CLEPA
European Association of Automotive Suppliers

JUNE 2021

SEMICONDUCTOR MANUFACTURING AND SUPPLY CHAIN RESILIENCE

BUILDING ON STRENGTHS AND CAPTURING OPPORTUNITIES

Executive summary

Disruptions in the supply chain of semiconductor chips, in particular microcontrollers (MCU), has globally delayed the production of 500,000 vehicles and draws attention to the resilience of the automotive supply chain.

CLEPA appreciates the outreach at political level to countries with high semiconductor production capacities to ensure that appropriate capacity is allocated to meet automotive demand. Despite the magnitude of the current supply chain disruptions and successful bilateral interventions at the global stage, CLEPA believes that there is limited space for policy makers to alleviate capacity bottlenecks in the short term with domestic policy. A strategic approach that builds on existing strengths and fosters demand and innovation but maintains the advantages of a global supply chain could in the long run be a basis for enhanced European production capacity and could help automotive suppliers diversify their sourcing.

Advanced processor chips installed in electronic control units (ECU) are essential for the performance of today's vehicles. A modern car may contain 100 ECUs, and 20-40 microcontrollers, controlling functions that range from the essential (such as engine and power steering control) to comfort (such as power windows, seats and HVAC), to security and access (such as door locks and keyless entry). The electrification of the powertrain and the development of connected and autonomous vehicles will only further enforce the importance of semiconductor chips, including the most advanced ones. Europe's automotive industry relies for 60-70% of its chips on production in contract manufacturing facilities in Taiwan and China. Europe has relatively strong automotive chip design capabilities, but the EU's fabless industry specialised in chip-design shrunk by 50% over the last 10 years[1], highlighting the need to reassess supply chain dependencies in the critical area of semiconductor technology.

The current crisis should raise awareness of the opportunities for a policy that builds on the global leadership of the EU's automotive sector to stimulate growth in sectors like the semiconductor industry that are integrated in the wider automotive ecosystem. CLEPA recommends strengthening the EU's economic framework with an industrial and innovation policy framework that plays to the strengths of the EU's industrial sector and increases the region's attractiveness for semiconductor related investment. A strategy will be successful if policy makers and industry build on existing strengths, maintain a global market scale for production and cooperate with industry on the basis of technology openness, ambitious objectives and the right framework conditions.

The competitiveness of Europe's automotive supply chain depends on its integration in the global supply chain and therefore requires an economy that remains open for investment and a trade policy that enhances access to markets for sourcing and export. A robust industrial policy could help address global supply chain risks and counteract distortions of the level playing field in critical areas of value creation, notably semiconductor technologies. It will be critical that policymakers look beyond chip production capacity alone as chip fabrication plants are unlikely to survive without a supporting ecosystem of chip design and application technologies.

[1] Stiftung Neue Verantwortung, April 2021, *The lack of semiconductor manufacturing in Europe*

CLEPA recommends a strategy that:

- Builds on existing strengths, namely a strong European automotive ecosystem and advanced automotive chip design capabilities.
- Creates the right conditions for private sector investments, stimulated by strategic, determined and substantial public investment.
- Invests in a skilled workforce and leading research ecosystem.

EU automotive sector strengths will be at the basis of a successful semiconductor strategy

Automotive is responsible for 37% of the demand for semiconductors in Europe[2], compared to 10% globally, highlighting that a successful strategy to foster a strong European industry for microelectronics should build on a central role for automotive suppliers.

The European Commission has rightly identified connected and autonomous vehicles (CAVs) as a strategic cluster that offers the EU economy a significant potential to expand its economic and innovative power. Ecorys concluded in April 2021[3], in a study requested by the ITRE committee of the European Parliament, that Europe is well-positioned to take a leadership position in the market of CAVs due to its strong legacy and innovation in Advanced Driver-Assistance Systems (ADAS) and Cooperative Intelligent Transport Systems. This leadership can be illustrated by the fact that roughly 60% of all global patents in autonomous driving and an estimated 68 to 70% of CAV innovations come from European suppliers.

ADAS increased the value share of electronic and semiconductor systems to 35% of a car's cost and this is likely to increase to 50% with the further development of CAV technologies. An accommodative policy framework that allows the EU automotive supply industry to expand its leadership on CAV technologies will result in higher demand for more advanced semiconductor chips and increase the EU's attractiveness as a location for investment in chip design and semiconductor production capacity. The critical role of the automotive industry is further accentuated by leading the application of industry 4.0 in its manufacturing process and the demand for advanced chips that will be linked to this development. Deloitte[4], in 2019, identified industrial electronics and automation as one of the leading drivers of demand growth for semiconductor revenue, next to automated driving technologies and electrification of automotive powertrains.

