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Strengthening Sovereignty in the Era of Global Value Chains

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Résumé

La crise sanitaire engendrée par le Covid-19 et plusieurs exemples de pénuries (tel que les semi-conducteurs) ont révélé la fragilité de certains approvisionnements reposant sur des chaînes de valeur mondiales. Si la réduction des stocks et la forte spécialisation de la production à l'échelle mondiale peuvent être sources d'économie, ces optimisations appréciables en temps normal ou pour des produits non stratégiques montrent leurs limites en cas de crise majeure. Les ruptures d'approvisionnement, comme certaines pressions ou ingérences étrangères, ont réveillé dans de nombreux pays les ambitions d'indépendance et de souveraineté ainsi que les volontés de relocalisation. Dans le même temps, ces États, les instances internationales auxquelles ils participent ainsi que de nombreux économistes continuent de promouvoir un approfondissement du commerce international et l'intégration des chaînes de valeur.

Dès lors, comment réduire les vulnérabilités induites par ces chaînes de valeur mondiales pour être plus indépendant, tout en tenant compte de la réalité de ces processus productifs qui génèrent justement des interdépendances ? Le maintien ou le renforcement de la souveraineté nécessite de trouver un équilibre entre les gains permis par l'optimisation des chaînes de valeur mondiales et les risques de dépendance qu'elles génèrent. Plusieurs tendances laissent penser qu'il est vain de miser sur une éventuelle « démondialisation » pour renforcer la souveraineté nationale ou européenne. D'abord, l'internationalisation des chaînes de valeur s'étend déjà aux secteurs les plus stratégiques de l'économie, tels que la défense. Ensuite, la dynamique de digitalisation facilite et étend l'internationalisation des chaînes de valeur. Enfin, la bipolarisation des relations internationales autour de la rivalité sino-américaine rendra plus difficile la reconquête d'une souveraineté effective.

Face à ce constat, cette étude propose des pistes pour mieux maîtriser des risques liées aux chaînes de valeur mondiales et regagner en souveraineté : (1) identifier et cartographier précisément les chaînes de valeur qui sous-tendent des capacités et des fonctions stratégiques ; (2) évaluer la criticité de ces chaînes de valeur à travers les actifs et approvisionnements qu'elles mobilisent, puis définir des plans de sécurisation des chaînes de valeur les plus critiques en recourant à une large gamme de leviers (stocks, innovation, réglementation, etc.) ; (3) organiser et articuler le rôle des différents acteurs : publics et privés, nationaux et européens.

Executive Summary

The Covid-19 pandemic and several supply shortages (e.g., in semiconductors) have revealed the fragility of supply based on global value chains. Stock reductions, just-in-time operations, and the strong specialization of production on a global scale can be sources of savings. However, such optimizations, which are welcome in normal times or for non-strategic products, show their limits in the event of a major crisis. Supply disruptions, as well as certain foreign pressures or interference, have thus awakened, in many countries, ambitions of independence and sovereignty, and a desire to relocate production. At the same time, the same governments, the international forums in which they participate (WTO, OECD, G20), as well as many economists continue to promote international trade and the integration of national economies.

In this context, how to reduce the vulnerabilities induced by global value chains to be more independent, while taking into account the reality of these production processes, which precisely generate interdependencies? Maintaining or strengthening sovereignty requires finding a balance between the benefits of global value chains optimization and the dependences they generate.

Several underlying trends suggest that it is futile to bet on a possible “de-globalization” to strengthen national or European sovereignty. First, the internationalization of value chains has already spread to the most strategic sectors of the economy, such as defense. Then, the ongoing digitalization tends to facilitate and extend the internationalization of value chains. Finally, the polarization of international relations around the Sino-American rivalry will make it more difficult to regain effective sovereignty.

This study proposes several avenues to better control the risks associated with global value chains and regain sovereignty: (1) to identify and precisely map the value chains that underpin strategic capacities and functions; (2) to assess the criticality of these value chains according to the availability of assets and supplies, and then to define mitigation plans for securing the most critical value chains; (3) to organize and articulate the role of the different actors: public and private, national and European.

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Introduction

The Covid-19 health crisis has exposed the fragility of certain supplies that depend on global value chains.¹ We witnessed disruption in the supply of masks and active pharmaceutical ingredients, for example, as well as in food supply chains. The crisis had a twofold impact on the normal functioning of many value chains, affecting both demand (for masks, medicines etc.) and supply (absent staff, implementation of remote working, suspension of various forms of transport, export restrictions).

