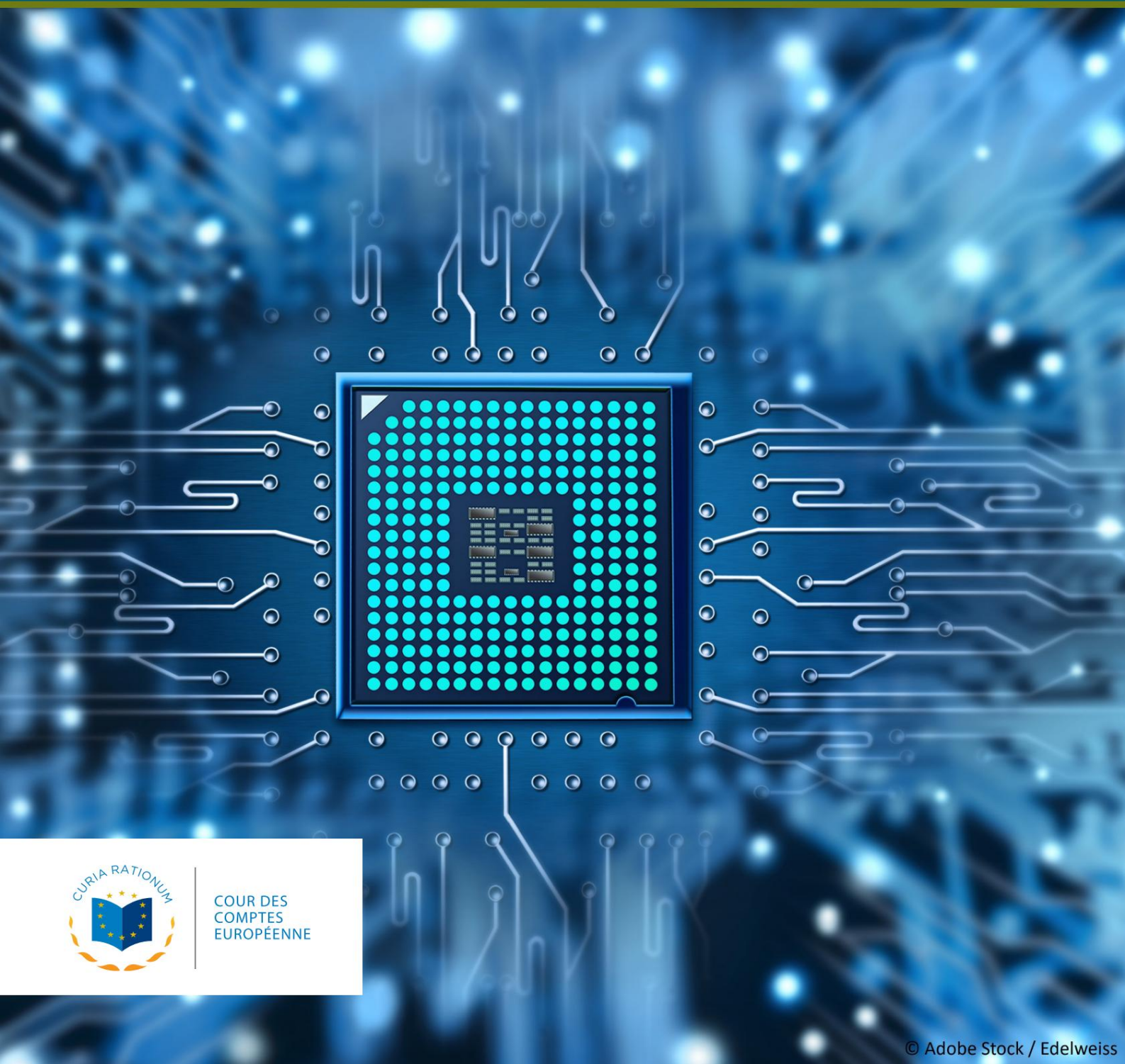
SPECIAL REPORT 12/2025 **FR**

The EU's microprocessor strategy

Implementation is progressing reasonably well, but the Chips Act will probably not be enough to achieve the overly ambitious goal set for the digital decade.



CURIA RATIONUM
COUR DES COMPTES EUROPÉENNE

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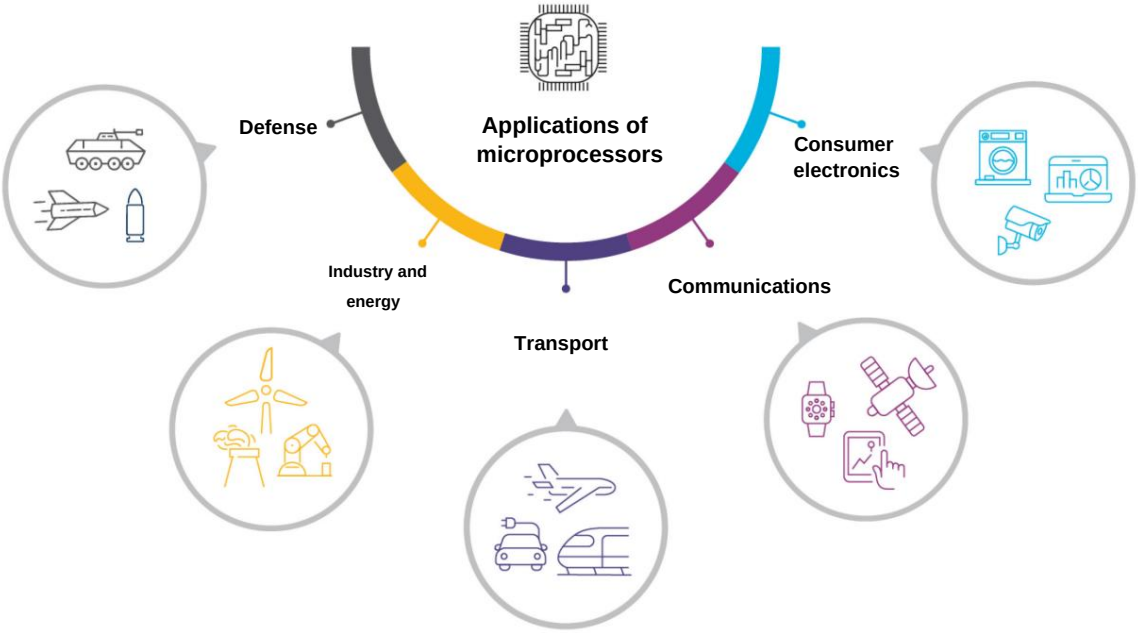
Main messages

Why is this topic important?

01 A microprocessor, commonly referred to as a "chip", is a small electronic device Manufactured using semiconductor materials (usually silicon) containing printed or etched electronic circuits and components. Microprocessors are essential for everyday electronic equipment, such as smartphones and cars, but also for satellites and precision military equipment ***(Figure*** 1). Their technology is also essential for ensuring the ecological transition.

Overall, due to their critical role, microprocessors have today become an essential component of any industrial policy.

Figure 1 | Microprocessors in everyday life



Source: European Court of Auditors.

02 Over the years, the EU has seen its production of microprocessors increase, but its share in the Global manufacturing capacity has shrunk sharply. In 2020, this share was around 9 %1. In 2021, with EU production sites operating at full capacity, the Union's trade deficit in microprocessors was almost €20 billion2.

03 Given the highly complex and globalized nature of the microprocessor value chain ***(Figure*** 2), complete autonomy in chip production is impossible. However, the COVID-19 pandemic has revealed the EU's dependence on the global microprocessor market, as well as the risk this dependence poses for European industry. For example, in the wake of the pandemic, the microprocessor shortage experienced by German car manufacturers has resulted in car production returning to 1975 levels. This has led the EU to recognize the importance of security of supply (i.e. manufacturing either in its

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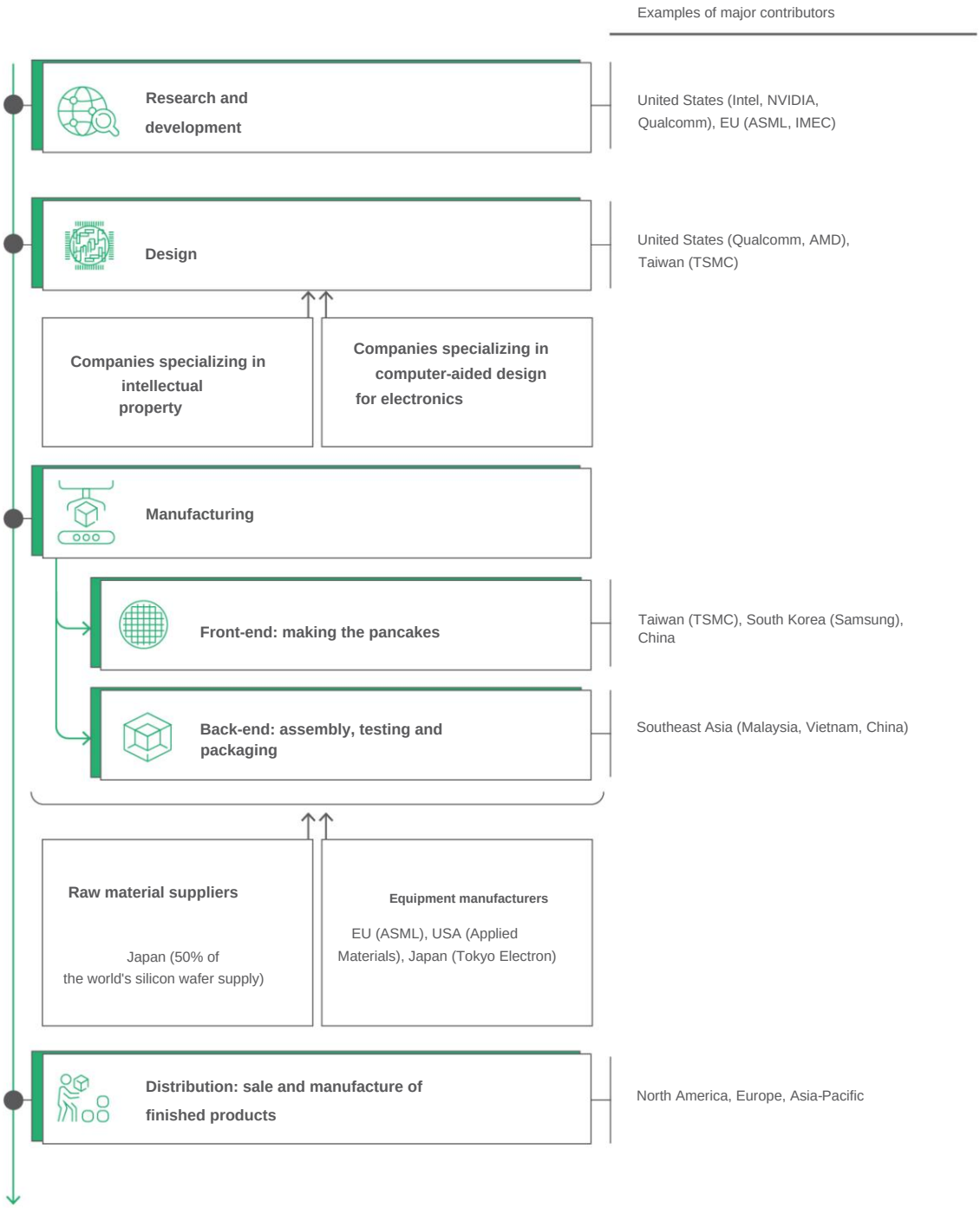
1 Semiconductor Industry Association, *Government Incentives and US Competitiveness in Semiconductor Manufacturing,* 2020, p. 7 *(Exhibit* 2).

2 Commission Staff Working Document, *A Chips Act for Europe* (SWD(2022) 147), p. 57.

within, either by reliable partners) in order to reduce dependence, but also the need to update its strategy regarding its role in the global microprocessor market.

Figure 2 | Illustration of the complexity of the microprocessor value chain



Source: European Court of Auditors, based on publicly available information.

04 Element of industrial policy of the EU, the European Action on Semiconductors3 (hereinafter the “Chips Act”) is a package of measures introduced in February 2022 in response supply chain disruptions due to the COVID-19 pandemic and also felt in Europe. The aim was to address microprocessor shortages and strengthen the EU's technological lead. The regulation semiconductors, meanwhile, came into force in September 2023.

05 A number of potential public and private funding sources have been identified for the microprocessor sector, with strategic public investments of at least €43 billion, complemented by an equivalent amount of private investment foreseen in the Chips Act. The total envelope can therefore be estimated at a minimum of €86 billion. Member States and industry stakeholders are expected to provide considerable resources to implement the Chips Act. The Commission has made the EU's target for the Digital Decade (i.e. to represent 20% in value of global production of sustainable microprocessors)

and cutting edge by 2030) the overall objective of the Chips Act.

06 As part of our audit, we aimed to examine the extent to which EU industrial policy supports the strengthening of the strategic autonomy of the European microprocessor industry. We assessed the design of the Chips Act against the results of the 2013 strategy. on the micro-nanoelectronics industry, the alignment of funding with EU strategic objectives, timeliness and progress in implementing the Chips Act against the overall objective to be achieved, as well as other factors and risks affecting its success. This audit report aims to contribute to the crucial debates on strategic autonomy and EU industrial policy. It complements our previous special reports on the circular economy, to the batteries and hydrogen. You will find in ***Annex I***

and in ***Annex II*** further background information and details on the scope and approach of the audit.

[3] COM(2022) 45 final, COM(2022) 46 final, COM(2022) 47 final and C/2022/782.

What are our findings and recommendations?

07 Overall, we conclude that the Commission's current strategy (the "Chips Act") gave new impetus to the policy pursued in this area.
The Commission has already made reasonable progress in its implementation, particularly with regard to Pillar I, but we have identified weaknesses in its development, implementation and monitoring. Given the current level of investment in production capacity, it is highly unlikely that this strategy will enable the EU to achieve the very ambitious target set in the Digital Decade by 2030, namely a 20% share in the value of global production. According to current forecasts, this share will only be 11.7% in 2030. The target may also be considered too ambitious for the Chips Act in view of the Commission's limited mandate and resources, dependence on Member State action, the level of private sector investment and other factors, such as the cost of energy.

The Chips Act has provided new impetus, even though it is not based on an impact analysis and lacks clear objectives.

08 The 2022 semiconductor package was preceded in 2013 by a strategy to strengthen the micro-nanoelectronics sector. Although from 2013 onwards the EU's capacity to produce microprocessors increased significantly, Europe failed to keep pace with global growth, and the Union's share of the global market ultimately declined. The Chips Act took over from the 2013 strategy and addressed the microprocessor shortage by proposing a new package of measures, namely: strengthening technological and innovation capacities and addressing gaps in the ecosystem (Pillar I), establishing the principles for assessing state aid support for investments in microprocessor facilities, and

pioneering production (pillar II), and establish monitoring and response mechanisms to anticipate crises (pillar III) (points ***17*** to 23).

