RECONNECT CHINA

POLICY BRIEF 6

— November 2023 —

Policy Orientations on EU-China Relations in Semiconductors: An outlook on bilateral and multilateral agendas

Raquel Jorge Ricart

The international agenda on semiconductors is not only a matter of U.S.-China rivalry. Also the EU plays a major role, in terms of economy, industrial policy and security. Moreover, jointly with EU institutions, each Member State needs to decide which approach to semiconductors, to China and to global technology governance it aims to undertake. Semiconductors have been embedded through an economic security outlook. However, this area cannot be only addressed on a bilateral basis. The understanding of how the EU's own technology partnerships with third countries is framed will provide policy guidance on how the Union may approach China, in their own mutual relationship and in how both sides reflect their own agendas within international fora and multilateral dialogues where semiconductors play an increasingly strategic role.

ASSESSMENT OF GLOBAL SEMICONDUCTOR SUPPLY CHAINS

For decades, **governments have developed digital agendas, but semiconductors were hardly a central element in any strategy**. However, the COVID-19 pandemic triggered an unprecedented digital transformation across services, sectors and applications, as well as a new rethinking over the disruptions and shocks in semiconductor supply chains that a large number of industries depend on, from the automotive industry to shipping and medical devices.

If the European Union accounted for 25% of chip manufacturing worldwide in 2000, in 2022 it accounted for only 8% [1] **.** The EU has several significant players, such as the Belgian research and development institute IMEC, Dutch ASML that produces extreme ultraviolet lithography machines and equipment, or Infineon and STMicoelectronics that are relevant for specific markets such as power semiconductors. However, the EU's market footprint is still limited in the global semiconductor value chain.

Other, non-European players have major roles[2]. The United States leads most of the research and development, fabless companies, integrated devices machines (IDMs) and a part of the high-technology equipment manufacturing. Japan leads in the stage of materials (which is at the high-end supply chain). Meanwhile, Taiwan leads in

Outsourced Semiconductor Assembly and Test (OSAT) and in foundries. The most important and edge foundries are based in Taiwan and South Korea, while chip testing and packaging services are in Taiwan and Malaysia. While OSAT is at the lower-end in the value chain, it represents a major chokepoint that may produce blockages and disruptions further downstream if OSAT is not duly produced or distributed across all dependent companies.

CHINA'S MULTIFACETED STRATEGY

In this deeply fragmented global value chain of semiconductors, China's overall market presence is divided in two blocks. On the one hand, China has certain leadership in trailing-edge (20-45nm) and mature nodes (>45nm), or in other words the older generation of semiconductors which is still essential for basic goods such as domestic appliances. On the other hand, its market share and profitability are still low in high-end semiconductors, which have become the core of the current geopolitical competition. While the country hosts most of the critical raw materials that are necessary for chip manufacturing, such as gallium and germanium, no Chinese company has a leading role in any of the sub-stages of the value chain in high technology.

While it remains essential to not overlook the older generation of semiconductors because they feed traditional industries, this paper focuses on cutting-edge, highly advanced semiconductor value chain (<17mn).

China's main import item are semiconductors ($33 billion per year), which in 2015 for the first time surpassed oil as the country's largest import. At the same time, China is also the largest global consumer of semiconductors (representing 40% of global semiconductor sales). Although its fabrication capacity grew to 24% in 2021, and it has attained relevant >7nm chip-making capabilities since the injection of national public funds into Chinese companies, the share of fabrication capacity for the most competitive chips is located in other countries. Chips with <3nm are mostly produced in Korea and Taiwan; chips between 5nm and 7nm are mostly manufactured in Taiwan, Korea and (increasingly) in the United States. Chinese firms tend to produce chips from 7nm to 16nm, but still their share is low.