During normal circumstances or for nonstrategic products, stock reduction, just-in-time production, and high levels of specialization in production worldwide can bring about significant savings; however, in the event of a major crisis, their limitations become clear. Back in 2011, the Fukushima disaster and severe flooding in Thailand exposed the impact of natural disasters on value chains, prompting numerous breakdowns in supply. The vulnerability of global value chains is therefore nothing new. However, unlike previous crises and shortages mostly creating delays and controlled economic losses, shortages of medical devices and active ingredients have put many lives at risk, thus bringing the issue to the fore. Moreover, the political and strategic exploitation of technological and industrial dependencies (e.g., embargoes, export bans) as well as recent semiconductor shortages would seem to indicate the need to revisit a risk-benefit analysis of these global value chains, particularly in the so-called “strategic” sectors.

Supply shortages have thus awoken ambitions of independence and sovereignty in many countries, along with a desire for relocation. While Donald Trump may have been widely criticized for his protectionist policies and defense of American industry, the criticism of globalization and calls for increased domestic (or European) production have multiplied in the United States, Germany, and even within European institutions. In addition to the United States and several European member states, China has been actively pursuing a policy to reduce its dependencies for several years already, via its “Made in China 2025” plan (a policy that, as we shall see, is beginning to bear fruit). In France too, the President has expressed his “will to rebuild a national and European sovereignty for the manufacturing of

1. The author would like to thank the Committee 5 auditors of the IHEDN's 57th National Armament and Defense Economics session: the joint work on sovereignty and globalization provided the inspiration for this study.

essential goods (masks, respirators, hand sanitizing gel) to combat the Covid-19 epidemic”.² In particular, this ambition has led to the creation of a High Commissioner for Planning, who has identified “risks of shortages [that] reveal our country’s dependence on faraway production lines, that are subject to decisions over which we have no influence”. He also stressed the need for reflection on “defining and securing the strategic sectors on which the sovereignty of our country depends, beyond the matter of national defense and supply”.³

At the same time, these countries, the international forums in which they participate (the European Union [EU], Organization for Economic Co-operation and Development [OECD], G20), and many economists continue to promote international trade and the integration of national economies. Some even see global value chains as an asset in terms of resilience.⁴ In their statement of March 26, 2020, the G20 members committed themselves to “work[ing] to resolve disruptions to the global supply chains [...], working together to facilitate international trade [...], avoid[ing] unnecessary interference with international traffic and trade”.⁵ They also stated that “emergency measures aimed at protecting health will be targeted, proportionate, transparent, and temporary”. Last, they reiterated their “goal to realize a free, fair, non-discriminatory, transparent, predictable and stable trade and investment environment, and to keep [their] markets open”. OECD researchers have also developed a model to assess potential economic losses in the event of the increased domestic relocation of the production of goods and services.⁶

At first glance, wishing to relocate industrial production to strengthen economic sovereignty while simultaneously furthering the integration of national economies and world trade, may seem contradictory. How can we reduce the vulnerabilities in global value chains to be more independent, while acknowledging the reality of these productive processes that necessarily generate

2. “Déclaration de M. Emmanuel Macron, président de la République, sur sa volonté de reconstruire une souveraineté nationale et européenne pour la production de biens essentiels (masques, respirateurs, gel hydroalcoolique) pour lutter contre l’épidémie de Covid-19”, Saint-Barthélemy-d’Anjou, March 31, 2020. Translator’s note: our translation. Unless otherwise stated, all translations of cited foreign language material in this article are our own.

3. “Produits vitaux et secteurs stratégiques: Comment garantir notre indépendance?”, opening note, High Commissioner for Planning, No. 2, December 18, 2020.

4. R. Baldwin and S. Evenett (ed.), *COVID-19 and Trade Policy: Why Turning Inward Won’t Work*, London: CEPR Press, 2020; O. Guinea and F. Forsthuber, *Globalization Comes to the Rescue: How Dependency Makes Us More Resilient*, ECIPE Occasional Paper, No. 6, 2020.

5. “Extraordinary G20 Leader’s Summit. Statement on COVID-19”, March 26, 2020, available at: www.ioe-emp.org.

6. *Shocks, Risks, and Global Value Chains: Insights from the OECD Metro Model*, OECD, June 2020.

interdependencies? The answer is perhaps all the more elusive owing to the fact that many countries have been substantially weakened by the budgetary impact of the health crisis. Is it to be expected that a sort of “de-globalization” will come to resolve this dilemma, or should we be seeking a better way to reconcile demands for sovereignty with global value chains?

