machine learning algorithms to increase competitiveness and to facilitate innovation.
- Understanding of the impact of AI applications: anything related to AI Ethics.

Beyond AI and machine learning, software skills are becoming more and more important for most microelectronics job positions: Robotic engineers, materials engineers, process engineers, power electronics engineers, RF engineers, etc. For instance, for RF and hardware engineers, software programming has become a very basic requirement in job descriptions currently. Up until the early 2000s, microelectronics technological developments were very hardware intensive, which shifted towards software in the early 2020s. In certain technologies (e.g., AI), software may be even more important than hardware in the semiconductor sector.

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However, many people may still not value skills in software as much as hardware, considering software as easier to learn whereas it covers a very wide range of skills and knowledge.

2) Systems architectures

System architecture traditionally regroups the skills and knowledge associated with microelectronics systems: System-on-Chip (SoC), System-in-Package (SiP) and System-on-Package (SoP).

- A System-on-Chip (SoC) consists of a series of blocks (processor, memory and caches, wireless system interfaces, network interfaces, sensor and actuators) integrated on the same die. SoC designs also include application software and runtime systems.
- System-in-Package (SiP) has evolved as an alternative approach to SoC for electronics integration because this technology provides advantages over SoC in many market segments. Sip provides more integration flexibility, faster time to market, lower R&D cost, lower NRE cost, and lower product cost than SoC for many applications. SiP is not a replacement for high level, single chip, silicon integration but should be viewed as complementary to SoC. For some very high-volume applications SoC will be the preferred approach.
- System-on-Package (SoP)[10] goes one step beyond the other approaches in overcoming both the fundamental and integration shortcomings of SoC and SIP, which are limited by CMOS processing and the shortcomings of current packaging. While silicon technology is great for transistor density improvements from year to year, according to Moore's Law, it is not an optimal platform for system integration of RF, optical, and certain digital components, as stated above. The SoP is akin to Moore's Law for integrated circuits, integrating transistors: it integrates thin film components at microscale in the short term and nanoscale in the long run for mixed-signal electronic and bioelectronics systems.

Educational level (EQF): Trainings to be provided in EQF 7-8 and requires 1-5 year(s) of work experience.

[10] "Packaging: Past, Present and Future", Rao R. Tummala, *Endowed Chair, Professor & Director of NSF-ERC, Packaging Research Centre, Georgia, Institute of Technology, Atlanta, USA. ©2005 IEEE. 2005 6th International Conference on Electronic Packaging Technology.*

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Associated job profiles:

- System design engineer.
- Design engineer.
- SoC architects.
- 3D systems architects.

System designers now face new challenges due to the increasing complexity of semiconductor technologies. As traditional scaling slows, advancements like 3D integration, heterogeneous integration and chiplet-based architectures have emerged as solutions to continue enhancing performance, efficiency, and functionality. This has driven the creation of new specialized sub profiles within system design:

- Design-to-Technological Co-Optimization architect (DTCO): DTCO architects play a critical role in ensuring that chip designs are optimized for manufacturing technologies. They leverage new tools, such as advanced Electronic Design Automation (EDA) software and machine learning algorithms, to collect data from microelectronics fabrication steps and optimize design choices. By balancing performance, power consumption, and manufacturing constraints, DTCO architects help bridge the gap between design and process technology. These profiles emerged along with the trend of Design for Manufacturability (DFM).
- System-to-Technological Co-Optimization architect (STCO): The emergence of STCO architects reflects the industry's need for holistic optimization at the system level. STCO architects translate high-level system specifications into technological requirements. This role involves close collaboration with R&D teams and uses modelling tools and iterative design methods to ensure that system-level performance is achieved within the technological constraints of current or emerging fabrication processes.
- 3D Integrated System Architect: This role focuses on the high-level system partitioning and architectural design of 3D systems. The 3D Integrated System Architect determines how to best divide a system's functions across multiple chips and layers, considering different technology choices for interconnects, packaging, and integrated circuit (IC) technologies. This architect compares different system configurations, evaluating trade-offs between performance, cost, power, and thermal management. Their work involves the conceptual design of the 3D architecture and sub-block specifications, requiring expertise in simulation tools to analyse power, thermal, and signal integrity. Their primary responsibility is to ensure that the overall architecture of a 3D system delivers optimal performance by selecting the best possible technological solutions and design strategies.

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- 3D Physical Implementation Designer: While the 3D Integrated System Architect focuses on high-level system architecture, the 3D Physical Implementation Designer works at a lower level of abstraction, translating these architectural decisions into physical layouts. This role involves the detailed physical design of partitioned systems, specifically ensuring that the chosen chiplet system is successfully implemented in terms of inter-chip communication, thermal dissipation, power distribution, and signal integrity. The 3D Physical Implementation Designer uses specialized EDA tools to address the multi-physical challenges that arise from stacking chips, such as managing heat flow and ensuring robust interconnects between dies. Their focus is on practical implementation, ensuring that all physical and technological constraints are respected, and the system is manufacturable without compromising the performance targets set by the 3D Integrated System Architect.