The country has approached semiconductors through a number of initiatives drawn from the government's industrial policy. Based on the Made in China 2025 strategy, and the "National Guideline for the Development and Promotion of the Integrated Circuit Industry" by the State Council in 2014, the Chinese government has aimed at reducing import reliance in the Chinese chip industry. Concretely, two integrated circuit funds (Big Funds) have been channelled at the national level, in addition to at least 15 local government funds at the city and provincial levels. Both national big funds and local government funds reportedly accounted for USD 150 billion in a six-year timeframe from 2014 to 2020. Government-supported funding is accompanied by government grants, low-interest loans, and tax incentives (such as tax breaks and below-market rates).

Type of government-backed investment	Funding	Administrative level
First National Big Fund	USD 21 billion	National
Second National Big Fund	USD 35 billion	National
15 local government funds	At least USD 25 billion	City and provincial
Government grants, tax incentives and low-interest loans	USD 50 billion	National

Source: Own elaboration by author based on HKUST IEMS[3] (2022) and Bruegel[4] (2022)

However, these initiatives are not only related to making industrial ecosystems grow and become increasingly competitive in economic terms. These funds also highlight the growing interest by Xi Jinping in **embedding technology as a strategic asset of a broader comprehensive security concept.** Framed through the Global Security Initiative[5], this broader concept aims to serve as an umbrella under which Beijing builds a diplomatic and security architecture globally through multilateral and plurilateral coalitions. It refers to policy areas from transnational crime and drug trafficking, to public health, climate change, cybersecurity, artificial intelligence, and biosecurity.

China's high dependence on third countries, mostly Japan, Taiwan, Korea, and the United States, has increasingly entangled it in a web of chokepoints. Since the start of **U.S.-led sanctions**[6] towards Chinese companies in May 2019, export limitations, interrupted licenses and specific restrictions have evolved from a partially tight regime where specific Chinese entities in certain technology areas were sanctioned with temporary blockades from 2019 until August 2020, to a scenario where there are greater levels of sanctions towards more Chinese firms, more sectors and with shorter compliance timeframes.

The latest, and strictest, change happened in October 2022, when the U.S. decided to (1) target all Chinese and foreign entities, (2) add new layers of banned products (advanced computing chips, computers and related equipment and supporting software equipped with advanced computing chips, specific chip manufacturing equipment), (3) expand the restrictions on items from <10nm chips (with the threshold set by the December 2020 sanctions) to new types of nanometres (<16 and <14nm chips, <18nm or lower memory chips, 128 layer NAND), and, (4) for the first time ever, ban U.S. persons and foreign firms using U.S. technologies from supporting China's chipmakers in these aforementioned categories.

Although Chinese firms are not yet the leaders in the value chain, specific companies such as Huawei and HiSilicon had gained ground as top global semiconductor equipment makers. Due to sanctions, they have reduced their fabless market share in China. Likewise, an overlooked but important issue is the **"snowball effect" of semiconductors bottlenecks towards other major technology sectors where China is becoming a worldwide leader**. Concretely, the sanctions on Graphic Processing Units (GPUs) and other application-specific integrated circuits (ASICs) that are limiting the production of semiconductors in China are also having an impact[7] on the design and training of generative AI systems, which largely depend on the computing power that GPUs and ASICs trigger. As Large Language Models (LLMs) grow larger and more sophisticated, the access to semiconductors that may manage large dataflows is needed.

Amid this assessment of direct and indirect effects on China's technological power, President Xi Jinping has launched what is called the **'Xiconomics' approach**[8], that has gained relevance in recent years. While in the past the focus was put on markets reform to enhance economic competitiveness, an increasing emphasis has been put on concepts such as "security" and "science and technology" as elements to achieve the competitive edge. These have fed what the government mentioned for the first time in 2020 as the "dual circulation" strategy, which aims to expand domestic demand and increase domestic growth (internal circulation), while reducing dependence on foreign markets, but remaining open to the outside economy by keeping an export-oriented development strategy (external circulation)[9].

A clear example is how China has imposed restrictions [10] from August 2023 on exports of gallium and germanium, silvery-white metals that are necessary for electronics, including semiconductors, smartphones, fibre optics, solar panels, camera lenses, space systems and pressure sensors. Invoking "national security interests", the Chinese Ministry of Commerce will require companies to first obtain an export license to sell products containing these two materials.