[2] The European Semiconductor Industry Association, website, 25 May 2021
[3] Ecorys, March 2021, *Impacts of the COVID-19 pandemic on EU industries*
[4] Deloitte, April 2019, Semiconductors, the next wave

Market demand and global scale will be crucial for competitive production

Businesses will have to review their supply chains and undertake appropriate action to reduce vulnerabilities where appropriate. Nevertheless, a globalised supply chain offers advantages that are critical for the competitiveness of Europe's automotive industry.

The high investments required to design chips and to build and operate a chip fabrication plant highlight the need for specialised products to be produced for significant markets. A certain degree of global specialisation is therefore likely to remain logical. Designing a 5 nm chip costs about $540 million for everything from validation to IP qualification. That is well above the $175 million required to design a 10 nm chip and the $300 million required for a 7 nm chip[5]. Semiconductor fabrication plants require an estimated 90-95% capacity utilisation to be profitable highlighting the need to produce at a global scale and the importance that investment plans are grounded in concrete business cases rather than protectionist policies. Automotive suppliers will depend on competitively priced semiconductor technologies to remain competitive in the global marketplace.

Nevertheless, a more volatile trade environment and less stable geopolitical context do invite industry and policy makers to reassess the resilience of the supply chain and disproportionate dependence on single countries or regions. Furthermore, research suggests the effects of a non-level playing field and the role of state subsidies in reducing attractiveness of the EU should be carefully assessed and addressed. BCG research from September 2020[6] suggests that government incentives can offset 15%-40% of the total cost of ownership of a chip fabrication plant, impacting the competitive position of the EU. Government incentives to help fund innovative products for which a sizeable European market exists or is likely to develop are therefore likely to play an essential role in allowing the EU to increase production capacity.

The EU should increase its engagement with likeminded trade partners and conduct a WTO compliant review of supply chains to avoid singular, geographic dependencies, but should avoid calls to establish autonomy, as strengthening resilience will require diversified sourcing. The announcement by the US and Japan to cooperate on sensitive supply chains, including semiconductors, and on the promotion and protection of critical technologies could serve as an example.

[5] McKinsey, August 2020, *Semiconductor design and manufacturing achieving leading edge capabilities*
[6] BCG, September 2020, *Government incentives and US competitiveness in semiconductor manufacturing*

Innovation will benefit from technology openness and cooperation between stakeholders

Most of the current automotive demand is for advanced microcontrollers. Automotive MCU's typically rely on process nodes below 40 nanometres, produced from 200 mm and 300 mm wafers. Market trends in the automotive industry, including automated and connected driving solutions, battery management systems and performance optimisation, are likely to lead to more demand for smaller nodes, with most demand expected to be between 16 and 40 nanometres.

Most fabrication plants would be able to switch production between node sizes in that category. It is less clear if automotive will create sufficient demand to run a specialised fabrication plant for chips smaller than 10 nanometres and it is less likely that the same fabrication plant can cater for both node size range.

The most advanced driving assistance systems currently being developed focus on chips with nodes of 7 to 5 nanometres that handle sensor data, vehicle-to-vehicle communication, and predictive analytics. These developments, including the further uptake of industry 4.0 and automation of production, could create a market to support European production of smaller nodes in the longer term. Assessments on when autonomous and near-autonomous vehicles will be launched vary, but technology is ready, and the real bottleneck is likely to be the state of existing infrastructure and regulation. In this context, the EU will be the first region of the world to adopt a legal framework for the mass-market approval of automated and fully automated vehicles, already in 2021. Several automotive and tech companies have already deployed autonomous and near--autonomous vehicles on EU roads. The first autonomous shuttles with level 4 are operating in the EU today and vehicles with advanced Level 2 autonomous driving capability are already on the market. The latest announcements indicate that the first Level 3 highway systems will hit the market at some point from 2021 to 2024[7]. Two to three years later, companies will probably upgrade their vehicle systems to Level 4. The increased market uptake of autonomous vehicles and the need to improve energy efficiency could create a market for chips with nodes of 3 or even 2 nanometres, but it cannot be ruled out that innovation focus will switch to optimisation of architecture or hardware-software co-design.

More importantly, there is more innovation in semiconductor technologies than can be expressed in the size of nodes alone. Policymakers should therefore also consider support of innovative production methods (carbon-neutral production, application of artificial intelligence in design and production[8]) or innovative applications, for instance in battery management. Innovation in other semiconductor domains, such as semiconductor sensors and efficient power-electronics will continue to be of major importance for our sector as well and areas where the EU automotive industry is globally competitive. CLEPA traditionally argues for a technology-open approach with regard to the question of what the focus of innovation in semiconductor technologies should be. A policy that supports a strong ecosystem of semiconductor application technologies, chip design and potentially production should go hand in hand with a policy seeking to enhance European chip production capacity.