The rise of new specialized roles reflects a global trend in the semiconductor industry, where traditional boundaries between design, system architecture, and technology development are increasingly blurred. System designers must now be proficient not only in circuit and system design but also in emerging technologies, advanced design tools, and multi-disciplinary integration strategies to meet the demands of rapidly evolving applications.

Content / sub-skills and sub-knowledge:

- Knowledge of systems architectures: system-on-chip and system-in-package. Interdisciplinary understanding of how the various system levels are interlinked and affect the overall performance.
- Understanding of the whole design and product life cycle.
- Ability to design ICs, ASICs, systems-on-chips, system-in-package and system-on-package, etc.
- Ability to optimize architectures.
- Ability to link and adapt design architectures to the end-using applications of systems (automotive, I4.0, etc.).

3) Security

The cybersecurity knowledge and skills, increasingly required, span several areas:

- Cybersecurity-by-Design (especially for designers, test engineers, and software engineers): Security-by-Design focuses on embedding security features directly into hardware and software during the design phase, rather than retrofitting security measures later in the product lifecycle.

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- Secure Connectivity: Expertise in designing and maintaining secure network infrastructures is essential, including proficiency in encryption, secure communication protocols, and vulnerability management in connected environments.
- Regulatory Compliance: Professionals must navigate evolving EU cybersecurity regulations that increasingly address hardware security. The EU Cybersecurity Act (effective June 27, 2019) establishes a certification framework for ICT products, including semiconductor hardware, requiring security to be integrated during design. The NIS2 Directive (effective by October 2024) expands cybersecurity requirements to include critical sectors like automotive and healthcare, where semiconductors play a key role. Additionally, the upcoming Cyber Resilience Act (expected to enter into force in 2025) focuses on ensuring high cybersecurity standards for products with digital elements, including hardware, throughout their lifecycle. Compliance with these frameworks is essential for ensuring the security and resilience of semiconductor systems used in critical applications.

Educational level (EQF): Trainings to be provided from EQF 6 to 7.

Associated job profiles:

- Experts in cybersecurity and IT technicians.
- Software engineers.
- Digital design engineers.
- System architects.
- Hardware/ software integration engineers
- Test engineer.

Content / sub-skills and sub-knowledge:

- Combined knowledge between hard and software necessary.
- Security by design (Especially important for IoT and I4.0.): Know-how and applicability of secure protocols necessary.
- Skills used for cyber-physical (production) systems like diagram a network for security.
- Cybersecurity:
- Advanced intrusion detection and prevention.

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- Advanced skills in forensics.
- Reverse engineering for the prevention of industrial spying (especially for test engineers).
- Ability to investigate the possible failures originated from improper use of malicious codes (highly for robotic engineers). Identify risks, issues, potential defects, or defects in any phase of the software life cycle, managing them through closure
- Data integrity: Ability to ensure integrity of data, particularly when using large volumes of data, and align with regulations.
- Data Security & Privacy by design: Ability to ensure security of data & data privacy. Including IP protection.
- Safety issues.

4) Data analysis

Data analysis skills and knowledge are increasingly required for nearly all profiles of the microelectronics industry today. Several companies report a lack of software engineers with good skills in data analysis.

Educational level (EQF): Trainings to be provided from EQF 4 to EQF 7. Every graduate at EQF 6-7 should have received initial training in this field.

Associated job profile:

- Nearly all profiles.
- Data driven profiles in general, which can provide support to direct semiconductor-related job profiles:
- Data analyst: provides statistical analysis and insights to different teams within the company, who can be mainly related to business aspects.
- Data scientists: leverage statistical/ data modelling to solve various manufacturing challenges. Often works in collaboration with expert profiles which provide the insights. Data scientists also have knowledge in machine learning.
- Data engineers: manages the data architecture within the semiconductor company, building the pipelines to make available any type of data for the different teams.

Content / sub-skills and sub-knowledge:

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- Data management: SQL, Cloud-based knowledge, etc.
- Data visualization: Tableau, Power BI, Dash, etc.
- Data integrity: Ability to ensure integrity of data, particularly when using large volume of data. Knowledge of the techniques to assess the quality of data.
- Data Security & Privacy by design: Ability to ensure security of data & data privacy. Including IP protection.
- Data analysis: Ability to interpret and make sense of large volume of data.
- Machine learning / Artificial intelligence.
- Algorithm optimization. This skill is increasingly sought-after by industrials.
- Performance Data Analysis: Analysing performance data.

5) Knowledge of applications

Content / sub-skills and sub-knowledge:

- Ability to link and adapt technical aspects of a product (materials to use, design architecture, type of connectivity tools to integrate, etc.), to its end-user market(s) and application(s) (I4.0, automotive, etc.).
- Knowledge of applications and associated technical requirements, to build solution-oriented products.