To address these questions, we will begin by identifying the impact of global value chains on a country’s sovereignty, carefully defining both terms. We will then demonstrate that large-scale “de-globalization” appears unlikely, for at least three reasons. First, global value chains have spread across all sectors, including the most strategic. Second, the trend toward digitalization is a structuring phenomenon which spans multiple industry and service sectors and seems likely to further the internationalization of value chains. Last, growing bipolarization between China and the United States will probably curb the process of reducing current French and European dependencies. Indeed, the quest for strategic autonomy, whether French or European, must vie with the competing interests of these two great powers, for whom the European market and its assets may hold strategic interest given the rivalry between them, particularly in the field of technology. Considering the forces involved, it is by no means certain that the dynamics of European integration will prevail over their transatlantic and Eurasian equivalents.

Having observed that global value chains can have an impact on strategic autonomy and national sovereignty, but that we cannot count on a potential “de-globalization” to counteract these fragilities, we conclude by proposing various avenues for better reconciling sovereignty with the internationalization of value chains. These proposals involve improved identification and prioritizing of vulnerabilities, expanding the range of available mechanisms, and improving coordination between the various agents involved—public and private; national and European.

Managing global value chains: A matter of sovereignty

Internationalization: An old dynamic that is losing speed

While recent shortages caused by the health crisis have served to highlight our dependence on globalized value chains, the world economy has been increasingly structured this way for several decades. Global value chains result from the international distribution of production processes based on several distinct but interdependent and extensively documented trends:

- A “vertical” disintegration of value chains, with increasing fragmentation of their component tasks, from conception through to after-sales service;
- Increased specialization in particular tasks by certain agents and territories, promoting geographical dispersion and sometimes leading to a concentration of certain processes in one part of the world;
- An increase in the international exchange of intermediate goods and services, in particular in the form of intra-firm trade;
- An increase in the proportion of services involved in the production of manufactured goods (transport, logistics, insurance).

This international division of production processes has been illustrated by several case studies, notably with regard to IT and telecommunications, as in the case of Apple products. Indeed, this is an area covered by numerous academic works along with publications from international organizations such as the OECD or World Trade Organization (WTO).⁷ The need to better understand these processes

7. Examples include: G. Linden, K. L. Kraemer, and J. Dedrick, *Mapping the Value of an Innovation: An Analytical Framework*, Personal Computing Industry Center, 2007; G. Linden, K. L. Kraemer, and J. Dedrick, *Who Captures Value in a Global Innovation Network? The Case of Apple's iPod*, Personal Computing Industry Center, 2008; K. L. Kraemer, G. Linden, and J. Dedrick, *Capturing Value in Global Networks: Apple's iPad and iPhone*, Personal Computing Industry Center, 2011.

Staying Competitive in the Global Economy: Moving Up the Value Chain (Main Findings), OECD, 2007; *Interconnected Economies. Benefiting from Global Value Chains – Synthesis Report*, OECD, 2013; H. Escaith and S. Inomata (ed.), *Trade Patterns and Global Value Chains in East Asia: From Trade in Goods to Trade in Tasks*, WTO/IDE-JETRO, 2011.

has also led to the development of substantial databases aimed at quantifying international trade in terms of value added—i.e., not only in gross value as until now—in particular the TiVA database (Trade in Value Added) from the OECD. By way of an indication as to how long awareness of these processes has been in existence, as early as 2010 Pascal Lamy stated that “more and more products can be said to be ‘Made in the World’”.⁸ It is no longer a question of particular companies or countries specializing in a given end-product; rather, specialization takes place at the level of the individual component tasks of the production process, so as to maximize the exploitation of comparative advantages. This kind of focus entails a loss of activity in the areas ceded, but also allows for gains in productivity and competitiveness linked to the resulting economies of scale on the part retained.

The French economy is not immune to these developments, as we shall see in the following section. For example, the exports of the transport equipment sector comprised 42% foreign added value content in 2015, while 80% of the intermediate goods imported by this sector—which makes a net positive contribution to France’s trade balance—were later re-exported.⁹ Global value chains have long been a major phenomenon both in the national economy and international trade. Many factors contribute to such an evolution in production processes, including productivity gains owing to task specialization, significant economies of scale, and access to specific foreign input materials which may be cheaper or more effective.