09 The Chips Act was, however, born in an emergency, which means that the procedures generally applied when drafting legislation (e.g. evaluation of previous strategies or an impact analysis of the proposal) were not followed.
Failure to thoroughly analyze why the 2013 strategy failed to achieve its goals and to learn from this failure risks causing exactly the same setbacks for the Chips Act. In our view, the Chips Act lacks clarity about its objectives and its monitoring. Without a proper impact analysis, it is difficult to determine whether the Chips Act takes sufficient account of the industry's needs for common chips (points ***24*** to 34).

The Commission is responsible for only a small part of the funding announced in the CHIPS Act, but the publicly funded projects we examined were, as a rule, aligned with EU policy objectives.

10 Investment decisions in the microprocessor industry are primarily made by private sector companies. In the context of the 2013 strategy and, subsequently, the Chips Act, a number of potential public and private funding sources were identified for the microprocessor sector. The Chips Act announced at least €43 billion in public investment, which could attract and leverage private investment of an equivalent volume. However, the majority of these funds come from the industry's own resources or national budgets, with the Commission providing only a small part (around 10% of public funding) of the total amount. The Commission has no mandate to coordinate national investments at EU level to align them with the strategic objectives of the Chips Act. Overall, the Commission has only partial information on the total funding that the industry receives and uses, which reduces its ability to monitor developments and identify gaps and duplications (paragraphs ***36*** to 45).

11 Although we found that, overall, the projects co-financed directly by the Commission or through the Semiconductor Joint Undertaking – and its predecessors, namely the Electronic Components and Systems for European Leadership (ECSEL) Joint Undertaking and the Key Digital Technologies Joint Undertaking – were fully aligned with the objectives of the relevant strategies, the arrangements in place to measure their impact were incomplete. Similarly, the Commission's information on the contribution of State aid investments to the achievement of the strategy's objectives is also not exhaustive (paragraphs ***46*** to 66).

Implementation of the Chips Act is progressing, but too slowly to reach the 20% digital decade goal

12 We found that the timeline for implementing the three pillars of the CHIPS Act was unclear and that it is highly unlikely that their implementation will be sufficient to achieve the overall target. Pillar I is progressing well, but is experiencing some delays. The implementation of pioneering investments under Pillar II is slow and will likely not be sufficient to achieve the overall digital target of 20% by 2030. Finally, the crisis coordination and monitoring mechanisms that form Pillar III and were supposed to be available in the short term are still in their infancy (paragraphs ***67*** to 87).

The Chips Act will likely not be enough to achieve the required level of investment, especially since its success also depends on global competition and other crucial factors.

13 Achieving the objectives of the Chips Act does not depend solely on the EU, but is also conditioned by the level of private sector investment, the competitiveness of European companies compared to their foreign competitors, as well as other crucial factors. The funding associated with the Chips Act may well be insufficient to support and stimulate the investments that the industry needs to increase the EU's market share and thus achieve the target of 20% of global production. Indeed, the EU's own forecasts Commission data published in July 2024 indicate a slight increase in the EU market share, to only 11.7%. At the same time, we observe that the industry is characterised by a relatively small number of large companies embarking on high-value projects, meaning that funding is also concentrated. As a result, the abandonment, delay or failure of a single project can have a significant overall impact (paragraphs ***89*** to 95).

14 Finally, as the semiconductor industry is globalized, the EU faces fierce international competition, but also many other challenges. Other countries around the world have their own strategies for attracting investors, increasing their market share, and strengthening their security of supply. Other factors also come into play, which also depend on coordination between the EU and its Member States and which influence the Union's competitiveness and the objectives of the Chips Act. These include export controls, access to necessary raw materials, energy costs, and environmental requirements (paragraphs ***96*** to ***113).***

What are our recommendations?

Recommendation No. 1

Urgently confront the existing strategy with the reality on the ground and take the necessary short-term corrective measures

The Commission should, in close cooperation with Member States and industry:

- urgently confront the Chips Act with the reality on the ground in order to establish whether the stated ambitions and the objectives set remain realistic in light of the resources available to achieve them, global competition and other crucial factors, such as the cost of energy and dependence on raw materials;

- where appropriate, take appropriate and necessary short-term corrective measures to ensure that the objectives set can be achieved;

- establish systematic monitoring to identify as early as possible any obstacles to achieving the objectives of the current (and future) strategy in the field of microprocessors, and put in place mechanisms to enable rapid corrective action to be taken.

When? By the end of 2025.

Recommendation No. 2

Start building the next semiconductor strategy

The Commission should, in close collaboration with Member States and industry, start developing the next semiconductor strategy. This strategy should:

- draw on the results of the review referred to in recommendation no. 1 as well as successes and failures of previous strategies;
- set specific, dated and realistic objectives which take into account the situation of the microprocessor sector in the EU, short- and long-term needs of European industry, global competition and other factors crucial, such as energy costs and material supply firsts;
- provide appropriate measures and financing and, where appropriate, present proposals for adapting the legal framework;
- integrate, at EU level, a coordinated approach, including interactions with globally competing economies.

When? By the end of 2026.

02

Our observation in detail

The Chips Act has given new impetus, even if it is not based on an impact analysis and lacks clear objectives

15 In February 2022, in the wake of the global semiconductor shortage due to the COVID-19 pandemic, the Commission presented a strategic package for the European semiconductor ecosystem under the name "European Action on Semiconductors" (hereinafter the "Chips Act"). This package of measures was followed by the adoption of the 2023 Semiconductor Regulation. This new strategy follows that of 2013 dedicated to the EU micro-nanoelectronics industry ***(Annex*** II).

16 We examined whether the Commission had properly designed the measures of the Chips Act. More In particular, we checked whether it had taken into account the strengths and weaknesses identified during the implementation of the 2013 strategy and whether it had responded satisfactorily to the needs of the industry.

The Chips Act has given new impetus after the 2013 strategy missed its main target

The 2013 strategy failed to achieve its objective of halting the erosion of the EU's market share

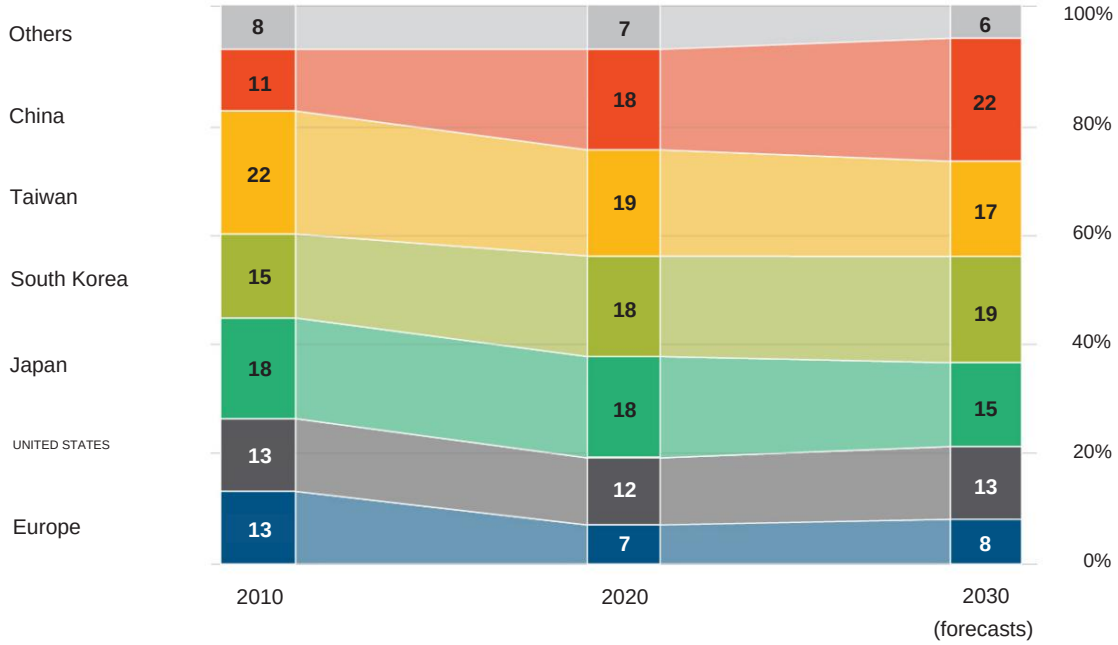
17 The 2013 strategy of the Commission intended to strengthen the industry micro-nanoelectronics aimed to halt the erosion of the EU's share of global supply and to achieve within ten years a level of production close to the Union's share of global gross domestic product. This would have required doubling the economic value of semiconductor component production in Europe over the period 2020-2025. This strategy also aimed to develop and strengthen leading European technology clusters by supporting the EU's industrial and technological presence throughout the value chain, but also to mobilize resources at regional, national and European levels to stimulate the renewal and growth of European production capacities while ensuring a wider adoption of electronics in all industrial sectors. Finally, it aimed to better integrate small and medium-sized enterprises (SMEs) into

value chains.

18 As planned, an Electronics Leaders Group (ELG) was created to develop a roadmap and contribute to its implementation, the aim being to make the 2013 strategy operational. This group has established an implementation plan with measures to be taken until 2020.

19 In 2013, the EU's share of global microprocessor production was around 10 %. During the decade 2012-2022, European semiconductor manufacturing capacity increased significantly (+63 %). This growth, however, did not prevent an erosion of the EU's relative share in global production ***(Figure*** 3).

Figure 3 | Share of different regions in global semiconductor production capacity (2010-2030)

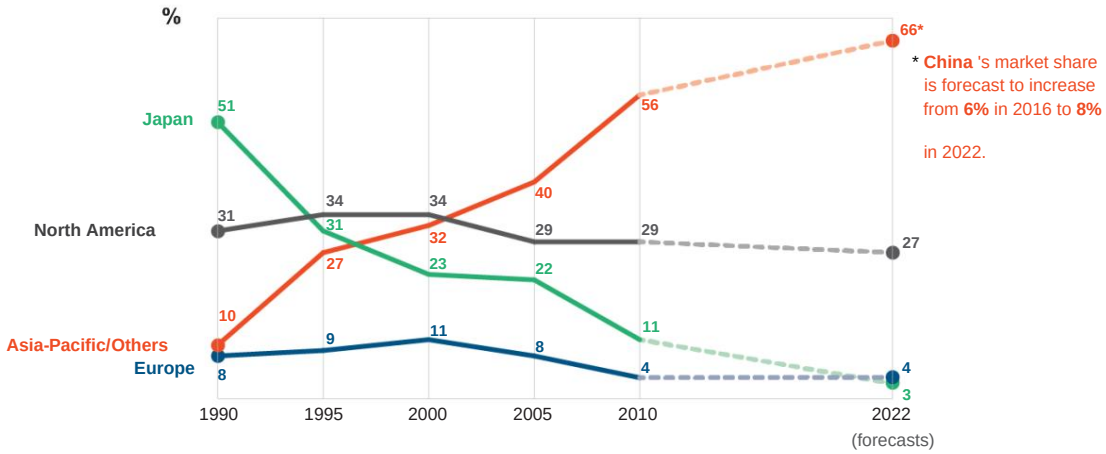


Note: All values are presented in 200 mm wafer size equivalents. The table excludes capacities less than 5,000 wafer launches per month or wafers smaller than 200 mm.
This corresponds to the capacity of modern semiconductor manufacturing facilities, where the wafer diameter is equal to or greater than 200 mm.

Source: European Court of Auditors, based on the BCG and SIA study entitled *Emerging resilience in the semiconductor supply chain,* 2024.

20 Investment in the European semiconductor sector has also declined relative to global volume, as in all other competing regions except Asia-Pacific. Thus, the EU's share of global capital expenditure fell from around 10% in 2000 to 4% in 2010 and did not improve over the following decade ***(Figure*** 4).

Figure 4 | Evolution of the share of capital expenditure in the semiconductor sector, by location of company headquarters (1990-2022)



Source: Commission, document SWD(2022) 147, p. 74, based on the Techinsights(IC) database Insights).

The Chips Act has given new impetus

21 The global shortage of microprocessors linked to the crisis triggered by the pandemic has reminded us of the extent to which semiconductors play a vital role in the economy. The EU responded to this shortage with the Chips Act, after its 2013 strategy did not allow it to increase its share in global microprocessor production. This is one of the Commission's initiatives supporting the European industrial strategy of 2021.

22 The Chips Act gave new impetus, particularly by focusing on increasing of production capacity. It introduced new objectives and measures grouped into three pillars ***(Figure*** 5).

Figure 5 | The three pillars of the Chips Act

Source: European Court of Auditors, based on the Chips Act and Commission Staff Working Document SWD(2022) 147 *(A Chips Act for Europe).*

23 The main changes contained in the Chips Act compared to the strategy previous are as follows:

- o while the 2013 strategy was based mainly on existing strengths, **Pillar I** aimed to fill gaps in the ecosystem by prioritizing the transfer of theoretical knowledge acquired during the research phase to the manufacture of commercial products, on new pilot lines;
- o Pillar **II** clarifies the principles for assessing State aid for investments in pioneering production facilities;
- o the coordination mechanism provided for by **Pillar III** to anticipate and respond to crises did not exist in the 2013 strategy and was therefore entirely new.

The Chips Act was born in a hurry, with, as a corollary, several shortcomings

The Commission did not rely on a comprehensive assessment or impact analysis in developing the Chips Act

24 The Chips Act was created in an emergency, partly because it was necessary to respond to shortages recorded in the aftermath of the COVID-19 pandemic. The Commission took into account some lessons learned from the 2013 strategy, including that insufficient attention had been paid to production capacity, but it did not fully assess the impact. Furthermore, by applying the derogation provided for in the Better Regulation Guidelines , The Commission has not carried out a thorough impact assessment or a public consultation on the Chips Act propose.

25 Instead, the Commission published a working document (SWD(2022) 147) in 2022, after the semiconductor package. It took stock of the state of the industry and set out the overall objective of the Chips Act, as well as the related budgetary information. This document identified existing weaknesses, such as the industry's short-term vision, insufficient attention to microprocessor design, the lack of a monitoring framework, and weak political momentum. However, it lacked an analysis of the trade-offs to be considered and possible alternatives, including their potential impact. The working document in question did not explain how the new strategy detailed in the Chips Act would address the failure of the 2013 strategy to increase EU market share, nor how new measures could rectify this. In other words, the Chips Act may well face the same problems.

26 To justify the fact that it had not carried out a thorough impact analysis, the
The Commission cited the urgency of the situation caused by the crisis. However, we note that many of the measures provided for in the 2013 strategy had 2020 as their horizon, so work on its update should have started a long time ago.

The measures provided for in the Chips Act lack clarity regarding their deadlines and follow-up

27 The Chips Act does not include measurable objectives for any of the pillars:

- or as regards **Pillar** I, the regulation provides for the monitoring of nine key performance indicators (KPIs), such as the number of legal entities taking part in the actions supported by the initiative or the number of competence centres active in the EU. However, no target values have been specified for these KPIs.

- o in the case of **Pillar II,** the Commission aimed to define the principles evaluation of pioneer installations, but it did not stop the slightest Measurable ICP nor set additional operational objectives for the adoption of these innovative facilities;

- o similarly, **pillar III** lacks a precise timetable with stages intermediaries.

28 In the absence of measurable targets for the adoption of pioneering installations at Pillar II level, the working document The Commission indicated that the success of the strategy implemented would be measured by the objective set for 2030 by the digital decade4 , which consisted of the EU achieving a 20% market share in value of global production of durable and advanced microprocessors. To achieve this goal, the EU's production capacity would have to almost quadruple by 2030, which is ambitious to say the least. We also identified some problems with implementing the 20% target ***(Box*** 1).