This counter-response is particularly relevant because China plays an overtly dominant position globally in these two raw materials, producing between 80-95% of the world's gallium[11] and 60% of germanium[12]. While China's initiative is primarily a reaction to U.S.-led sanctions, other actors, such as the European Union, also have certain positions of dominance in the geopolitics of semiconductors and may be equally affected.

THE ROLE OF THE EUROPEAN UNION AND MEMBER STATES

Although IMEC and ASML have long been leading companies worldwide and have represented the bulk of European leadership in the global value chain, semiconductors were not a "political element" of policy discussion in the EU until the 2021 State of the Union speech[13] by the President of the European Commission Ursula von der Leyen. At that time, the Commission President set the vision for Europe's strategy to jointly create a connected, larger, and more sophisticated European chip ecosystem, in research, design, testing and production.

When the EU announced in February 2022 [14] a proposal for a Chips Act, a legislative instrument that would subsequently lead to binding obligations and requirements, the main reaction came regarding the overt reference to the possible usage of subsidies, which received admiration, but mostly criticism. U.S. associations rejected the idea of state aid to strengthen a technology sector that, according to their opinion, needed to be marked by the offer-and-demand dynamics of the market. However, months later, in August 2022[15], the U.S. Congress passed the Chips and Sciences Act, which provides $52.7 billion for American semiconductor research, development, manufacturing, and workforce development. This includes $39 billion in manufacturing incentives, including $2 billion for the legacy chips used in automobiles and defence systems, $13.2 billion in R&D and workforce development, and $500 million to provide for international information communications technology security and semiconductor supply chain activities.

In the EU, the Chips Act was approved and entered into force in September 2023, and aims to mobilize more than €43 billion of public and private investments. Its three pillars of action are: (1) the "Chips for Europe Initiative" (to set up a Design Platform, develop pilot test lines, develop quantum chips, establish a network of competence centres across the Union, and facilitate access to debt financing and equity, for start-ups, scale-ups, SMEs and small mid-caps); (2) a framework to guarantee the security of supply and resilience of the sector; and (3) a coordination mechanism to ensure complementarity across the Commission, Member States and stakeholders.

The EU, the U.S. and China are all providing public support to semiconductor companies to ensure their competitiveness. In the case of the EU, state aid is provided when the market cannot deliver alone, and when the criteria comply with three principles: state aid must be proportionate to needs, must have a pan-European effect (not leading to geographic inequalities across Member States), and must be non-discriminatory.

Second, the EU Chips Act and other industrial policy mechanisms, such as the Important Project of

Common European Interest (IPCEI) or the Joint Undertaking, go beyond an economic orientation and aim to make Europe competitive in global trade. Also, an important pillar is to contribute to Europe's security of supply. To do so, the EU has provided the definition of two types of facilities to be fostered within the territory: "open EU foundries" (OEFs), which are facilities that design and produce components mainly for other industrial players; and the "integrated production facilities" (IFSs), which are factories that design and produce components that serve their own market. If these facilities are considered as "first of a kind" in Europe, they may benefit from access to fast-track permit granting in the Member States for state aid to build up and operate these facilities. They also may have prioritized access to pilot lines, which are platforms[16] for process development, testing and experimentation for European research and development with an industrial perspective to pass from the lab to the fab.

While IFSs are being approved in some of the aforementioned countries, **open EU foundries have awakened a debate on which "other industrial players" EU facilities should devote their efforts to for exporting their products**. China is front and centre in this debate. In June 2023, The Netherlands' government announced[17] restrictions on exports of some semiconductor equipment, following the U.S.-led sanctions regime towards high-tech components to China. Based on "the interest of national security", Dutch companies such as ASML[18], which is a worldwide leading company in supplying the printing machines to produce chips, are required to seek a license before they can export their DUV lithography systems. The list of restrictions resulted from a triple negotiation between the U.S., the Netherlands and Japan, which also joined the regime.