Paradoxically, the growth in awareness of global value chains brought about by the Covid-19 crisis coincides with a relative slowing in their proliferation. It would appear that trade restrictions adopted during the health emergency have, at least temporarily, confirmed this trend. Indeed, between 2011 and 2016, the foreign value-added content of exports decreased in many countries or groups of countries—most notably in China, but also in the United States and, more recently, in Japan. In the EU however, while a slight decrease was seen, the figure remained close to 30% on average.¹⁰ In France, the value-added content of exports fell slightly, from 23.4% in 2011 to 22.1% in 2016—a level that nevertheless remains higher than in 2005.¹¹ The case of China is particularly instructive, appearing to illustrate at least a partial

8. Pascal Lamy’s address to the symposium “Globalization of Industrial Productive Chains and Measurement of International Trade in Value Added” (conference held on October 15, 2010 in Paris, organized by the Senate Finance Commission and the Secretariat of the WTO).

9. *Trade in Value Added: France*, Country Note, OECD, December 2018.

10. *The Changing Nature of International Production: Insights from Trade in Value Added and Related Indicators*, TiVA Indicators, OECD, 2018.

11. *Trade in Value Added: France*, Country Note, OECD, December 2018.

success of the “Made in China 2025” strategy. The foreign value-added content of Chinese exports went from 26.3% in 2005 to 16.6% in 2016, i.e., a decrease of nearly 10 percentage points. This “nationalization” of export contents is particularly marked in the IT, communication, and electronics sector, where the share of foreign value added fell from 41.8% to 30.3% over the same period.¹²

More generally, the WTO reported a 3% decrease in world merchandise trade volumes for the year 2019,¹³ prior to the outbreak of the health crisis. While many factors underly this decline, recent years have been notably marked by accumulating global tension over trade policies: difficult negotiations on the transatlantic free trade treaty, the exacerbating effect of Donald Trump’s presidency on trade rivalries, tariff increases, and so on. These elements point to at least a temporary slowdown in the consolidation of free trade and the integration of economies.

Although the spread of global value chains appears to be treading water for the time being, they are nevertheless a structuring phenomenon which is probably here to stay, as we shall see. It is therefore important to identify the risks and opportunities involved in terms of strategic autonomy or even sovereignty.

Managing interdependencies: The dilemma between globalization and economic sovereignty

As previously explained, global value chains generate de facto interdependencies between countries. This interdependence is twofold:

- Upstream, domestic production may be dependent on the supply of foreign intermediate inputs: any disruption in the supply of these imports can adversely affect the satisfaction of domestic or foreign demand, in the case of the latter by indirectly penalizing exports;
- Downstream, the production of intermediate goods or services depends on foreign demand: a negative shock on foreign demand can thus threaten domestic production.