[4] Document COM(2021) 118.

Box 1

Problems with applying the 20% target to the Chips Act

The digital compass defines sustainable and advanced microprocessors as semiconductors that are 10 times more energy efficient compared to 2021 standards and are smaller than 5 nanometers (nm).

When, as part of the Digital Decade, the Commission set the objective of doubling the production of sustainable and advanced microprocessors by 2030, it based its target on an estimated starting level of 10% in 2020. However, this level did not reflect reality, as it corresponded to the revenues of EU-based companies for the entire value chain and not to statistics on the production of advanced semiconductors in the Union.
As for the production of this type of microprocessors, we observe that in 2020, the only two companies that manufactured them in a size of 5 nm were located in Taiwan and South Korea, the EU has no production capacity for semiconductors below 22nm.

During our audit, the Member State authorities we interviewed stated that the Commission had not clarified how the EU target should be integrated into national targets.

Chip manufacturers and national authorities see the 20% target more as an ideal to be achieved than a realistic project.

29 Under the Digital Decade Action Programme By 2030, Member States are required to submit roadmaps setting out the policies and actions envisaged to achieve the digital objectives, including major investments in production capacity for the 20% target. However, the roadmaps of the Member States we visited do not provide information on their national contribution to this target. Moreover, none of the countries in question has developed strategic documents detailing their plans to increase the production of advanced microprocessors.

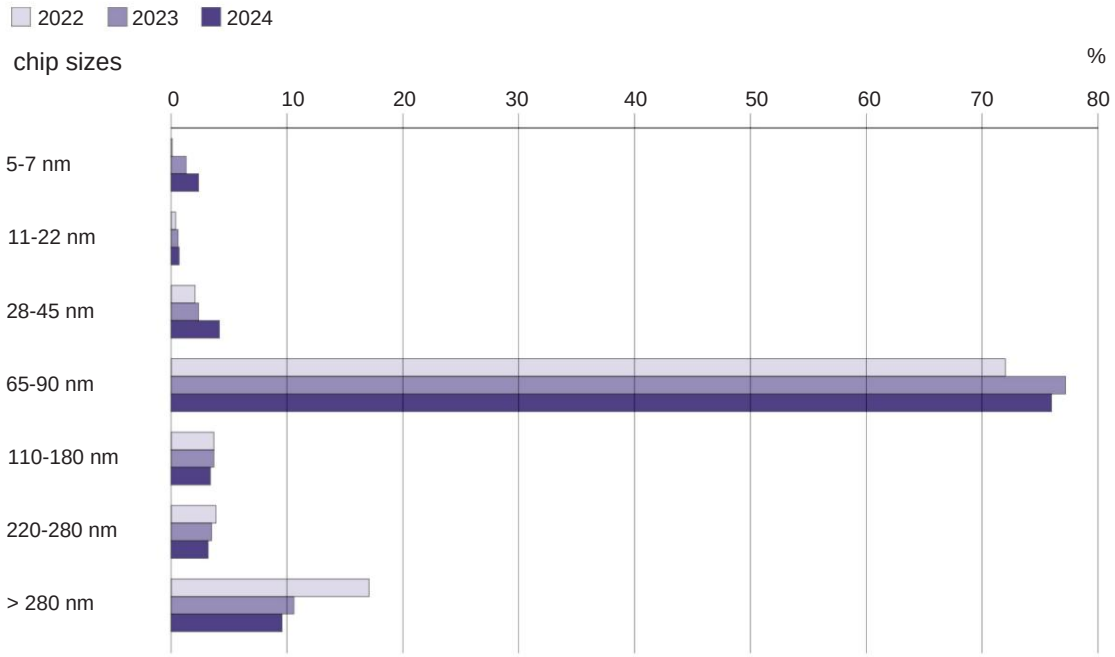
The Chips Act may not have sufficiently taken into account the current demand from the European industry

30 Pillars I and II of Chips Acts are aligned with medium- and long-term objectives. Pillar I primarily targets cutting-edge technologies, including smaller, advanced microprocessors. Pillar II also provides guidance to companies on how to apply for state aid to finance facilities that manufacture common chips, provided these factories offer an innovative element (e.g., improved energy efficiency, a new manufacturing process, etc.). While the Commission expected progress by 2023-2025 for some deliverables (e.g., pilot lines, competence centers, and the first pioneering facilities), the impact of many projects and initiatives will only become visible in the longer term.

31 The main supply problems faced by the EU during the COVID-19 pandemic were not, however, linked to a shortage of advanced microprocessors5. According to industry forecasts at the time, demand for such semiconductors in the short and even medium term was likely to be low, since the bulk of the market was made up of 65-90 nm chips ***(Figure*** 6). This point was confirmed during our discussions with national authorities and manufacturers of microprocessors.

[5] Document SWD(2022) 147, p. 16 and 17.

Figure 6 | Projection of cumulative demand of surveyed EU companies, by microprocessor size, for the period 2022-2024



Source: European Commission (DG GROW and JRC), *European Chips Survey Report,* July 2022. This survey report is based on statements from 43 respondents.

32 Currently, European demand for mainstream microprocessors is increasing more quickly than the supply from manufacturers located in the EU. The Joint Research Centre (JRC) drew attention to a trade deficit of €6 billion in both advanced and less advanced microprocessors6, with 30% of the EU's imports of common semiconductors coming from China. As microprocessors of this type are needed for the technology associated with the ecological transition, this trade deficit is likely to widen further in the future.

33 Furthermore, we note that common microprocessors are still considered important, including outside the EU. Thus, China has recently sought to boost its domestic production of less advanced chips.7 The joint statement of the EU-US Trade and Technology Council of 4-5 April 2024 expressed shared concern about non-market-based economic policies and practices that could lead to distortive effects or excessive dependencies on mainstream semiconductors.

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6 *Semiconductors in the EU* (JRC133850), Publications Office of the European Union, 2023, p. 16.

7 *Mapping China's semiconductor ecosystem in global context: Strategic dimensions and conclusions,* Stiftung Neue Verantwortung ÿ Merics (2021), p. 37.

34 Without a proper impact analysis (point 24), it is difficult to determine whether the Chips Act takes sufficient account of the industry's needs for common chips.

The Commission is responsible for only a small part of the funding announced in the Chips Act, but the publicly funded projects we examined were, as a rule, aligned with EU policy objectives

35 In an environment where investment decisions in the industry microprocessors are mainly taken by private sector companies, we analyzed the sources of public funding from the EU and other entities for the successive European strategies on microprocessors for the periods 2014-2020 and 2021-2027. We also examined whether the calls for proposals and projects we audited were aligned with the strategic objectives pursued. With regard to the audited projects from the period 2014-2020, we checked whether they had achieved the expected results.

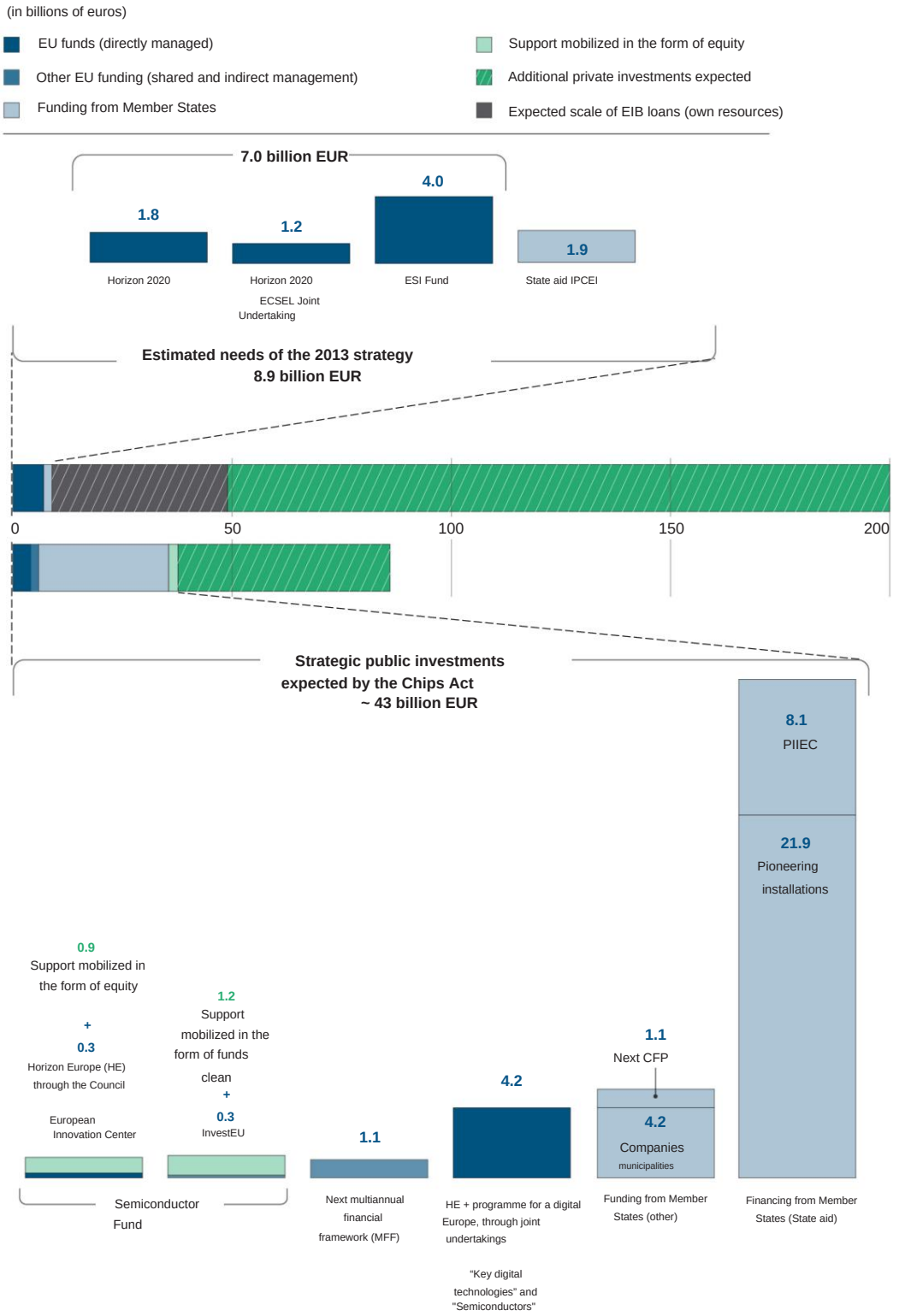
Information on the total expected funding is incomplete, as the Commission is only responsible for a small part of it.

36 Financial support for semiconductor projects is channelled through a range of EU funding sources, such as the Horizon Framework Programmes, the European Structural and Investment Funds (ESI Funds), the European Fund for Strategic Investments (EFSI) and InvestEU. The European Investment Bank (EIB) also finances the sector. These financial resources complement national public financing (e.g., grants, state aid, and tax breaks). The Recovery and Resilience Facility (RRF) may also provide funding to the semiconductor industry during the period

2021-2027.

37 However, the available information does not allow a direct comparison of the funds available under the two successive strategies, and, given that investments depend essentially on the decisions of investors and the willingness of Member States to support them, the Commission does not have a complete picture of the situation (paragraph 39). Figure **7** illustrates the main sources of financing for the two EU strategies.

Figure 7 | Main sources of funding for EU semiconductor strategies for the periods 2014-2020 and 2021-2027



Source: European Court of Auditors 2013 Strategy Analysis; GLE Roadmap and Implementation Plan; Chips Act and Working Document, as well as data provided by the Commission.

38 The 2013 strategy did not provide an estimate of the total amount of investments necessary. According to the estimate in the Electronic Leaders Group (ELG) roadmap, a total investment of between €50 and €60 billion of public money was needed to leverage over €200 billion of total investment.8 The EU budget and national funds accounted for only a modest part (€8.9 billion) of the public investment, with the remainder expected to be provided mainly by EIB loans (between €10 and €40 billion). The ELG roadmap, however, did not take into account other existing sources of financing, such as co-financing of EU grants by Member States and national contributions in the form of state aid.

39 The strategic package contained in the **Chips Act** was more specific. It announced a minimum of €43 billion in public strategic investment by 2030, with this funding expected to attract an equivalent amount of private investment. In other words, the expected investment should therefore reach a total of at least €86 billion. This remains significantly lower than the needs estimated in the GLE's 2013 strategy roadmap, but the corresponding funding sources are better identified. However, these estimates do not take into account certain EU funds envisaged in the 2013 strategy roadmap (e.g., the ESI Funds), or RRF funds, or EIB financing for the sector (€2 billion between 2021 and 2023).

40 Overall, the Commission is not responsible – either directly or through through the Semiconductor Joint Undertaking – only a very small part of the €86 billion in funding estimated by the Chips Act, namely mainly funds from the Horizon Europe programme and the Digital Europe programme , which represent a total amount of around €4.5 billion. The remainder is mainly the responsibility of the Member States and private companies concerned ***(Figure*** 8). While the Commission does approve State aid for Pillar II investments, it does not have a mandate to coordinate such investments at EU level to align them with the objectives of the Chips Act.

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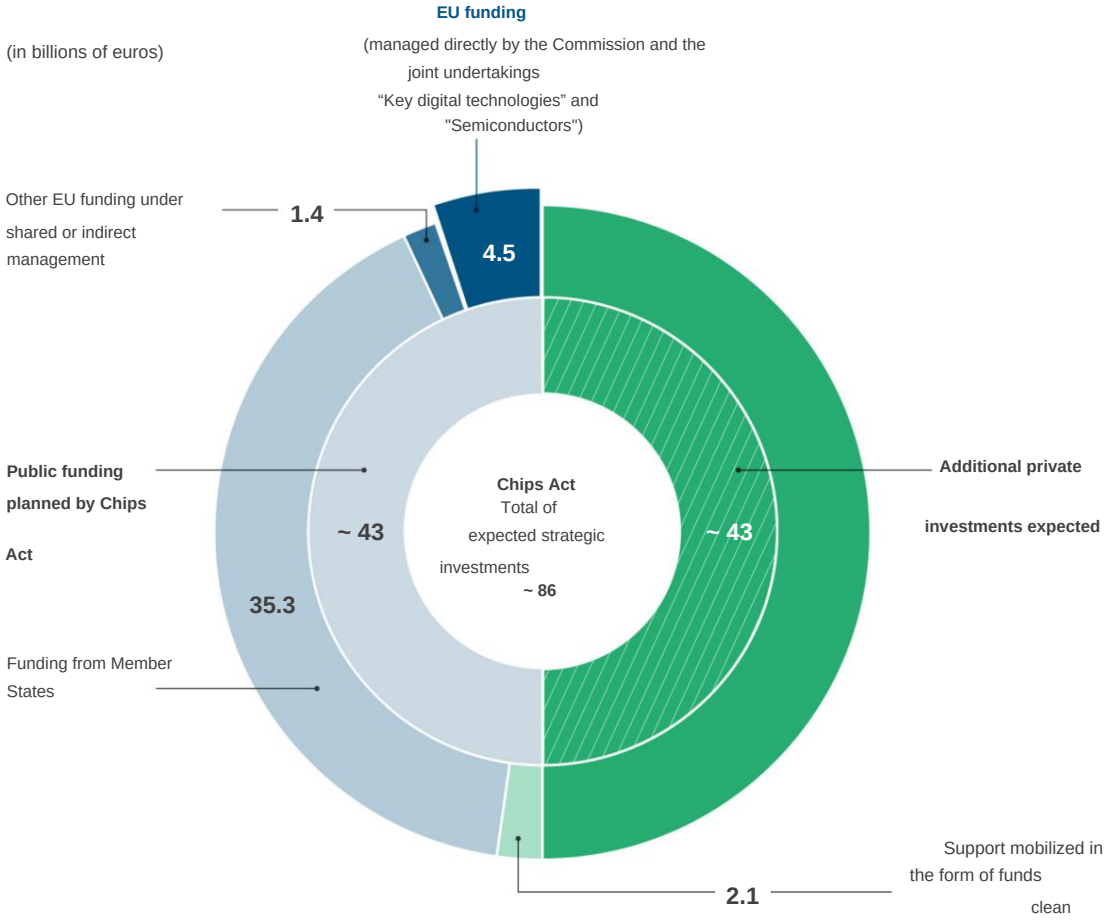
[8] *A European Industry Strategic Roadmap for Micro- and Nano-Electronic Components and Systems – Implementation Plan,* GLE, 2014, p. 11-13 and 19.