Illustrations:

A good knowledge of ADAS tools, other automotive developments or Industry 4.0 applications can be required for system engineer experts but also for software engineers.

A good knowledge of automotive applications and associated technical requirements is required for the development of magnetic sensors development for the automotive industry: Safety, standards, Requirement Management and Change & Configuration Management.

A material engineer needs to be able to link specific requirements on new materials with applications (e.g., high quality of images).

Educational level (EQF): Trainings to be provided from EQF 6 to EQF 7.

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Associated job profiles:

- Application engineer.
- Materials engineer.
- System design engineer.
- Design engineer.
- Software engineer.
- Every profile in general

6) Hardware / Software integration

HW/SW integration is a skill depicted as very difficult to find and long to acquire (many years) by many stakeholders. Hardware and software co-design will become more and more important especially in line with the development of IoT and I4.0.

Educational level (EQF): Trainings to be provided from EQF 6 to EQF 7.

Associated job profiles:

- System design engineer.
- Design engineer.
- Software engineers.

7) Analog design

Analog design is one of the skills, and related profile, for which the involved stakeholders are noticing the greatest shortage since its introduction. A progressive but very significant shortage has emerged in the industry during the past 20 years for this profile, due to the aging workforce and the lack of new graduates trained in analog design, as explained earlier. Even though there is the trend of digitalizing as fast as possible, there remains the complementary analog side, where there are too few experts available within every company.

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The shortage is particularly high for the job profile as it takes a particularly long time to develop analog design skills and more than ten years to become good analog designer. This cannot only be done by education, but there are also many practical skills needed through experience.

Educational level (EQF): Trainings to be provided from EQF 6 to EQF 7.

Associated job profiles:

- Analog design engineers.
- Design engineers.

Content / sub-skills and sub-knowledge:

- Signal Processing: Proficient with analog and digital electronic design, noise, signal integrity, etc.

8) Quality / reliability

Knowledge associated with quality / reliability (manufacturing quality control) is more and more needed by the microelectronics industry, especially to transfer prototypes into mass production. For instance, reliability and functional safety are two of the four main domains where increased skills are required for microelectronics engineers in line with the development of automotive electronics, with security and cost management (according to the focus group on automotive organized by METIS).

- Reliability: There is a strong focus on improving the reliability of components, systems, and designs, even equaling the drive for innovation itself. This makes system design increasingly challenging and requires advanced testing systems to assess the reliability of components. As a result, the roles of test technicians and engineers, along with their associated skills, are becoming more critical for microelectronics companies, particularly those serving the automotive, aeronautics, and defence sectors, where reliability is an important aspect.
- Functional Safety (Quality): Vehicle safety is an aspect linked to the improvement of reliability and led to the introduction of Functional Safety and the ISO 26262.

Educational level (EQF): Associated skills and knowledge must be acquired for graduates at EQF level 6 (and above depending on the profile).

Associated jobs:

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- QA/ Reliability engineers
- System and design engineers
- Test technicians and engineers

The main skills and knowledge associated are:

- Basic knowledge on quality engineering.
- Quality assessments (skill): Knowledge of the methodology of quality (Quality 3.0 and 4.0), and ability to use Quality tools (including quality tools associated to I4.0).
- Reliability analyses: Multidisciplinary knowledge in failure analyses, physics of failure.
- Robustness of microelectronics: Electromagnetic compatibility (EMC), electromagnetic interference (EMI), electrostatic discharge (ESD), aging, radiation hardness...
- Deep understanding of measurements and a physical sense of statistics.
- Analytical knowledge in reliability.
- Functional safety.

9) Knowledge of new materials

New materials are becoming increasingly important in microelectronics: polymers, shape-memory materials, composites, materials for additive manufacturing, garbitol, etc. Microelectronics engineers must have knowledge not just on traditional material engineering, but additionally on chemical and physical sciences (e.g., nanostructures).

Educational level (EQF): Trainings to be provided from EQF 7 to EQF 8.

These knowledge and skills are required for process engineers and especially material engineers and involve:

- A greater understanding of new semiconductor materials beyond silicon, such as gallium nitride (GaN) and silicon carbide (SiC), which are crucial for high-power and high-frequency devices.
- Physical-Chemical properties of new materials.
- Material compliance with EU regulations (for material engineers).

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The main skills and knowledge associated are:

- Knowledge of new materials: polymers, shape-memory materials, composites, materials for additive manufacturing, garbitol, gallium nitride. etc. Understanding of material properties, and the need to modify the integration flow.
- Knowledge in chemical and physical sciences (e.g., nanostructures). Basic knowledge in chemistry (missing in many curricula).
- Environmental awareness associated to traditional and new materials.
- Ability to link a material with production processes, product(s) specification(s) and end-user applications.

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