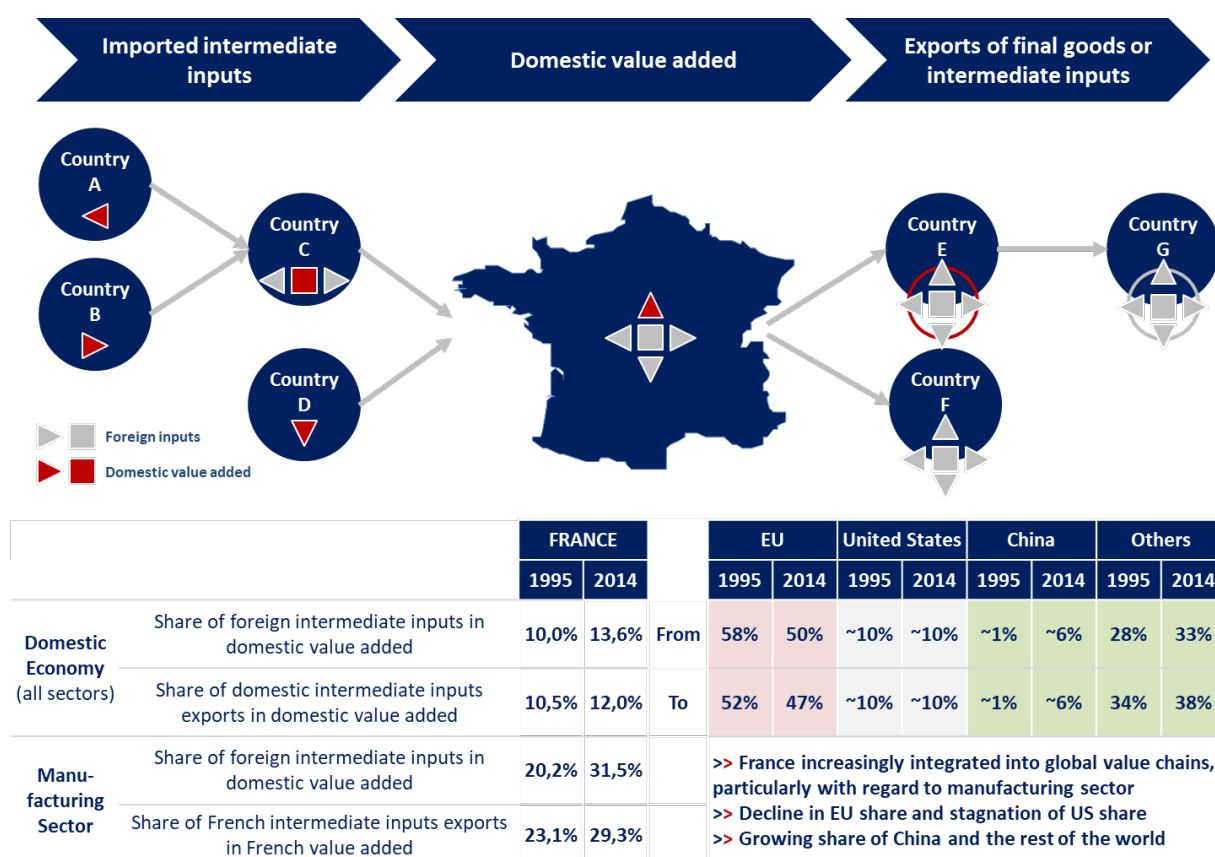
All sectors combined, the dependence of French gross domestic product (GDP) on imported foreign inputs (including EU) was 13.6% in 2014 (compared with 10% in 1995), while dependence on foreign demand (including EU) for French inputs was 12% (compared with 10.5% in 1995). However, these dependencies are more pronounced in the industrial sector, whose dependence on foreign inputs exceeded

12. *Trade in Value Added: China*, Country Note, OECD, December 2018.

13. *World Trade Statistical Review 2020*, WTO, 2020.

30% in 2014, with dependence on foreign demand for French inputs at 29%. While at the time of writing TiVA data is not available for the last few years¹⁴, French industrial production appears increasingly integrated into global value chains. The geography of such trade is also interesting, with the EU's share falling significantly between 1995 and 2014: from 58% to 50% in terms of French dependence on foreign inputs, and from 52% to 47% for dependence on foreign demand.¹⁵ This relative decrease in dependence on European partners has been to the benefit of China (although to a small degree) and, above all, that of the rest of the world (about a third). In other words, potential dependencies on countries with less strategic and diplomatic proximity to France than those of the EU have increased. The French economy has not only become more integrated and more dependent on external inputs and demand: it is also more dependent on non-European players, which suggests that the risk associated with the potential exploitation of these dependencies for political purposes has increased.

France's integration into global value chains



Source: based on A. Reshef and G. Santoni, "Chaînes de valeur mondiales et dépendances de la production française", *La Lettre du CEPII*, No. 409, June 2020.

14. The original version of this study was completed in December 2021.

15. A. Reshef and G. Santoni, "Chaînes de valeur mondiales et dépendances de la production française", *La Lettre du CEPII*, No. 409, June 2020.

While the internationalization of supply chains necessarily entails the creation of dependencies, national sovereignty on the other hand implies curtailing and managing these dependencies, particularly so as to avoid foreign pressure or interference. According to Louis Le Fur's oft-cited definition, sovereignty is "the quality of the State to be obliged or determined only by its own will, within the limits of the higher principle of law, and in accordance with the collective goal that it is called upon to achieve". Economic dependencies should not, therefore, have any influence over the will of a nation-state. Article Three of the Constitution of the Fifth Republic completes this definition, stipulating that "national sovereignty belongs to the people, who shall exercise it through their representatives and by means of referendum". Sovereignty thus does not only involve the State, but rather the entire Nation, meaning that management of these dependencies should therefore involve both public and private actors, bringing together both companies and representatives of the Nation, as we shall see in the last section. These definitions also show that sovereignty requires a form of power, in the sense of an "ability to do; ability to have things done; ability to prevent doing; ability to refuse to do", as per Serge Sur's definition.¹⁶ In light of the diversity and evolution of resources that can be conferred by these powers and capacities, the notion of sovereignty is manifest in numerous fields, and, accordingly, is increasingly supplemented by adjectives: legal, economic, monetary, military, diplomatic, cultural, food, and digital. All of these fields are affected by the global value chains which permeate every sector, and whose security is a matter of economic, financial, legal, and diplomatic interest.