Figure 8 | Expected Chips Act Funding, by Source of Funds (EU, public funds and private funds) for the period 2021-2027



Source: European Court of Auditors, based on information provided by the Commission, the Semiconductor Package and Staff Working Document SWD(2022) 147.

41 For example, the largest portion of expected public funding covers the expansion of production capacity through pioneering facilities. The €21.9 billion involved depends on Member States and private investors. Similarly, the 2023 Important Projects of Common European Interest (IPCEI) initiative, which accounts for €8.1 billion of the expected funding under the CHIPS Act, ultimately also depends on investments by Member States and the private sector.

The Commission's information on funds disbursed is incomplete

42 In the case of EU industrial policy on microprocessors, the Commission's information on EU funding for the sector was limited to a subset of projects to which it had awarded grants – either directly (under Horizon 2020 and Horizon Europe) or through the Semiconductor Joint Undertaking (and its predecessor, the ECSEL Joint Undertakings) and "Key Digital Technologies") – and which were specifically intended to contribute to the strategic objectives, namely:

- during the period 2014-2020, 102 projects for a total amount of EUR 0.5 billion (out of a budget of EUR 1.8 billion under the Horizon 2020 programme – ***Figure*** 7) managed directly by the Commission, and 91 projects implemented by the ECSEL Joint Undertaking, which allocated its budget of EUR 1.2 billion;

- during the period 2021-2027, 30 projects under Horizon Europe with a total value of EUR 342 million to be implemented by the Key Digital Technologies Joint Undertaking, followed by nine calls for projects launched by the Semiconductor Joint Undertaking, still ongoing in 2024 and with a total budget of EUR 2.3 billion (all out of a total budget for the two Joint Undertakings of EUR 4.2 billion). During our audit, the Commission provided us with a non-exhaustive list of 26 other Horizon Europe projects with a total value of EUR 115 million, whose objectives were consistent with the Chips Act, although the latter only became operational later.

43 The Commission had no information on financing contributing to semiconductor strategies and allocated through the ESI Funds, the EFSI and the RRF, either for the 2014-2020 period or for the current period (2021-2027). It also had no information on related financing disbursed by the EIB.

44 Similarly, as regards State aid under the EU industrial policy on microprocessors, the Commission did not use for monitoring purposes the data relating to the amounts actually disbursed at national level under the PIIEC of 2018 and 2023, and did not have such information at the project level. Regarding *ad hoc* State aid measures in the 2013 strategy (this is aid that does not fall under an already approved scheme), it did not audit its contribution to the strategy, but provided us with details of three decisions approving €0.5 billion of State aid that it considered relevant to our audit. Furthermore, our searches in the Commission's databases on the 10 semiconductor companies we selected for the audit revealed more than 400 State aid measures granted (up to January 2022) worth €1.6 billion, 83% of which were granted by France and Germany.

45 Despite the importance of frontier investments, the Commission's monitoring of expected investments (including State aid) under the Chips Act relies on information such as press releases, negotiations underway, and notifications from national authorities. The Commission identified 29 potential or ongoing investments in production capacity. This list included 13 expected frontier projects (four approved and nine planned), financed by State aid of €26 billion and by private investment of an expected €60 billion.

The Commission funds projects that generally fit with the strategies, but it does not have a complete vision of their real contribution

EU funds managed directly by the Commission will undoubtedly have positive effects, even if these are not quantified

46 **For the period 2014-2020,** we examined the work programmes Horizon 2020 under which the 102 projects identified by the Commission (paragraph ***42)*** were funded. We found that the objectives concerned were consistent with the 2013 strategy. However, a 20239 evaluation study commissioned by the Commission and covering Horizon 2020 highlighted gaps in research at certain levels of technological readiness before deployment.

47 The Commission was unable to provide any quantification of the contributions related to strategic objectives at project level. The objectives of the Horizon 2020 project that we examined ***(Annex III,*** project 1) were incidentally consistent with those of the 2013 strategy.

48 **As regards the period 2021-2027,** we examined the three calls under which the 26 ongoing Horizon Europe projects were selected (paragraph 42), confirming that they did indeed address semiconductor research and Pillar I. We also found that they could contribute to addressing the research gaps mentioned in paragraph ***46.***

49 In addition, we identified and reviewed a Horizon Europe project ***(Annex III,*** Project 2) which was not included in the list of 26 projects under this programme provided by the Commission (paragraph 42). Its objectives were consistent with the Pillar I objective of strengthening the EU's lead in research and technology. At the time of our audit, the project in question was still in the early stages of implementation, so it was too early to assess its potential effects.

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[9] *Evaluation Study on the European Framework Programs for Research and Innovation for Addressing Global Challenges and Industrial Competitiveness – Focus on Activities for the Digital and Industrial Transition – Phase 1 Final report – Horizon 2020", Commission, April 2023, p. 68.*

There is a greater emphasis on EU strategic objectives applicable to projects carried out by joint undertakings, although the extent to which which they contribute is not clearly established

50 Part of the Horizon 2020 and Horizon Europe funding in favour of the research and development is also carried out by the Semiconductors Joint Undertaking or, before it, ECSEL or Key Digital Technologies as appropriate.

51 **As regards the period 2014-2020,** the 2023 evaluation study found that, in general, the ECSEL Joint Undertaking had stimulated research and innovation in the field of electronic components. However, it did not focus on projects that maximized the contribution to the EU's long-term objectives and challenges, as research was driven by the short-term priorities of industry and the participating Member States. Moreover, the Commission did not have precise information on how many of the 91 projects implemented by the ECSEL Joint Undertaking (paragraph 42) directly contributed to the objectives of the 2013 strategy.

52 The three projects completed by the ECSEL Joint Undertaking that we examined ***(Annex III,*** projects 4, 5 and 6) were consistent with the objectives of the 2013 strategy. One of them contributed to strengthening the production capacity of less advanced microprocessors. The other two involved research into the manufacture of advanced microprocessors. We note that, as the equipment developed under these two projects is currently mainly used outside the EU, their effects contribute to the production of non-European microprocessors.

53 **As regards the period 2021-2027,** the Joint Undertaking "Technologies "Key Digital Activities" has integrated specific priority themes into its work programs in order to target certain technological areas considered more strategic in the long term. However, only a small number of the activities planned for 2021-2022 by this joint venture (eight projects out of a total of 30, representing 23% of the total allocation) have contributed, by their nature, to the achievement of the objectives (point 42). The Commission has not verified how many of the remaining 22 Key Digital Technologies Joint Undertaking projects directly contributed to achieving the objectives of the CHIPS Act.

54 During our audit, we examined a project ***(Annex III,*** Project 3) in which the The Commission is funding the EUROPRACTICE platform. The project's objectives are relevant and contribute to the research objectives of the CHIPS Act. While the project was still ongoing, some of the reported KPIs showed, at the time of our audit, that the content and use of the platform's services were falling short of the objective.

55 Since 2023, the joint venture "Semiconductors", which succeeded the company The "Key Digital Technologies" commune manages the implementation of Pillar I. According to our analysis, the design of the nine calls for projects and the two underlying work programs launched at the time of our audit directly support all elements of Pillar I (virtual design platform, pilot lines, and competence centers). As the calls are still ongoing, we were unable to assess their contribution to the objectives of the Chips Act.

State aid is expected to play a major role in strengthening production capacity, but the Commission has no information on their real contribution to EU objectives

State aid under the IPCEIs contributes to production capacity targets

56 The first PIIEC in the field of microelectronics (2018 IPCEI) brought together France, Germany, Italy, the United Kingdom and Austria. It covered power semiconductors, energy-efficient microprocessors, advanced optical components and composite materials. The Commission approved **€1.9 billion** in state aid was granted to 32 companies, with a potential €6.5 billion in private funding. Nearly €5.8 billion of the total cost of €8.7 billion concerned first industrial deployment (FID) activities10. According to Member States11, the FID component of this IPCEI should enable the development of highly innovative products and/or the deployment of new production processes, as well as their commercialization.

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[10] Communication from the Commission on the 2018 IPCEI (C(2018) 8864), December 13, 2018, p. 68.

[11] Ibid., p. 6.

57 Our analysis confirmed that the objectives set out in the IPCEI decision of 2018 were consistent with those of the 2013 strategy. The participants we interviewed recognized the role of the IPCEI in supporting EU policy objectives and stabilizing the semiconductor industry. The objectives of the two 2018 IPCEI projects we examined ***(Annex III,*** projects 7 and 8) were consistent with those of the decision. They contributed to the construction of new facilities production, whose pilot lines were subsequently adapted for mass production of microprocessors, and thus supported the EU's objective of expanding manufacturing capacity.

58 We noted, however, that the Commission had not assessed the contribution of the PIIEC from 2018 to the 2013 strategy. Furthermore, the PIIEC decision and the annual report did not mention any relevant KPIs.

59 The stakeholders we interviewed noticed problems with timing and coordination. They pointed to the long approval time, which is not really compatible with the speed of technological developments in the industry. Comparable problems were identified in an evaluation12 carried out on behalf of the German authorities (e.g. a four-year delay in approving a project). This situation was also accompanied by legal issues within the Member States, resulting in delays in the implementation of activities (including IDPs) and limited coordination between the Commission and the Member States regarding reporting obligations and late disbursements.

60 The second PIIEC in the field of microelectronics (IPCEI 2023) approved by the Commission involved public aid granted to 68 projects carried out by 56 companies from 14 Member States. At the time of our audit, some projects were still awaiting financial support provided at national level. The state aid of €8.1 billion is supposed to complement the €13.7 billion of private investments, with €7.6 billion of the total amount earmarked for IDP activities, which is higher than the previous IPCEI.

[12] PwC, *Evaluation of the "IPCEI on Microelectronics" funding measure – Final report,* June 2023.

61 Overall, the design and objectives of the 2023 IPCEI are consistent with those of the Chips Act. The companies we interviewed spoke positively about the role of the 2023 IPCEI, both in terms of the Chips Act and in supporting semiconductor production in the EU through investments in IDP activities. We found that the objectives of the Dutch project in our sample were to contribute to the Semiconductor Joint Undertaking's Pillar I pilot lines ***(Annex III,*** Project 9). However, it was too early to determine the impact.

62 We also noted improvements in the monitoring of projects under the 2023 IPCEI. Member States and companies involved have introduced more than 30 KPIs to measure project progress, environmental impact and benefits. Most of these indicators contain aggregated EU-wide target values.
However, it is premature to determine how they will be applied at Member State and project level.

Pioneer installations will likely contribute to increasing production capacity, but the Commission will have difficulty obtaining information on their actual effects.

63 As regards the period 2014-2020, the information available to the Commission was limited to three State aid decisions related to the semiconductor industry (paragraph 44). In addition, it did not verify the completion and results of these projects against the 2013 strategy. The Commission's Directorate-General for Communications Networks, Content and Technology (DG CNECT), which was then in charge of the strategy in question, was not consulted about these decisions and had no information on their implementation. However, our analysis of the objectives pursued by these projects confirmed that the decisions concerned were consistent with the strategy from 2013.

64 For the period 2021-2027, the technical analysis of technology and The impact assessment has strengthened the intervention of DG CNECT in the Commission's approval of State aid for pioneering installations.

65 At the time of our audit, the Commission had approved decisions relating to State aid for the period 2021-2027 and covering four investments in pioneering facilities, for a total of EUR 10.2 billion in State aid and EUR 21 billion in private funds. The Italian project we examined ***(Annex III,*** project 10) provides an example of a potential contribution to EU security of supply by enabling the production of silicon carbide.

66 The lack of available information on implementation is comparable to that observed for the previous period. National authorities or beneficiaries are not required to report on the progress of projects, and their effects, to the Commission. This means that it will be difficult for the Commission to monitor and evaluate the impact of investments linked to the Chips Act and to establish whether the target value of 20% has been achieved.

achievement.