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[7] McKinsey, December 2020, *private autonomous vehicles, the other side of the story*

[8] McKinsey, April 2021, *Scaling AI in the sector that enables it, lessons for semiconductor device makers*

Four recommendations to strengthen supply chain resilience and capture opportunities of a digitalising economy

- **Building on existing strengths:**

  - Policy efforts to accelerate the development of application technologies such as autonomous and connected driving will play a critical role to grow demand and attract private investment in the semiconductor sector. R&I funding for projects such as the CCAM and 2ZERO partnership are examples of projects that could further cement the EU's technological leadership in CAV and strengthen the industry's position in low emission technologies. CLEPA is fully supportive of the objectives of the CCAM Partnership, however, its current funding is much too low (500 million euro over 7 years) to provide real support to European research. Similarly, the Commission's intention to launch an IPCEI on CAV can be beneficial and provides a real impulse towards achieving the European vision.

  - Strategic public procurement and support for local projects to experiment with new mobility solutions for urban traffic and freight transport could further support industry players to develop target-oriented solutions that could eventually be scaled at a global level and cement technological leadership and create clusters attracting private semiconductor investment. With autonomous driving technology advancing quickly, cities could become a bottleneck. Experts warn most cities may not be ready until 2030 if no systematic efforts are undertaken[9]. This highlights the role public actors may have to play to ensure new technologies can get to the market.

  - Investments in Europe's digital infrastructure will be crucial to allow for the market uptake of CAV technologies and could potentially present a market of sufficient scale to support bigger European semiconductor production capacities.

- **Creating the right conditions for private sector investment:** Standard setting in the areas of the Internet of Things, CAV and the creation of a regulatory framework that could help embed advanced driverless technologies will further support market development. The harmonisation of the EU's fragmented patent system could further increase the attractiveness of investments in R&D&I in both application and semiconductor technologies.

[9] BCG, 8 July 2020, *Can Self-Driving Cars Stop the Urban Mobility Meltdown?*

- **Investing in a skilled workforce and a leading research ecosystem:** Private sector developments should be linked with a strong ecosystem of public and private research hubs and the EU has catching-up to do when it comes to activities of importance for the digital economy. The EU underperforms China and the US in the number of leading universities on AI and computer science degrees per million inhabitants and more EU citizens with a PhD degree work outside the EU than the number of non-EU PhD's working in the EU[10]. The availability of a skilled workforce will be both necessary to develop applications of advanced semiconductor technology and create sufficient demand. Skills will also play a critical role to attract investment in semiconductor chip production. Whereas in automotive components as a whole proximity to markets and customers influenced 42% of investment decisions since 2010, for semiconductors proximity to customers was with 23% less important than availability of skilled workforce, which was the leading motivation for 65% of investment decisions. The availability of a skilled workforce plays a key role in investment in the overall automotive supply industry too, being the primary motive for 42% of investments[11].

- **Proving public investment and access to finance:** Appropriate funding and access to finance for innovation and innovative production methods of semiconductor technologies will be fully effective if the right conditions to attract private investment have been established. The IPCEI framework to enable state aid for research, development and innovation and first industrial deployment of products with high R&D&I content or of a fundamentally innovative production process could support investment and further expand the EU's specialisation in automotive semiconductor technologies. The Joint Undertaking of Key Digital Technologies offer opportunities for effective cooperation between the private and public sector in developing the chips of the next decade.

Would like to know more? You can contact:

CLEPA's Trade & Market Affairs Manager

Nils Poel at n.poel@clepa.be

[10] Bruegel, August 2020, *Europe has an artificial intelligence skills shortage*

[11] CLEPA analysis of FDI markets data of foreign direct greenfield investment in semiconductors and automotive components

CLEPA, the European Association of Automotive Suppliers, represents over 3,000 companies supplying state-of-the-art components and innovative technologies for safe, smart, and sustainable mobility.

CLEPA brings together over 120 global suppliers of car parts, systems, and modules and more than 20 national trade associations and European sector associations. CLEPA is the voice of the EU automotive supplier industry linking the sector to policy makers.

- The automotive sector accounts for **30% of R&D** in the EU, making it the number one investor.
- European automotive suppliers invest over **30 billion euros** yearly in research and development.
- Automotive suppliers register over **9,000 new patents** each year.
- Automotive suppliers in Europe generate **1.7 million** direct jobs.

CLEPA

Cours Saint-Michel 30g,

1040 Brussels, BELGIUM

www.clepa.eu

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