While sovereignty requires a certain level of independence, it is not synonymous with autarky, self-sufficiency, or the absence of interdependencies. Thus, for example, states can ally and unite by means of treaties, usually ratified by parliament or a referendum. Since sovereignty is inalienable, these dependencies must be freely entered into, governed, and reversible.¹⁷ Management of the dependencies generated by global value chains is particularly important to prevent political and strategic dependencies being brought about by economic, technological, and industrial ones. The tensions that emerged within the Atlantic Alliance during the 2003 Iraqi crisis serve as a reminder that economic interdependencies in both the civilian and military sectors represent a means by which to put pressure on a country and influence

16. S. Sur, *Relations internationales*, Paris, Montchrestien, 2000.

17. Several examples testify to this: France's withdrawal from NATO's integrated military command in 1966, the United Kingdom's exit from the European Union following a referendum, the withdrawal of the United States from the Paris Climate Agreement under the presidency of Donald Trump, and so on.

its will: a boycott of French products, difficulties in supplying certain critical military components, and so on. Moreover, France's dependence on Germany for certain military equipment subsystems made it difficult for French companies to fulfill international contracts, for example as a result of Germany blocking the supply of firing posts for Milan ER missiles sold by MBDA; blocking VABs (*véhicules de l'avant blindé*, or "armored personnel carriers") sold by Renault Trucks Defense; and blocking Mercedes chassis used by Nexter, among others.¹⁸ Similar hurdles were encountered during the sale of Rafale fighter jets to Egypt, owing to the US's refusal to export certain component parts necessary for the manufacture of the MBDA SCALP missiles these aircraft carry.¹⁹ In addition to tensions such as these that can arise between even the closest of allies, economic sanctions and embargoes testify to this instrumentalization of trade for political and strategic purposes. The management of global value chains and ensuing dependencies is therefore a matter of sovereignty, both with regard to preserving autonomy of judgment, decision-making and action, and in terms of equipping the French armed forces and ensuring the success of exports upon which the Defense Technological and Industrial Base (DTIB) depends. As we shall see in the last section, such management requires a good knowledge of strategic value chains, an assessment of their vulnerabilities and the impact of possible disruptions, and the ability to implement security mechanisms.

Preserving or strengthening sovereignty thus requires a balance to be sought between the gains made by optimizing global value chains and the risks of dependence that accompany them. Aside from the fact that having zero interdependence appears impossible—even North Korea depends on international partners—it is also probably undesirable, as it would mean renouncing the economic benefits associated with the economies of scale and specialization that underpin global value chains. Emmanuel Combe and Sarah Guillou²⁰ are among many experts who are skeptical about the myth of self-sufficiency and the negative effects of mass relocations, citing a loss of competitiveness due to the increase in domestic production, a reduction in exports due to a lack of foreign inputs, and a reduction in the diversity of supplies. Poorly thought-out relocations can entail a twofold loss of competitiveness, in terms of price (increase in price) and non-price factors (loss of attractiveness of the product itself). Ultimately, a country's ability to innovate, and to develop the new technologies necessary for the development of sovereign capabilities, may be negatively affected.

18. M. Cabirol, "Armement: Quand Berlin trahit l'esprit de la coopération franco-allemande", *La Tribune*, September 11, 2014.

19. M. Cabirol, "Rafale en Égypte: Les États-Unis bloquent", *La Tribune*, February 16, 2018.

20. E. Combe and S. Guillou, *Souveraineté économique: Entre ambitions et réalités*, Fondation pour l'innovation politique, January 2021.

Last, it is not necessarily the case that large-scale relocations would reduce the risk of shortages in supply: in the event of significant supply and/or demand shocks, national resources could quickly become overwhelmed, and not prove any more agile than global productive systems. The distinction made by Sébastien Miroudot²¹ between robustness and resilience when it comes to value chains invites us to question exactly what it is we are seeking to achieve: is it to avoid any disruption and to maintain activity at all costs (robustness), or is it to promote the timely absorption of any shocks and an efficient return to normal activity following disruption (resilience)? Whereas robustness involves maintaining supply and is aimed at avoiding shortages, resilience is more concerned with restoring supply after a shock or rupture. When not arguing in favor of robustness in supply chains, some researchers argue that globalization promotes their resilience, providing increased opportunities to get swiftly back on track when compared to a purely domestic production.²² A dependency management strategy must therefore specify the preferred objective for each strategic capability: while closing an airport, motorway, or train station for a few hours may be deemed tolerable, the prolonged unavailability of government communications or power outages in critical facilities are far less acceptable scenarios.