Implementation of the Chips Act is progressing, but too slowly to reach the 20% digital decade goal

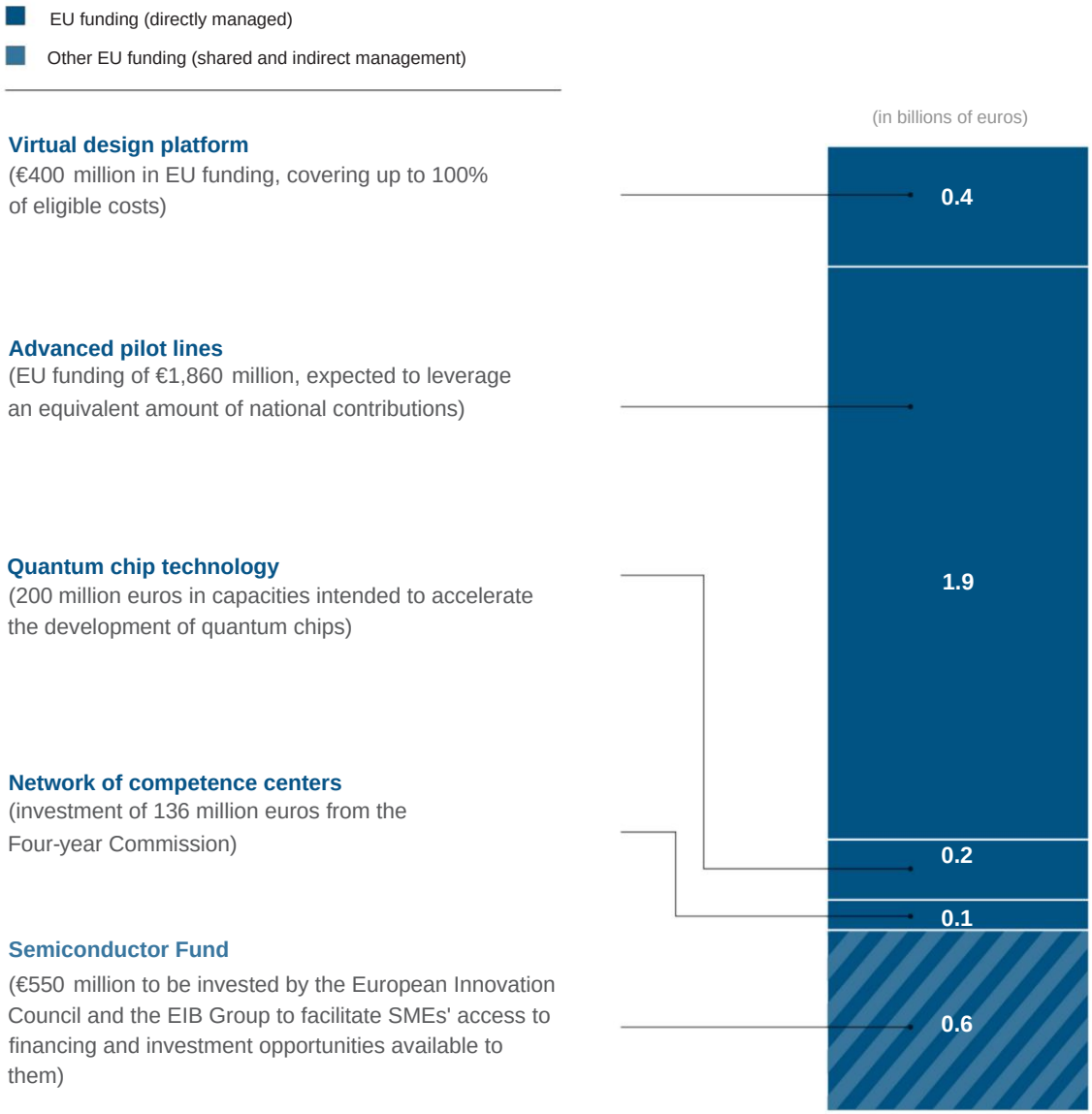
67 We examined the progress made in implementing the measures defined for each pillar of the Chips Act, as well as compliance with deadlines (point 22). We checked whether the measures defined for each pillar of the Chips Act were implemented in a coordinated and timely manner to enable the achievement of the strategic objectives.

Pillar I is progressing well, but is experiencing some delays

68 The Pillar I initiative is structured around five elements ***(Figure*** 9). Following extensive preparatory work, implementation of this pillar began after the adoption of the Semiconductor Regulation in September 2023. According to the Commission, for the initiative to be successful, all elements must be in place and working together smoothly. 13 Effective coordination of all elements is a prerequisite, and delays in any one of them can negatively impact the effectiveness of the initiative as a whole. The Chips Act does not include a specific timeline for the implementation of Pillar I measures. Pillar I KPIs had not been monitored or reported on at the time of our audit, as, according to the Commission, this will only be possible once the individual elements are in place. Given the current state of progress of the design platform and the ongoing calls for competence centers, it appears that not all elements (including pilot lines) will be in place by the end of 2025.

[13] Document SWD(2022) 147, p. 63 and 64.

Figure 9 | The five elements of Pillar I and the planned EU funding



Source: European Court of Auditors, based on information provided by the Commission (November 2024).

69 The **Virtual Design Platform** is an online tool that aims to enable academia, start-ups, and SMEs to design and develop microprocessors. It is intended to be an extension of—and even a replacement for—the EUROPRACTICE platform, which is co-funded by the EU and has been providing comparable services, mainly to academia, since 1995. The Commission expects EUROPRACTICE services to be integrated into the new design platform in

the two years since its launch.

70 A first call for projects of 25 million euros (6% of the budget) relating to the coordination and support was launched in August 2024. At the time of our audit, a second call was pending, so the platform will hardly be operational at the end of 2025 as the Commission initially planned.

71 **Pilot lines** are intended to serve as a bridge between the development and production phases. They are intended to provide industry with facilities for testing, experimenting with, and validating semiconductor technologies and system concepts.

72 The first four calls for pilot lines were launched by the company Semiconductor Joint Venture in December 2023 after intense discussions between the Commission, leading research and technology organisations (RTOs) and industry. This interaction began before the publication of the Chips Act, which formalized the results of these discussions with regard to the technological areas of the pilot lines.

73 The stakeholders we interviewed had a positive opinion on the usefulness and necessity of these pilot lines. The calls for projects were open to all EU entities, but the three-month deadline was short, given the complexity of the subject and the numerous administrative requirements. Without questioning the usefulness of the four pilot lines, we note that competition was limited by the inability of some to respond to the calls.

74 In April 2024, the Semiconductor Joint Undertaking started negotiations with the consortia that had won the calls. According to the four RTOs we interviewed, the conclusion of the agreements would be slightly delayed due to the necessary clarification of details related to co-ownership of equipment and service pricing models. The Commission expects the first four pilot lines to reach initial capacity by the beginning of 2025 and full capacity by the end of 2026. In July 2024, the Semiconductor Joint Undertaking launched a call for a fifth pilot line dedicated to advanced photonics, which is expected to start before the end of 2025 and be operating at full capacity by the end of 2026.

75 Regarding **quantum chip technologies,** the work preparatory work was underway at the time of our audit, with the call for projects planned for September 2024.

76 The planned **network of competence centres** for Member States is intended to enable start-ups, SMEs, small mid-caps and academia to access the new virtual design platform and pilot lines. The Chips Act provides Member States with the possibility of establishing at least one competence centre on their territory. Neither the Chips Act nor the Semiconductor Joint Undertaking have provided timeframes or quantified targets for these centres, but the Commission intends to have them operational by the end of 2025, aligning the timing of their deployment with the commissioning of the new virtual design platform and pilot lines.

77 In July 2024, the Semiconductor Joint Undertaking launched a call for competence centres and another call for the establishment of a network for such centres. In November 2024, it selected 29 competence centres for 25 participating countries and amended its 2024 work programme to include a second call for competence centres for the four participating countries.
remaining.

78 The **Semiconductor Fund** aims to improve access to capital for young people startups, expanding companies, SMEs and other companies in the semiconductor value chain. It consists of two components:

or the first, which is part of the program of the European Council Accelerator innovation within the framework of Horizon Europe, provides an investment of 300 million euros aimed at attracting 900 million euros of private financing;

o the second, which falls under the InvestEU Fund managed by the European Investment Fund (EIF), consists of a guarantee of 125 million euros covered by EIF resources to reach 250 million euros capable of being invested, an amount which should be able to mobilize 1.2 billion euros of equity financing.

79 At the time of our audit, the first component was still in its early stages of implementation. A total of EUR 44 million in grants and EUR 152 million in equity had been committed to 19 projects that directly implement – and from the outset – the Semiconductor Fund through financing provided through the European Innovation Council Accelerator Challenges. Regarding the second component, the Commission had little information on its progress. Funds had been committed, but given the early stage of the process and the time needed for deployment, the EIF had only supported a small number of final beneficiaries.
at the time of our audit.

Pioneer installations under Pillar II are unlikely to make a major or timely contribution to the 20% Digital Decade target

80 Pillar II of the Chips Act aims to stimulate public and private investment to increase EU production capacity. To this end, it specifies that State aid to facilitate the financing of pioneering production facilities may be granted under Article 107(3)(c) of the Treaty on the Functioning of the European Union. Pioneer facilities must bring an innovative element to the internal market with regard to manufacturing processes or the final product, which could be based on new or existing technology nodes.

81 The Chips Act specified the principles to be applied for the assessment of aid in favour of investments in pioneering facilities. However, its implementation has been slow. While the Commission had identified 29 existing or potential investments aimed at increasing production capacity, our analysis showed that only 13 of these could be considered frontier installations (paragraph 45). Moreover, only two of these 13 investments concerned cutting-edge projects (in this case the production of sub-5 nm wafers) that could contribute to the 20% target of the digital decade.

82 At the time of our audit, among the 13 existing or potential pioneer installations:

- only four had obtained approval from the Commission for State aid for pioneering installations (according to the same Commission, three of them should be operating at full capacity in 2029);
- six were in the negotiation phase, although the two leading projects (production of wafers of less than 5 nm) were frozen by the manufacturer;
- three were at the stage of initial discussions with the Commission.

83 Finally, even if state aid is approved, there is no guarantee that the projects will materialize or are completed within the given timeframe. Ultimately, everything will depend on the decisions of investors, based on customer demand and market conditions. In any case, building a semiconductor factory takes four to five years. In other words, new production facilities approved in 2025 will not be able to begin operations until 2030. Therefore, they are unlikely to contribute to the 20% goal of the digital decade.

As for Pillar III, the monitoring mechanism is on track, but the deployment of the crisis response mechanism is not yet on the agenda.

84 **The concept of a "monitoring mechanism"** has evolved between the 2022 strategic package contained in the Chips Act proposals and the final 2023 regulation. While the Chips Act provided for monitoring the supply chain to be entrusted to Member States alone, the Semiconductor Regulation provides that the Commission must carry out a strategic mapping of the EU's strengths and weaknesses in the
semiconductor industry worldwide. In consultation with the board
European Semiconductor Council (the new governance body established by the Chips Act), the Commission must then establish the necessary framework and methodology. On this basis, the European Semiconductor Council is supposed to create early warning indicators to monitor, at EU level, possible disruptions in the sector in terms of supply or trade.

85 The Chips Act does not include a specific timetable for the implementation of the measures under Pillar III. Preparatory work began in 2022. The Commission's formal work on the monitoring mechanism began once the Semiconductor Regulation entered into force (in September 2023), but requires the expertise and assistance of an external contractor. The Commission intended to launch the relevant procurement procedure in early 2025.

86 The Chips Act introduced the crisis response mechanism, a kind of "hot box" emergency tools" consisting of measures that the Commission may take, in consultation with the European Semiconductor Council, to respond to anticipated or confirmed shortages in EU supply, once a crisis state has been reached. This mechanism provides for:

- the collection of information;
- joint procurement, to enable the Commission to purchase names of participating Member States;
- priority orders, in order to ensure the supply of critical sectors listed in the semiconductor regulation.

87 While the first two elements of the mechanism are ready for deployment under the Semiconductor Regulation, the priority ordering mechanism will not be operational until 2028. Under the Regulation, the Commission may require production facilities that have obtained certain labels to accept priority orders. At the time of our audit, three of the four approved pioneer facilities had applied for a label allowing priority orders. They were expected to be fully operational between 2028 and 2032. The approval process for applications from six other companies was ongoing. It remains to be seen how this mechanism will work in practice, given the variety of microprocessors used by the industry and the time required to requalify production lines, even between seemingly similar products.

The Chips Act will probably not be enough to stimulate investment in the required proportions, especially since its success also depends on global competition and other factors.

crucial

88 We examined whether both the planned investments and the EU funds available were sufficient to enable the Union to achieve its objective of increasing its market share. We also analyzed other aspects influencing the competitiveness of EU companies in the semiconductor sector, namely the strategies of support for microprocessor production deployed by other global economies, but also other crucial factors.

The investments that the Chips Act is supposed to generate will probably not be up to the industrial challenge.

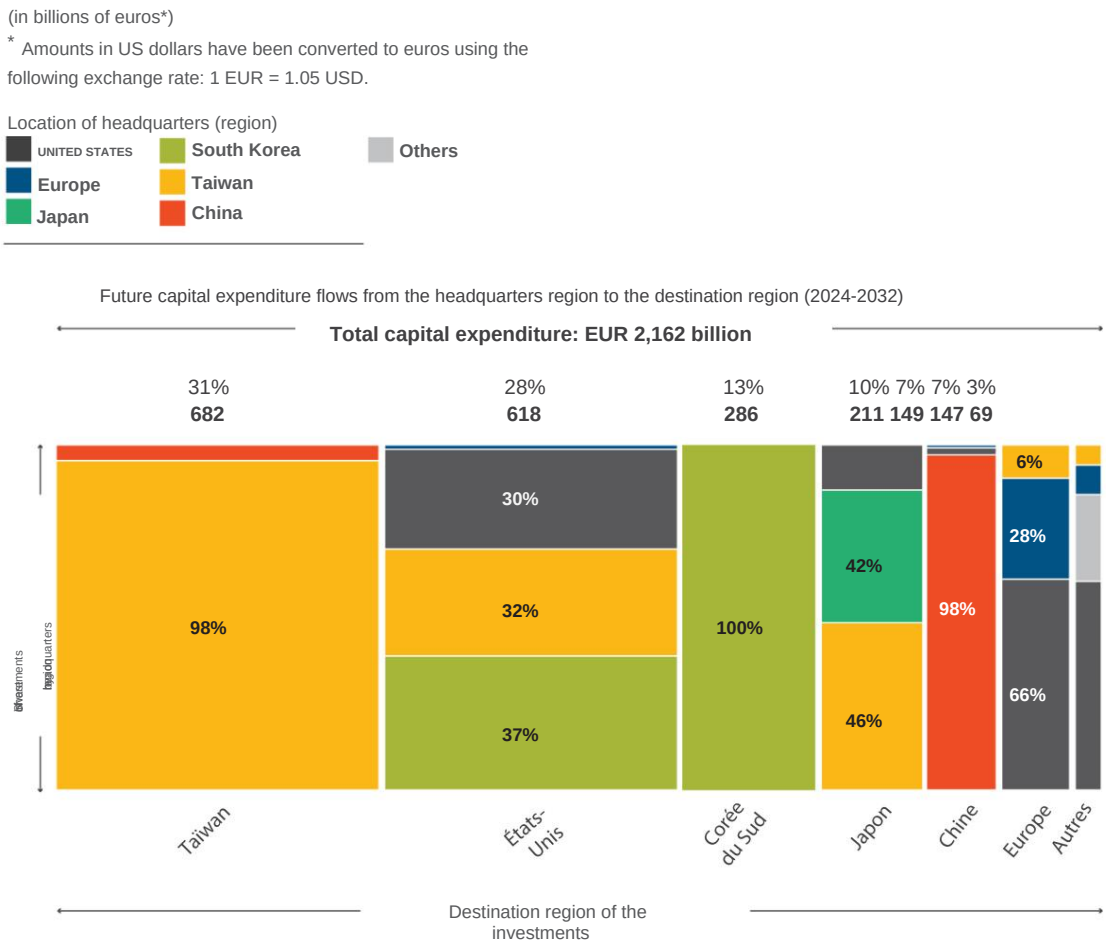
89 The Chips Act aimed to raise at least €86 billion over the period 2020-2030 (point 39). By comparison, according to a JRC report14, the world's leading semiconductor manufacturers planned to invest $425 billion (€405 billion)15 between 2020 and 2023, with 60% of this amount being contributed by TMSC, Samsung, and Intel. Of these three giants, only TMSC has launched major plans investment in the EU.

90 SEMI, the global industry association representing the electronics manufacturers' supply chain, estimates that by 2032, capital expenditure in the EU is expected to reach €147 billion, compared to €2,162 billion globally ***(Figure*** 10). In a document In a February 2022 position paper, ASML explains that maintaining the EU's market share at 8% of global microprocessor production would require capital expenditure of $66 billion (€63 billion), while increasing it to 20% would cost $264 billion (€251 billion) by 2030, due to the Union's poor starting position in the advanced microprocessor sector.