The unilateral decision from one EU Member State to join a third country's sanctions regime towards China **triggered an internal discussion on the actual level of comprehensive, fully-fledged coordination and cooperation across EU Member States on technology issues.** While the Netherlands' decision to join the U.S.-led export control regime is valid by law (sanctions criteria is agreed at the EU level, but its implementation and interpretation depends on national considerations), it signalled the degree to which an actual implementation of collective measures in the EU is needed.

During the same month, the EU launched its proposal for an Economic Security Strategy[19], which aims to **address the economic security risks derived from certain economic flows and activities that may remain vulnerable or threatened in the current scenario of geopolitical tensions and accelerated technological development**. The strategy is based on a three-pillar approach, or three Ps: promotion of the EU's economic base and competitiveness; protection against risks; and partnership with countries with shared concerns and interests. The four areas that require risk assessment are: resilience of supply chains, including energy security; physical and cyber-security of critical infrastructure; technology security and leakage; and weaponization of economic dependencies and coercion.

One of its first deliverables has been the **proposal for a list on critical technologies** [20], which encourages Member States to provide their risk assessments and lead to a collective work to determine which proportionate and precise measures should be taken to promote, protect and partner in specific technology areas. Out of the 10 technology areas, the first top-tier priority is advanced semiconductors (including microelectronics, photonics, high frequency chips, and manufacturing equipment).

The main question mark is how each Member State, when developing their national risk

assessments to be sent to the European Commission before the end of 2023, will address semiconductors: as a security risk, threat or challenge; as a purely economic issue; or as a topic that needs to be addressed only through regulation (namely, the Chips Act). As it has occurred with other proposals, such as 5G Cybersecurity Toolbox, Member States may have different political, security and market approaches to the same issue.

Another relevant point is the fact that **neither the Economic Security Strategy nor the list on critical technologies makes any reference to China**. However, since early 2023 the President of the European Commission has promoted the European approach to de-risking, which aims to keep away from the decoupling issue with China. Although the de-risking approach was initially criticized by some countries that considered the EU's approach to China as not being assertive, the United States eventually picked up the same discourse, as reiterated by the National Security Advisor, Jake Sullivan.

DYNAMICS AND CHALLENGES IN THE EU-CHINA SEMICONDUCTOR RELATIONSHIP

Although China and the European Union do not have massive, major leading companies in the highest stages of the global semiconductor value chain, it is important to note that each of them possesses individual strengths in specific stages of the chain that make others dependent on them.

On the one hand, China has a dominant position in critical raw materials for semiconductors, namely gallium and germanium, which the EU's goals on green and digital transition by 2030 depend on to a large extent. The EU has pushed towards a Critical Raw Material Act proposal[21], which establishes benchmarks on domestic extraction, processing, and recycling of an identified list of strategic raw materials to be discussed. In 2023, the EU designated 34 raw materials as "critical"[22], based on an assessment of economic importance and supply risks for the EU.

For more than a decade, the EU has participated in multilateral debates with like-minded countries on how to secure supplies of critical raw materials. A U.S.-Japan-EU trilateral forum on the topic was established in 2011, for instance, and recently enlarged to include Australia and Canada[23]. All sides of the forum confirmed that their respective countries and regions will continue to advance collaborative efforts toward securing a stable supply of critical materials[24]. In 2023, the EU proposed the creation of a Critical Raw Materials Club for all like-minded countries willing to strengthen global supply chains, the role of the World Trade Organization, and the push on enforcement to combat unfair trade practices. It is not by chance that, after China's export restrictions on gallium and germanium, a European Commission spokesperson urged[25] China to base its trade policy on security considerations in line with the WTO.

Meanwhile, the implementation of Dutch sanctions to Chinese companies constitutes a major chokepoint for Chinese producers. **What remains to be known is the impact of this decision on how other EU Member States partner with Chinese companies in semiconductors and other technology areas**. Currently, Europe produces only 10% of the world's chips, primarily for industrial and automotive applications. In design, Europe has no capacity to design cutting-edge chips and accounts for only 2% of the global market for chip design outside of companies that both design and produce chips[26].