In order to strengthen sovereignty then, it seems less relevant to aim for massive and expensive relocations, and more suitable instead to seek better integration into global value chains, along with better management of their risks—in particular by diversifying sources of supply or stock, as some experts propose.²³ Moreover, several underlying trends suggest that this process of value chain internationalization will continue to be key in terms of structure, including for strategic sectors such as defense. The increasing integration of digital technologies should provide a boost to this process. Here, French and European desires to better manage the dependencies associated with global supply chains come up against the issue of Sino-American rivalries, which are generally played out in the technological and industrial arena.

21. S. Miroudot, “Resilience vs. Robustness in Global Value Chains: Some Policy Implications”, in: R. Baldwin and S. Evenett (ed.), *COVID-19 and Trade Policy: Why Turning Inward Won’t Work*, London: CEPR Press, 2020.

22. O. Guinea and F. Forsthuber, *Globalization Comes to the Rescue: How Dependency Makes Us More Resilient*, *ECIPE Occasional Paper*, No. 6, 2020.

23. X. Jaravel and I. Méjean, “Quelle stratégie de résilience dans la mondialisation? Les notes du conseil d’analyse économique”, *Conseil d’analyse économique*, No. 64, April 2021.

Ambitions for sovereignty: Facing the reality of production processes and geopolitics

Although signs of a slowdown in the dynamics of globalization exist, several underlying trends suggest that it would be futile to bet on any kind of “de-globalization” for the strengthening of national or European sovereignty. While not an exhaustive list, we would highlight three major elements. First, the internationalization of value chains already extends to the defense sector, often identified as one of the most strategic. Second, digitalization is likely to facilitate the further internationalization of value chains. Third, the bipolarization of international relations around the Sino-American rivalry will probably make it more difficult to regain effective sovereignty—despite perhaps making it more desirable.

Internationalized value chains concern all sectors, including the most strategic

Although the health emergency particularly exposed the internationalization of procurement and supply in the medical sector (masks, active pharmaceutical ingredients, ventilators, etc.), other strategic sectors are also affected by this internationalization. We will come back to the notion of what constitutes a “strategic sector”, but defense is widely recognized as being among them. A regal and sovereign domain par excellence, defense lies at the heart of concerns and ambitions surrounding technological and industrial independence, as seen in the very idea of a Defense Technological and Industrial Base. The DTIB brings together the main actors involved in the design, delivery, and maintenance and overhaul, from small- and medium-sized enterprises (SMEs), to mid-sized businesses (MSBs) and larger groups. The defense industry is certainly not spared by the internationalization of value chains. Indeed, many historic or more recent changes on the side of both supply and demand indicate that this dynamic will continue.

On the supply side, the expansion of network-centric warfare has transformed the arms industry. The integration of electronic, followed by computer and digital, technologies into military systems has increased their reliance on civilian-produced components and

equipment. In turn, these commercial or dual-use components and equipment pertain precisely to those sectors which are most exposed to the internationalization of value chains,²⁴ indirectly leading to the internationalization of military value chains.

Moreover, the use of these commercial or dual-use components may have increased as a result of the budget cuts at the end of the Cold War and during the economic crisis of the late 2000s, resulting in the need to save on specific development costs by relying on off-the-shelf solutions. This budgetary pressure is not expected to abate in the coming years, particularly in France, due to the effects of the health crisis on public finances, and the range of major programs to be financed. Furthermore, the defense sector being able to exploit civilian innovations is generally viewed in a positive light.²⁵

For example, the internationalization of electronic component supplies was the subject of scrutiny almost as long as ten years ago, following US parliamentary research into fakes and major quality issues regarding electronic components from China which had been integrated into mission systems or military platforms.²⁶ As part of their work in seeking to understand the origins of various technical malfunctions, investigators traced the supply chain of the electronic components and revealed just how fragmented the value chains were. While tier 1 or tier 2 suppliers appeared to be located in the United States or Europe, further mapping revealed that many of the counterfeit and non-quality components originated in China. Thus, despite aiming high in terms of autonomy and having significant budgetary resources at their disposal, even the largest industrial and technological base in the world is affected by the internationalization of value chains.