[14] European Commission, Joint Research Centre (JRC), Cerutti, I., and Nardo, M., *Semiconductors in the EU,* Publications Office of the European Union, 2023.

[15] In this report, the conversion into euros of amounts expressed in United States dollars is given for information purposes only, using an exchange rate of EUR 1.00 for USD 1.05.

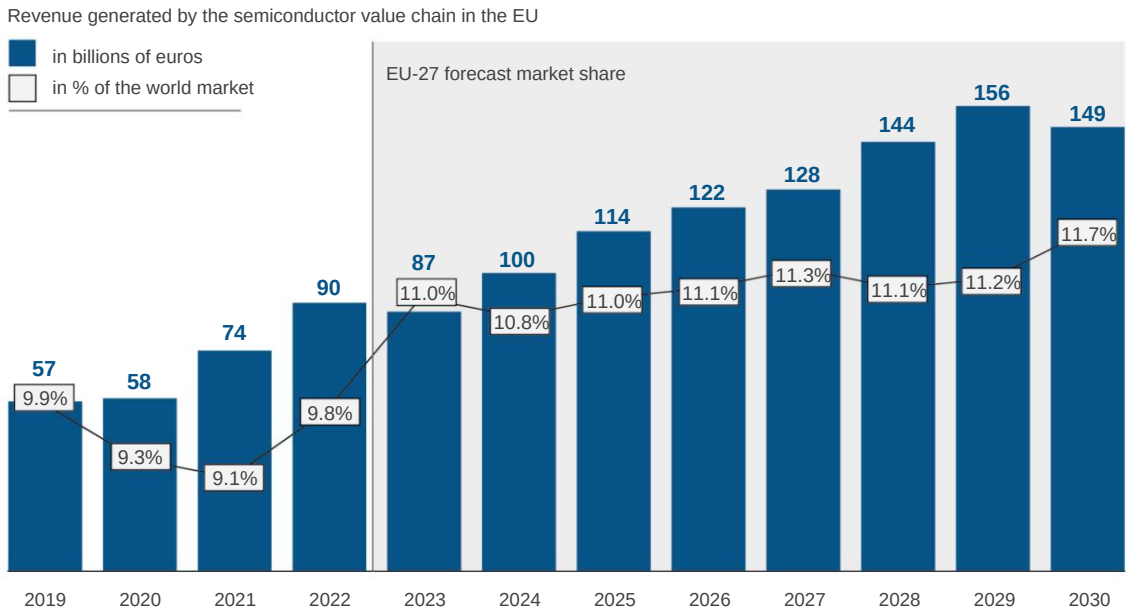
Figure 10 | Projection of capital expenditure flows between different regions for the period 2024-2032



Source: European Court of Auditors, based on the BCG and SIA study entitled *Emerging resilience in the semiconductor supply chain,* 2024.

91 The JRC and the stakeholders of the semiconductor industry that we have respondents stated that the strategic investments announced in the Chips Act are unlikely to be sufficient for the EU to achieve its market share targets. Recent forecasts in a study commissioned by the Commission indicate that, despite the expected significant increase in production capacity, the EU's total share in the global value chain is expected to increase only slightly to 11.7% in 2030 ***(Figure*** 11).

Figure 11 | Expected evolution of the EU-27 market share by 2030 in the global value chain



Source: COM(2024) 260 – Annex II, page 14, figure 8; based on the International Data Corporation (IDC) study entitled *Semiconductors market data by feature size, sector and region* (CNECT/2022/MVP/0084).

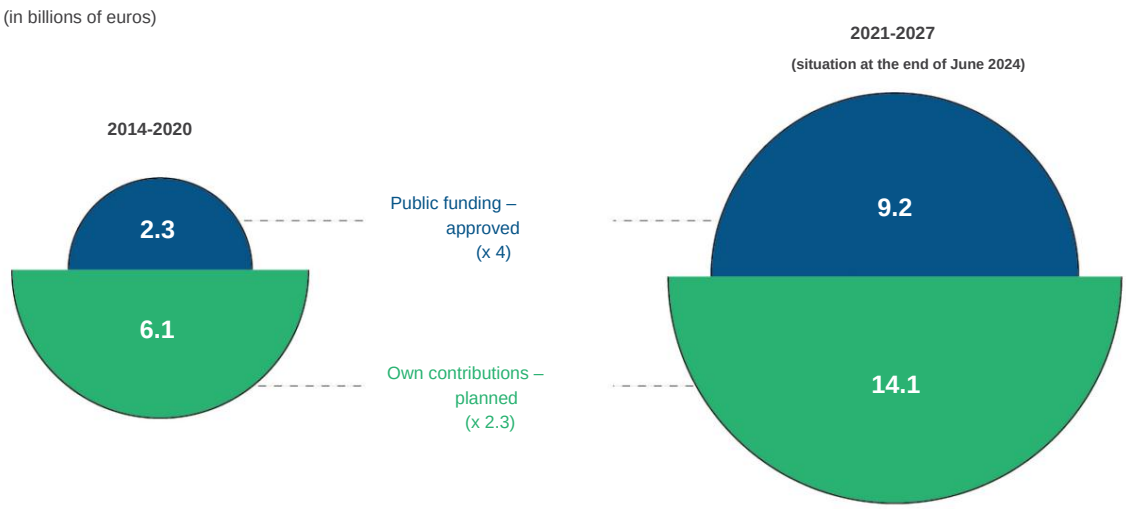
92 Finally, since investments are essentially made by industry (point 64), there is also, in our view, a risk of a windfall effect, whereby public investments do not in reality generate any additional activity or innovation. The practice16 which consists of allowing the start of projects before the Commission's decision on the granting of State aid can accelerate the implementation of projects. We note, however, that it can increase the risk of deadweight loss, because it favors projects willing to take the risk of implementation without public funding.
In 2021, the Commission updated its guidance on IPCEIs to include a clawback mechanism that is triggered based on the level of profits made.
This mechanism was introduced to act as a safeguard and ensure that State aid remains proportionate and limited to what is necessary, but its effectiveness in removing the risk of deadweight loss remains to be demonstrated.

16 Commission, *DG COMP* Code of good practices for *a transparent, inclusive, faster design and assessment of IPCEIs,* May 2023.

The concentration of financing is inherent to the sector, but it generates specific risks

93 The semiconductor industry is characterized by a relatively small number of large companies. We interviewed 14 significant beneficiaries (item ***17*** of ***Annex*** I) for which EU funds and public financing had been approved. Our sample shows that, although small in number, these large companies received a substantial amount of funding, which even increased during the current period ***(Figure*** 12). The companies in question participated in 300 projects under State aid programmes, Horizon 2020 and Horizon
Europe.

Figure 12 | Public funding and own contribution of our sample of 14 beneficiaries



Source: European Court of Auditors, based on information provided by the 14 beneficiaries (situation as of June 2024).

94 At the time of our audit, although the funding expected by the Chips Act had not been Although only partially allocated, the public funds approved for the period 2021-2027 for the 14 beneficiaries in our sample were already four times higher than in the period 2014-2020. However, the scale of private investments compared to the funds received is proportionally lower in the new period than in the previous one. The concentration of funds in a small number of large companies is expected to increase further in the current programming period, given that large projects (pioneer installations and IPCEIs) absorb a large part of the financing. In addition, we can expect an increased concentration of funds in large Member States, due to the high use of State aid-based financing sources, as provided for in the Chips Act.

95 Concentration in a limited number of large companies and large-scale projects is inherent in this capital-intensive industry. Further consolidation may also be beneficial.17 However, the achievement of the strategic objectives of the Chips Act could be significantly disrupted if a major investment were to be cancelled or delayed or fail to deliver the expected results.

The Chips Act competes with the strategies of other global economies

96 The Chips Act is just one strategy being deployed globally to strengthen domestic supply chains amid fears of market disruptions and rising geopolitical tensions. Other countries are also investing in semiconductor research and manufacturing. Figure ***13*** presents an overview, adopted in May 2024, of the main measures planned in the major multi-annual strategies.

[17] Draghi, M., *The future of European competitiveness,* 2024.

Figure 13 | Overview of government incentives in other major regions

* The US dollar amounts were converted to euros using the following exchange rate: 1 EUR = 1.05 USD. 1 $39 billion for manufacturing and $13.2 billion for research and development and workforce development. 2 25% tax credits expected to generate $2.3 billion annually for seven years.

3 Covers manufacturing and assembly, testing and packaging projects announced, launched or completed since 2020.
4 This figure may be lower than the actual total number of sites in China.

Source: European Court of Auditors, based on the BCG and SIA study entitled *Emerging resilience in the semiconductor supply chain,* 2024.

97 The strategies of world economies in the field of microprocessors are often translate into competing goals and actions . While the EU is trying to strengthen its autonomy in sectors such as advanced microprocessors, other global economies are working to maintain their positions of strength or to close the gap in sectors where they are lagging behind ***(Box*** 2).

Box 2

Competing Initiatives in the Global Microprocessor Industry

Initiatives from many countries, including the United States, from Taiwan and Japan, compete directly with the Chips Act, as they place a strong emphasis on research and development of cutting-edge technologies.

The European Union and the United States share similarly ambitious goals for building semiconductor production capacity, with the aim of reducing their dependence on Asian-dominated supply chains and improving their resilience in critical technologies. Both regions have set targets to capture a substantial share of the market, with the EU aiming for 20% and the United States claiming to be on track to reach 30%. of global production by 2032.

Taiwan has launched a program of 300 billion local dollars (8.8 billion euros18) to promote innovation in semiconductors for artificial intelligence, talent development and international investments. The long-term objective is a 40% market share in integrated circuit design and 80% in advanced semiconductors by 2033.

The Japanese RAPIDUS initiative aims to produce 2nm microprocessors by 2027. The United States is investing in semiconductor technologies for the automotive industry, one of the EU's traditional strengths.

98 Several of these strategies support the industry through tax benefits. This
This approach cannot be replicated at EU level, as the granting of tax advantages is a prerogative of Member States (which must, in some cases, notify them to the Commission). We found that some Member States have used tax advantages specifically targeting the microprocessor industry, while others have introduced general schemes, from which the sector has benefited ***(Box*** 3). However, the Commission does not have information on this type of aid. An uncoordinated application of this type of measure would risk creating competition between Member States, which could have the effect of making the granting of tax advantages to the

less effective EU level.

[18] The conversion into euros of amounts expressed in New Taiwan dollars is given for information purposes only, using an exchange rate of EUR 1.00 for TWD 34.145.

Box 3

Examples of tax benefits granted to the microprocessor industry in the EU

Italy provides various tax incentives to the semiconductor industry as part of its broader strategy to strengthen the sector. For example, in response to the Chips Act, tax credits of approximately €0.5 billion were introduced in 2023 and will be maintained until 2028 for research and development activities in the field of microelectronics.

In the Netherlands, tax breaks totalling €3.1 billion were granted to the two semiconductor companies between 2018 and 2022, which compares with the €66 million paid on average each year by the EU to the sector between 2015 and 2022.

In Germany, a tax reduction scheme for the energy sector exempted large energy consumers (including semiconductor manufacturers) from network charges. However, the Commission considered that this measure was incompatible with the internal market and requested the Member State to recover the aid granted.

99 Furthermore, although the Commission has analysed global strategies in a certain
To this extent, the industrial landscape has continued to evolve since the development of the Chips Act. Since its launch, other global economies have announced major initiatives impacting investment attractiveness and aimed at increasing their market share. In addition to the subsidies provided for in their own *Chips Acts*
(Figure 13), the United States has allocated, in 2022, an additional 280 billion dollars (267 billion euros) over 10 years under the *Chips and Science Act.* Of this amount, $200 billion (€190 billion) was earmarked for scientific research and PDI activities, as well as workforce development and the creation of regional technology hubs.

[19] Omnibus Decree – DL No. 104, August 10, 2023, Article 5.

100 Although the semiconductor industry is a dynamic environment, competitive and rapidly evolving, we note that the Chips Act and the measures it provides are not subject to regular reassessment in the light of emerging developments in the industry or in response to competing strategies. The Commission is required to submit the first evaluation and review of the Semiconductor Regulation by September 2026. Negotiations on the next Multiannual Financial Framework are scheduled to start in 2025-2026. In other words, the strategy is likely not to have been evaluated and reviewed in time to determine and adapt the necessary funding. The development of the post-2030 strategy should start early enough to be well-founded and operational in time.

Other factors are crucial to achieving the objectives of the Chips Act

101 Other factors also present significant risks to the achievement of the objectives of the Chips Act, particularly where cooperation between the EU and its Member States in the area of policies and initiatives is insufficient.

Dependence on foreign raw materials

102 Some chemicals, substrates and other materials needed for semiconductor production are rare and are not necessarily mined or produced in the EU. This poses a real challenge to the EU's quest for strategic autonomy, as confirmed by the semiconductor manufacturers we interviewed. In this respect, the EU is often worse off than China or the United States. According to a JRC analysis, it remains extremely dependent on foreign imports20, particularly from China, a country which produces 95% of the world's refined gallium.

103 In April 2024, the Raw Materials Regulation entered into force; it establishes a framework to ensure a secure and sustainable supply of critical raw materials.

[20] Cerutti, I., and Nardo, M., p. 38.

Energy needs and costs

104 Semiconductor manufacturing is very energy-intensive; it even consumes more energy than the automotive or refining industries21. If more advanced factories are built in Europe, energy demand and strain on power grids are likely to increase, particularly because newer processes require up to 10 times more electricity than previous technologies.

105 High energy prices in Europe compared to those in force in other regions of the world (for example in the United States) pose additional challenges in terms of competitiveness and require intervention in energy costs and, in some cases, an increase in network capacity22.

Environmental issues

106 Semiconductor production is resource-intensive. In addition to its energy requirements, it consumes large amounts of water and hazardous chemicals. 23 Environmental requirements are therefore an important factor for this industry.

107 At the time of our audit, five EU Member States had proposed restricting the use of several synthetic chemicals in semiconductor production due to their health risks and long-term environmental impact, what the European Chemicals Agency took into consideration in 2024. Furthermore, the European Semiconductor Industry Association has called for certain exemptions from requirements on the use and recycling of chemical substances, arguing that the industry would otherwise be at a competitive disadvantage compared to regions with more flexible policies.24

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21 Alfieri, F., and Spiliotopoulos, C., *ICT Task Force study: Final Report,* Publications Office of European Union, 2023, p. 20.

22 Government of the Netherlands,The *Netherlands to invest €2.5 billion to strengthen business climate for chip industry in Brainport Eindhoven,* March 28, 2024.

23 IMEC, *Vision Paper The green transition of the IC industry,* 2022.

24 European Semiconductor Industry Association, *Towards a more competitive semiconductor industry for Europe.*

108 In the United States, the recent *Building Chips in America Act* was considering revising downwards the environmental requirements for semiconductor projects. As far as the EU is concerned, the Commission intends to propose a new package of measures for the chemical industry for greater clarity and simplification, but it is too early to say whether it will have an impact on the semiconductor industry.