In turn, EU Member States have different capacities as well as attitudes towards China's geopolitical influence. Taiwan is a major provider of semiconductors on the global market, but the way each country approaches Taiwan politically may change their own national relationship with China's industrial ecosystem. For instance, after Lithuania's invitation for Taiwan to open a representative office under the name of Taiwan (Embassy) instead of Taipei (which has long been the standard across Europe as Taipei Trade Offices), China imposed blocks on Lithuanian exports and pressured companies to remove Lithuanian components from supply chains when exporting to China. This situation reinforced the need for the Anti-Coercion Instrument (ACI) [27], which the EU was already proposing based on the considerations that the U.S. Administration led by former President Trump and Türkiye used trade as a political tool as well. The issue with China and Lithuania sped up the process and explained a greater focus on China as well.

Beyond the Taiwan question, the **latest chip bans from the U.S. may have a strong impact on the ease for EU companies to partner with Chinese companies**. The October 2022 sanctions restricted U.S. persons from supporting China's chipmakers, as well as restricting foreign firms using U.S. technology from partnering with Chinese counterparts. Some EU companies designing or producing semiconductors have shareholders from U.S. firms, or some of their high-level managerial members may be originally U.S. citizens. Likewise, the increasing investments that U.S. companies are injecting in the EU – for instance, Intel in Germany – may limit the ways in which EU companies can partner with Chinese firms.

Additionally, **the EU has been developing its own bilateral technology partnerships with like-minded countries that also frame the scope of the bilateral relationship with China**. Concretely, the EU has launched in recent years the EU-US Trade and Technology Council (TTC) [28]. The TTC's working group on semiconductors has been one of the most productive, completing a joint early warning mechanism for supply chain disruptions, establishing a transparency mechanism for reciprocal sharing of information about state aid, and facilitating exchanges on best practices. The launch of the EU-India TTC [29] in May 2023 also outlines the interest in coordinating policies on strategic semiconductors through a dedicated Memorandum of Understanding. India aims to become a chip powerhouse in the Asian region and is proposing that U.S. companies move their offices to their territory after sanctions on China. The EU-Republic of Korea Digital Partnership Agreement[30] calls for ensuring transparency in the area of subsidies and avoiding distortions of competition in the market. Announcements on cooperation with Japan[31] in this area have also been made[32], though progress has yet to be made public. The Digital Partnership Agreement with Singapore [33] focuses on ensuring transparency and avoiding distortions with subsidies, as well as guaranteeing supply chain resilience vis-à-vis global shocks.

In other regions, semiconductors remain an under-addressed issue in the EU's initiatives, such as the Digital Alliance with Latin America and the Caribbean as well as the different digital agendas with the African continent and specific African flagship countries. China's Belt and Road Initiative has made a major footprint in these two regions, and the EU should see that semiconductors are part of broader efforts to upgrade relations.

There is no doubt that the international semiconductor agenda is more than a matter of U.S.-China rivalry. The EU plays a major role, in terms of economy, industrial policy and security. Moreover, jointly with EU institutions, each of the Member States needs to decide which approach to semiconductors, to China and to global technology governance it aims to undertake. Semiconductors have been embedded through an economic security outlook. However, this area cannot only be addressed on a bilateral basis. **The understanding of how the EU's own technology partnerships with third countries is framed will provide policy guidance on how the Union may approach China,**

in their own mutual relationship and in how both sides reflect their own agendas within international fora and multilateral dialogues where semiconductors play an increasingly strategic role.

Raquel Jorge Ricart *is Policy Analyst on technology policy and international affairs at Elcano Royal Institute think tank. She is a former Fulbright Fellow in Washington DC and Harvard University's Berkman Klein Center for Internet & Society. She has previously worked as independent expert for the European Commission's Joint Research Centre, the Spanish Ministry on Foreign Affairs elaborating the national strategy on technology and global order, and at a UK-based consultancy firm.*

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Funded by the European Union