Geopolitical tensions and export controls

109 The global microprocessor supply chain is highly exposed to the effects of geopolitical tensions. For example, Russia's war of aggression against Ukraine disrupted the global supply of neon, which is essential for laser lithography used in chip production. 25 The geopolitical risk to the global supply chain is even more acute due, for example, to the weight of Taiwan (with a giant like TSMC) and China in the semiconductor market ***(Figure*** 3). In this regard, tensions between these two countries across the Taiwan Strait are a persistent source of insecurity for the sector.

110 In our discussions with industry stakeholders and national authorities, we noted some concern about the significant impact that export controls in the EU and other regions of the world could have on the European semiconductor industry because they would result in supply chain disruptions and limited access to critical materials and advanced technologies. Such restrictions increase production costs, delay access to equipment, and impair the EU's competitiveness. Negotiations often take place at Member State level, rather than at the EU level. For example, ASML's exports of advanced equipment to China were restricted following discussions between the United States and the Netherlands. Following US export controls on advanced semiconductors to China in 2022, Japan and the Netherlands agreed to new restrictions in March 2023. 26 The US may want to expand27 these controls to include less advanced machinery and equipment.

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[25] European Commission, JRC, Georgitzikis, K., and D`elia, E., *Rare Gases (Krypton, Neon, Xenon): Impact assessment for supply security* (JRC130349).

[26] *Netherlands to restrict chip exports after US pressure over China threat* | Financial Times, March 8, 2023.

[27] *Chip sector caught in battle of AI versus geopolitics* | Financial Times, July 17, 2024.

111 In January 2024, the Commission published a White Paper on export controls, in which it proposes initiatives to harmonize EU export policies with a view to greater economic security. It calls for a more coordinated approach to replace fragmented national policies and advocates for a regulation on dual-use goods, which would integrate emerging technologies. The Commission also published a White Paper on outbound investment, in which it proposes to re-examine certain investment operations concerning sensitive technologies linked to the production of

semiconductors.

Shortage of skilled workers

112 From our discussions with industry stakeholders and authorities, it emerges that national authorities that the semiconductor sector is facing a significant shortage of skilled workers. This lack of personnel is hampering production, which requires highly specialized experts but also people with lower levels of education28, two categories of labor essential to strengthening chip manufacturing in the EU.
According to forecasts, The global shortage could reach one million skilled workers by 203029.

113 The Chips Act includes skills development among the strategic objectives of the Pillar I, which gives the future competence centres the task of increasing the EU's resources of qualified personnel. The EUROPRACTICE platform, the RETICLES project which is linked to it, as well as the *European Chips Skills Academy* aim to help bridge the gap. More generally, skills development can also be funded through EU budgetary instruments, such as the European Social Fund Plus and the Digital Europe Programme, or through the RRF.

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[28] Document SWD(2022) 147, p. 59.

[29] Deloitte, p. 5.

This report was adopted by Chamber II, chaired by Annemie Turtelboom, Member of the Court of Auditors, in Luxembourg at its meeting of 26 February 2025.

By the Court of Auditors

Tony Murphy
President

Annexes

Appendix I – About the audit

Nature and importance of microprocessors

01 A microprocessor, commonly referred to as a "chip", is a small electronic device Manufactured using semiconductor materials (usually silicon) containing printed or etched electronic circuits and components. Microprocessors play an essential role in everyday life. Consider smartphones, vehicles, healthcare systems, energy infrastructure, mobility solutions, communications technologies, satellites, advanced military applications, and more.

02 According to Moore's Law, Transistor density will double every two years. This rule is a reliable prediction of the industry's evolution. Advanced production technology today uses transistors ranging in size from 7 nm to 5 nm, allowing for many more transistors to be packed onto a single microprocessor. This development results in greater processing power and energy efficiency. The next generation of **cutting-edge microprocessors** will use transistors smaller than 5 nm. Advances are also possible in the materials used to manufacture transistors, such as gallium nitride, which offers greater energy efficiency.
than silicon.

03 Chips can be classified into three broad categories, depending on their purpose:

- **logic microprocessors** for processing complex information intended to perform tasks (e.g. in computers);
- **memory microprocessors** for storing information (e.g. in devices such as laptop hard drives);
- **application-specific integrated circuits,** designed to perform specific tasks in industrial applications (e.g., in the automotive and manufacturing industries).

EU position in the global value chain

04 Over the past 20 years, the EU has increased its manufacturing volume by microprocessors1, but its global market share has declined significantly for all types of microchips, falling to just 9% in 2020, driven by continued growth in global production. In 2021, with EU production facilities operating at full capacity, the Union's trade deficit in semiconductors was nearly €20 billion2. Research in the semiconductor value chain is dominated **by** the United States and Asia, with major contributions from countries such as Japan and South Korea.

The EU plays a notable role through its RTOs and cooperation programmes, focusing on innovation and technological advances.

05 **Logic** microprocessor design is dominated by the United States, with contributions from the United Kingdom, Japan, South Korea, Taiwan and China. The memory microprocessor market is primarily a South Korean and American affair, but Japan, Taiwan and China also play a role.

06 Chip production takes place mainly in East Asia, with Taiwan and South Korea producing advanced microprocessors. The EU favors application-specific integrated circuits **(ASICs)** *and* holds a key competitive advantage in the **production** of equipment for advanced microprocessor manufacturing.

07 The **raw materials** side of the global semiconductor value chain is dominated by China, Japan, South Korea, and the United States, with the EU playing a limited role here, focused on refining niche materials. Similarly, **packaging and testing** are mostly carried out in Asia (led by China, Japan, and Malaysia), with the EU operating primarily in specialized, high-value-added areas.

08 The industry is very capital intensive, which explains why it is dominated by a relatively few leading firms. Global economies compete with subsidies or other incentives to attract private investment.

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[1] Semiconductor Industry Association, *Emerging resilience in the semiconductor supply chain,* May 2024, p. 15.

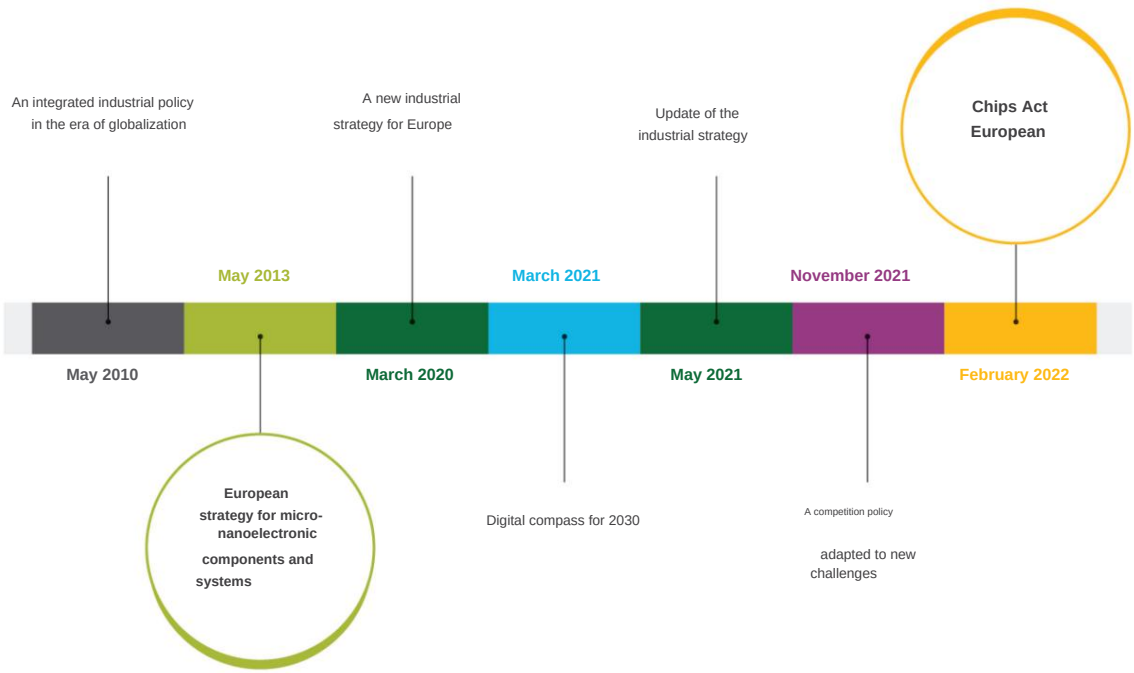
[2] Document SWD(2022) 147, p. 57.

09 In this context, the global microprocessor market is recording growth fast, with annual revenues which, according to forecasts, will grow from $600 billion (€571 billion) in 2022 to more than $1 trillion (€952 billion) by 2030. If the EU does not invest rapidly and massively, its market share could fall below 5%, further compromising its industrial competitiveness and technological autonomy3.

EU policy framework and legislation related to microprocessors

10 Figure ***1*** presents a timeline mentioning the main documents strategic since 2013, including the 2013 Strategy and the Chips Act, which are the two EU strategic documents concerning microprocessors. ***Annex II*** provides further details on these two strategies, as well as other relevant strategic documents.

Figure 1 | Main strategic documents since 2013



Source: European Court of Auditors.

3 European Parliamentary Research Service, *Global Semiconductor Trends and the Future of EU Chip Capabilities,* 2022.

Support for microprocessor strategies: roles, responsibilities and main sources of funding

11 As regards EU funds and public funds, the support provided since 2013 to The microprocessor industry has mainly taken the form of:

- o grants under programs managed directly by the Commission, such as Horizon 2020 (2014-2020 period), but also Horizon Europe and the Digital Europe Programme (2021-2027 period). The Commission is responsible for awarding grants and monitoring their use, with the support of the Semiconductors Joint Undertaking;

- o grants under programmes managed jointly by the Commission and the Member States, such as the European Regional Development Fund. The Commission approves the Member States' multiannual programmes and monitors their implementation. National or regional managing authorities are responsible for selecting and implementing specific projects;

- o grants and other forms of financial support (e.g. guarantees) under programs such as EFSI (2014-2020 period) and InvestEU (2021-2027 period). Projects are selected and monitored by the implementing partner (most often the EIB Group);

- o FRR funds, in the case of Member States which have provided for such investments in their plans, which are assessed by the Commission and approved by the Council;

- o subsidies financed from national budgets (State aid under the IPCEI, pioneering installations and specific cases) for companies selected by the national authorities.

12 **The microprocessor industry** and **private companies** are the main players investing heavily in research, as well as in chip design and manufacturing. Their role is crucial to the success of the Chips Act, which is extremely dependent on private investment in developing production capacity.

13 The **Commission** plays a vital role in the implementation and monitoring of the Chips Act and collaborates with industry and other stakeholders through the Semiconductor Joint Undertaking, which is responsible for implementing the Semiconductors for Europe initiative. It also approves state aid notified by Member States, primarily by verifying its compatibility with the EU internal market, but its responsibilities for monitoring implementation are limited. The **EIB** Group (European Investment Bank and European Investment Fund) cooperates closely with the Commission within the framework of the "Semiconductor" Fund.

14 **Member States** have a crucial role in encouraging businesses to invest in research and production capacity. They manage national and regional programmes financed by the European Regional Development Fund and administer state aid at national level to support these efforts.

Scope and approach of the audit

15 As part of our audit, we aimed to examine the extent to which EU industrial policy supports the strengthening of the strategic autonomy of the European microprocessor industry. To this end, we assessed:

- the design of the Chips Act following the results of the 2013 strategy;
- the alignment of available EU and public funds with the objectives of both the 2013 strategy and the Chips Act;
- the speed of implementation of the Chips Act in relation to the strategic objectives of the EU;
- other factors and risks that may compromise the success of the Chips Act.

16 In our report, we wanted to formulate findings and recommendations which could inform the Commission during the first interim evaluation and the first review of the Chips Act, these documents being expected to be presented to the European Parliament and the Council by September 2026.

17 Our audit covered the period from May 2013 to July 2024. However, where more recent information was available, we used it wherever possible. As part of our audit work:

- we examined strategic documents, legislative acts, documents guidance and reporting, both at EU and Member State level;

- we interviewed representatives of the Commission, the joint undertaking "Semiconductors", from the EIB, the EIF, national authorities and supreme audit institutions, as well as associations and the European semiconductor industry;

- we visited Germany, Italy and the Netherlands. These states members were selected on the basis of criteria such as the presence of semiconductor clusters and their importance for the EU's role in the global value chain, the concentration of large recipients of EU and public funds on their territory, as well as the existence of national digital strategies;

- we spoke with 14 beneficiaries from the industry semiconductors, namely 10 companies (8 chipmakers and 2 equipment manufacturers) and 4 ORTs, chosen because they were among the main beneficiaries of EU and public funds (with a total approved amount of EUR 11.5 billion in public funding – see paragraph 93);

- We selected 10 relevant projects from large beneficiaries – six for the 2014-2020 period and four for the 2021-2027 period – that received funding from multiple sources and represented different links in the value chain. We analyzed the documentation, focusing on the relevant selection process, agreed objectives, implementation progress, results achieved, as well as barriers and challenges encountered (see ***Annex III).***

Annex II – Main strategic documents since 2013

The 2013 strategy

01 Announced at the time by Nellie Kroes, Vice-President of the European Commission, the 2013 strategy1 emphasized the urgent need to strengthen the EU's position in semiconductor production. The Commissioner stated On this occasion: "Europe cannot remain behind while others invest massively in computer chips." For Ms. Kroes, the EU must produce more microprocessors
on its territory than the United States manufactures at home. The strategy highlighted the EU's strengths and weaknesses, considering modest and fragmented investments as a major handicap compared to other global players.

02 The 2013 strategy led to the formation of the Electronics Leaders Group (GLE), which brings together 11 CEOs of major companies in the sector, to establish a roadmap and implementation plan with a 2020 horizon. The GLE focused primarily on strengthening demand, supply and manufacturing capacity, with the stated objective of doubling microprocessor production in the EU and creating 250,000 direct jobs. Key initiatives include the ECSEL Joint Undertaking (which was succeeded by the Key Digital Technologies Joint Undertaking) and the IPCEI in the field of microelectronics, presented in the GLE roadmap as a strategic tool for strengthening EU capacities in this sector2.

1 Document COM(2013) 298.

2 Document SWD(2022) 147, p. 33.

The Chips Act

03 The Chips Act is the EU's response to its stagnation in the global chips market. microprocessors and severe supply chain disruptions due to the COVID-19 pandemic3. Ursula von der Leyen, President of the European Commission, announced this initiative in her 2021 State of the Union address, stressing the need for the EU to give it its full attention. The proposal for a regulation on semiconductors was unveiled in February 2022, as part of the broader package
and the regulation itself came into force in September 2023.

04 The communication relating to the Chips Act explained that, despite advantages in certain sectors, Europe was dependent on imports, making it vulnerable to supply chain disruptions. According to the paper, such a disruption could plunge some industries, such as the automotive sector, into a microprocessor shortage within weeks. Europe also had limited capacity for the production of mature nodes (22 nm) and was absent from the leading-edge microprocessor segment (7 nm and below).

05 The Chips Act aims to strengthen the EU's technological leadership in the field of semiconductors and ensuring a secure supply chain by increasing production capacity and committing to advanced technologies. The objective is "to achieve, by 2030, a share of at least 20% in value of global production of sustainable and advanced semiconductors", which should reduce dependence and capitalize on the economic opportunities emerging in the microprocessor industry. To achieve this, the Chips Act has defined three pillars.

06 ***Pillar I – "Semiconductors for Europe" Initiative*** It was designed to fill the research, development and infrastructure gaps in the EU and thus to strengthen the EU's capacity to operate at the forefront of microprocessor technology. The Key Digital Technologies Joint Undertaking has been transformed into the Semiconductor Joint Undertaking, strengthened and refocused on the strategy's objectives, with a new design platform and new types of experimental pilot lines. New measures have been introduced to address skills shortages and facilitate access to debt and equity for start-ups, SMEs and small mid-cap companies.

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[3] Document COM(2022) 45, p. 1.

07 ***Pillar II – Security of supply*** This pillar aims to strengthen the capacities of EU manufacturing and production. To achieve this, the pillar relies on the state aid revisions of the 2013 strategy, such as the IPCEI and Horizon 2020. The Commission's proposal for a regulation4 specifies the framework for assessing State aid that may be granted under the Treaty on the Functioning of the European Union to promote public and private investment in frontier installations. In the short term (2024-2025), the aim is to consolidate the EU's position and, in the medium and long term (2026-2030), to facilitate progress towards the 20% market share targeted by 20305.

08 ***Pillar III – Crisis Monitoring and Response*** This pillar focuses on the measures to be taken in the event of a crisis in terms of response and monitoring. It aims to establish a coordination mechanism between the Commission, Member States and industry to monitor supply, estimate demand and anticipate future disruptions and crises. The idea is based on two elements:

- a strategic supply chain mapping and tracking system;
- a specific toolbox of measures that can be used when a level of crisis is activated (e.g. targeted requests for information, priority orders and joint public procurement).

Other communications from the Commission relating to semiconductors

09 The **2010 Communication on "An Integrated Industrial Policy for the Globalisation Era"6** emphasised the strategic importance of key enabling technologies, such as microelectronics, nanoelectronics, advanced materials and biotechnology, as key drivers of industrial innovation and competitiveness. It stressed the need to develop a coordinated approach to these technologies at EU level to address the gap in research and commercial deployment.

4 Document COM(2022) 46.

5 Document SWD(2022) 147, p. 82.

6 Document COM(2010) 614.

10 The emphasis on essential generic technologies has directly influenced the 2013 strategy by prioritizing investments and initiatives focused on strengthening EU capacities in microelectronics, considered a key technology, and more specifically on innovation, industrial leadership and the development of the value chain in the Union.

11 **In March 2020, the EU launched "A New Industrial Strategy for Europe"7** with the aim of boosting the twin transitions to a green and digital economy while strengthening competitiveness and strategic autonomy. This document called for support for key strategic technologies, including microelectronics, and laid the foundations for the Chips Act by highlighting the need to reduce strategic dependencies, establish technological sovereignty, and strengthen critical value chains, including that of semiconductors.

12 **In March 2021, the Commission published its communication entitled "A Compass digital for 2030"8,** which gave rise to the decision on the digital decade9 in 2022. This set the objective of ensuring that "production, in accordance with Union law […], of advanced semiconductors in the Union represents at least 20% of global production in value" by 2030, with Member States required to report annually on their progress. Subsequently, the Commission made this ambition the overall objective of the Chips Act.

13 **In May 2021, the Commission launched the updated** 202010 industrial strategy for take into account the impact of the first year of the COVID-19 pandemic on European industry, as well as the vulnerabilities it had revealed. This review was accompanied by in-depth reviews of strategic areas, including semiconductors. The document also announced the Commission's intention to launch an industrial alliance for processors and semiconductor technologies in the second quarter of 2021, with a view to strengthening the EU's capabilities in these areas.
This alliance was subsequently designated in the Chips Act as a key player in the European semiconductor ecosystem, a player that the European Semiconductor Council was called upon to consult.

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7 Document COM(2020) 102.

8 Document COM(2021) 118.

9 Decision (EU) 2022/2481.

10 Document COM(2021) 350.

14 **In November 2021, the Commission published the communication "A policy of Competition adapted to new challenges"11,** which highlights the role of competition policy in supporting the green and digital transitions. It underlined the importance of stimulating innovation, adopting scalable market dynamics and addressing disruptions in critical sectors, such as semiconductors. It also reinforced the importance of IPCEIs and emphasized the need to support innovative semiconductor facilities, which can offer new capabilities to the EU market, by integrating them into the microelectronics sector as frontrunner facilities. The Chips Act builds on these principles to promote investment and innovation and, in doing so, strengthen the EU's strategic autonomy and resilience in the field of semiconductors.

11 Document COM(2021) 713.

Annex III – Overview of the projects examined

01 The **EPIQUS** project under the **Horizon 2020** programme focuses on capacities quantum. Led by an Italian ORT within a consortium of partners from the EU and South Korea, it is a continuation of previous EU-funded research in the field of quantum photonics. Although technical setbacks have delayed its progress, this project responds indirectly to the 2013 European strategy and directly to the objectives of Pillar I of the Chips Act through its fundamental research in the field of cutting-edge technologies, particularly quantum. Its objective is the development of the first revolutionary simulator of quantum mechanical problems in a compact device operating at ~800 nm and at room temperature.

02 The *Advanced modeling and characterization for power semiconductor materials and technologies* **(AddMorePower)** project within the framework of the **Horizon Europe** program focuses on new innovative materials and the 3D integration of power semiconductors.
Launched in January 2023, this project, coordinated by a German ORT, aims to enable the semiconductor industry to transition to advanced semiconductor materials. Its results will likely support the objectives of the Chips Act, which focuses on fundamental research into advanced semiconductor materials and technologies and their application in an industrially relevant environment. It is anticipated that the new materials could be used for chips ranging in size from 1 nm to 10 mm.

03 The **RETICLES** project *(Research, Entrepreneurship, Training, IP-exchange & Chip platform of EUROPRACTICE Services)* under **Horizon Europe** is managed by an EU RTO located in Belgium. It is the successor to EUROPRACTICE, a platform that provides academia and SMEs in the EU with a range of services needed to design, manufacture, assemble and integrate microelectronic circuits. The overall objective of the RETICLES project is to strengthen design capacity in the EU and further lower the thresholds that prevent access to advanced semiconductor technologies. It does not target a specific type of semiconductor or production node: its main objective is to establish open access services enabling affordable prototyping in advanced nanoelectronics and fully assembled systems to support Pillar I of the Chips Act.

04 The **TAKEMI5** project of **the ECSEL joint undertaking** aims at the discovery, development and demonstration of lithographic, metrological, process, and integration technologies to integrate modules for the 5 nm node on a pilot line. It is coordinated by a semiconductor equipment manufacturer based in the Netherlands and is implemented in collaboration with 25 partners. It meets the Chips Act objective of taking leadership in semiconductor technologies. In line with the estimated demand at the time of signing the grant agreement, several tools developed within the project for the production of semiconductor equipment have already been ordered by chip manufacturers located in the United States and Asia. Although we were unable to obtain direct evidence of the number of orders for the EUV tool intended for EU chip manufacturers, we have learned that in September 2023, Intel announced the first use of this technology in Ireland.

05 The **PIN3S** project of **the ECSEL Joint Undertaking** is dedicated to the development and integration of process modules of sufficient maturity, as well as the development of appropriate structuring and metrology capabilities for 3nm nodes and beyond. It is coordinated by a semiconductor equipment manufacturer based in the Netherlands and is implemented in collaboration with 24 partners. It is in line with the 2013 strategy, which aimed to strengthen the EU's strengths, as well as with the Chips Act's objective of leadership in advanced semiconductors.

06 The **ADMONT** project of **the ECSEL Joint Undertaking** established a *“More than Moore”* pilot line that provides a kind of “one-stop shop” to diversify the applications of CMOS (complementary metal oxide semiconductor devices) technology in areas such as smart energy, mobility, healthcare and manufacturing. Led by a German semiconductor manufacturer and implemented in collaboration with 14 European partners (including three German RTOs), this project involved conducting applied research and a first industrial deployment (FID) for applications using 200 mm wafers and compatible with 350 nm chips. Once implemented, the pilot line’s capabilities were demonstrated. The project strengthened EU manufacturing capacity by increasing wafer capacity at an EU *front-end* manufacturing facility by 400% , enabling back *-end* processes from Asia to be moved back to Europe. However, we found that several key performance indicators (e.g., profitability targets) were not fully achieved during the project implementation.

07 One of the **2018 IPCEI** projects implemented in Germany focused on the development of power semiconductors and smart sensors, as well as on their PDI on 300 mm, 200 mm and 150 mm wafer lines. These semiconductors are used, among others, in the automotive industry, consumer electronics and the Internet of Things. The 300mm wafer manufacturing facility took four years to build. The plant became fully operational in December 2020, increasing EU production capacity in the 300mm wafer segment. The beneficiary intends to further develop smart sensor technology for the 300mm wafer plant under the 2023 IPCEI, in line with the objectives of the Chips Act.

08 Another **project under the 2018 IPCEI,** approved by Italy in 2019, focused on R&D and PDI of low-power microprocessors, power semiconductors, and smart sensors. It involves the establishment of a new pilot line for 300 mm silicon wafers for the automotive, satellite, consumer electronics, and computing markets. Once completed, this line is expected to produce 120 nm nodes, with possible further miniaturization down to 22 nm, which is in line with the objectives of Pillars I and II of the Chips

Act.

09 The **Next GEN-7A** project under the **2023 IPCEI,** implemented in the Netherlands, includes R&D and PDI activities on High -*NA EUV* lithography for the production of advanced microprocessors. It aims to develop High-NA EUV technology and apply it to one of the pilot lines of the Semiconductor Joint Undertaking.
Operational from January 2024 to December 2029, this line supports Pillar I of the Chips Act and will undoubtedly contribute to the objective of the digital decade, namely to achieve a market share of 20% by 2030.

10 Investment in Italy in a **pioneering plant,** approved by the Commission in its decision SA.103083, consists of the construction, in the EU, of a first plant for the manufacture of 150 mm silicon carbide substrates for power electronics. With production expected to start in 2027, this site aims to cover between 40 and 50% of the beneficiary's needs for substrates currently purchased outside the EU and, therefore, to strengthen the resilience of the supply chain. The total cost of the project is €730 million, including approved State aid of €292 million granted under the Italian Recovery and Resilience Plan. The beneficiary also plans to invest in a new front *-end* facility for the production of 200 nm substrates in Italy. This investment, with a total estimated cost of €5 billion (including State aid of €2.1 billion), has already been approved as a "pioneer facility". The "integrated production facility" label (point ***87)*** has been requested for this new facility, which will focus on power microprocessors for the automotive industry and is expected to be operating at full capacity by 2032. These two projects are in line with the objectives of pillars I and II of the Chips

Act.

Acronyms, acronyms and abbreviations

BCG: *Boston Consulting Group*

EIB: European Investment Bank

DG CNECT: Directorate-General for Communications Networks, Content and Technology (European Commission)

ECSEL: Electronic Components and Systems for European Leadership Joint *Undertaking*

EFSI: European Fund for Strategic Investments *(European Fund for Strategic Investments)*

ESI Funds: European Structural and Investment Funds

FRR: Facility for Recovery and Resilience

ICP: Key Performance Indicator

JRC: Joint Research Centre *(European* Commission)

nm: nanometer

ORT research and technology organization

PDI: first industrial deployment

IPCEI: Important Project of Common European Interest

SMEs: small and medium-sized enterprises

R&D: research and development

SIA: *Semiconductor Industry Association*

SWD: Commission staff working document

Glossary

State **aid :** direct or indirect support provided by public authorities to a company or organization, which gives it an advantage over its competitors.

Impact analysis: analysis of the probable *(ex ante)* or real *(ex post)* effects of a strategic initiative or other type of action.

Strategic autonomy: the ability to act autonomously in important strategic areas without being too dependent on other countries.

Capital expenditure: long-term expenditure on fixed assets.

Semiconductor ecosystem: A network of companies, organizations, technologies, and processes engaged in the design, manufacturing, testing, and distribution of semiconductor devices.

Joint Undertaking: EU body set up with a partner to carry out a project or an activity in the field of research or industry.

European Fund for Strategic Investments: support mechanism launched by the EIB Group and the Commission, as part of the Investment Plan for Europe, to encourage private investment in projects of strategic importance for the EU.

Wafer: In the microprocessor industry, a thin, flat slice of semiconductor material (usually silicon) forming the base of a chip.

Horizon Europe: EU research and innovation funding programme for the period 2021-2027.

Horizon 2020: EU research and innovation funding programme for the period 2014-2020.

Pilot line: physical infrastructure and equipment required to produce small series of products before commercialization.

Current microprocessor/mature chip: A less advanced microprocessor of 28 nanometers or more, as defined applicable at the time of our audit.

Important Projects of Common European Interest: large-scale projects bringing together knowledge, expertise, financial resources and economic actors from different Member States and creating significant benefits for the EU as a whole.

Chip: An electronic device composed of several functional elements housed on a single substrate of semiconductor material. Also known as an "integrated circuit."

Quantum technology: A type of technology based on the principles of quantum mechanics (the physics of elementary or subatomic particles).

Commission's responses

https://www.eca.europa.eu/fr/publications/sr-2025-12

Calendar

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The audit team

The Court's special reports present the results of its audits of EU policies and programmes or management issues relating to specific budgetary areas. The Court selects and designs these audit activities to maximise their impact by taking into account risks to performance or compliance, the level of revenue or expenditure concerned, expected developments, and political and public interest.

The performance audit covered by this report was carried out by Audit Chamber II (Investments for Cohesion, Growth and Inclusion), chaired by Annemie Turtelboom, Member of the Court. The audit was carried out under the responsibility of Annemie Turtelboom, Member of the Court, assisted by: Éric Braucourt, Head of Cabinet, and Guido Fara, Cabinet Attaché; Gediminas Macys, Senior Manager; Rafal Gorajski, Head of Mission; Manja Ernst, Deputy Head of Mission; Aleksandra Klis-Lemieszonek, Nils Odins, Daniel Tibor, Federica Di Marcantonio and Panagiotis Pavlopoulos, Auditors; Austin Maloney, Audit Support; and Maria Malvezzi, Intern. Graphic design was provided by Alexandra Damir-Binzaru.

From left to right: Federica Di Marcantonio, Gediminas Macys, Panagiotis Pavlopoulos, Manja Ernst, Eric Braucourt, Rafal Gorajski, Guido Fara, Annemie Turtelboom, Austin Maloney and Aleksandra Klis-Lemieszonek.

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Microprocessors play a vital role in modern society, from consumer electronics to defense systems, and their importance is set to grow. The audit covered by this report examines how EU industrial policy has strengthened the strategic autonomy of the European microprocessor industry. We found that, despite reasonable progress in its implementation, the Chips Act will most likely be insufficient to achieve the very ambitious Digital Decade target of a 20% share of global production in value. The EU may have overreached given the Commission's limited mandate and resources, its reliance on Member State action, the level of private sector investment, and other factors, such as energy costs.

We recommend that the Commission urgently compare its strategy with the reality on the ground and begin, in the process, to develop the next strategy in this area.

Special report of the European Court of Auditors submitted pursuant to the second subparagraph of Article 287(4) of the TFEU.

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