On the demand side, international markets increasingly require technology transfer to design, produce, and maintain their weapons locally, so as to gain in autonomy and bolster employment. Whereas in the commercial sphere, the internationalization of value chains arises mainly due to the relative erasure of states via the reduction of customs barriers, in the military sphere it often takes place at the request of importing states. This trend is also observed in other strategic sectors such as energy or aeronautics. European cooperation programs also generally result in production being divided between different countries, and therefore to value added being distributed in a way that creates a

24. See previously cited OECD reports.

25. In particular, in the Reference Document for the Guidance of Defense Innovation published (“Document de référence de l’Orientation de l’Innovation de Défense”) by the Ministry of the Armed Forces in 2020. This highlights the need to “harness innovations from the civilian world”, in particular calling upon the Defense Innovation Agency to this end.

26. *Inquiry into Counterfeit Electronic Parts in the Department of Defense Supply Chain*, Report of the Committee on Armed Services, United States Senate, Washington, DC: US Government Printing Office, May 2012.

“Europeanization” of value chains. Last, the formation of large multinational companies lends itself to this internationalization of production processes, when the internationalization strategy is not limited to a multi-domestic model (local to local) but rather elicits synergies and exchanges between the different subsidiaries (local to global).

The naval defense industry illustrates the dynamic of value chain internationalization, albeit to a varying degree depending on the specific program. At the European level, various cooperative programs contributed to an early Europeanization of value chains, especially at the level of parts manufacturing. Mapping of the main components used in the Horizon and FREMM frigates, for example, shows cross-purchases between France and Italy of combat systems and platforms (radars, sonar equipment, electronic warfare, propulsion systems). A similar situation can be found in aeronautics, where the manufacturing of component parts and subassembly of the A400M military transport plane are distributed among various European countries. We can therefore consider Europeanization as a form of internationalization, albeit carried out on a regional scale. Beyond intra-European cooperation, strategic alliances and partnerships such as the Atlantic Alliance are also shaping value chains. This is particularly the case with British deterrence programs that rely on American know-how, technologies, and systems (nuclear propulsion, missiles, missile compartments, components of nuclear warheads, etc.). Such collaboration can also lead to international commercial partnerships, as shown by Navantia’s F100 frigates which incorporate weapons and combat systems supplied by Lockheed Martin and have been sold to Spain, Australia, and Norway.

One of the most structurally significant developments lies in the enhanced requirements for technology transfer and local content creation. This dynamic tends to reduce exports of ships designed and built in France in favor of international programs, part of the added value of which is generated locally. The Indian and Brazilian Scorpene submarine programs and the Malaysian and Egyptian Gowind corvette programs illustrate the desire harbored by many countries to form national DTIBs so as to increase their autonomy, develop their high-tech sectors, and create employment. Paradoxically, these ambitions of sovereignty lead—at least temporarily—to an internationalization of the value chains involved in weapons systems, to the detriment of a more classical model whereby finished products are exported from the country in which they are produced. These new dynamics are not limited to the defense sector. Indeed, they have existed for several years in the field of energy and transport, as illustrated by the technology transfers made to China for Airbus aircraft or nuclear power plants (European Pressurized Reactors, or EPRs).

Digital technologies further strengthen the internationalization of value chains

In addition to the fact that the internationalization of value chains has already partly won over one of the sectors which is most desirous of autonomy, the rapid development of digital technologies is likely to promote the geographical dispersion of their component tasks as well.

The impact of digitalization on value chains

Digitalization facilitates the fragmentation of the entire value chain. If we start by considering the production process, we can clearly see that digitalization is at work every step of the way. It permeates the entire product life cycle in infinite guises, such as computer-aided design, the management of manufacturing operations, additive manufacturing, digital twins, and predictive maintenance. In other words, all industrial production is potentially affected by such digitalization. The concept of modularity is key here. As defined by Karl Ulrich in 1995, modularity is based both on the architecture of systems (one-to-one mapping from functional to physical architectures) and on the decoupling of interfaces between components, or modules. The fact that each module is a physical and functional unit, decoupled from the others, means that they can be designed, produced, or modified in parallel or even independently of one another, thereby promoting the fragmentation and dispersion of the value chain.²⁷ This modularity and accompanying standardization of interfaces is largely facilitated by digitalization. The development of collaborative tools for product design and manufacturing makes it possible to work as an extended enterprise, making it much easier to segment tasks and distribute them geographically to exploit comparative advantages.

It is not just operational activities that are affected: digitalization also facilitates support activities, such as supplier management, customer relations, and recruitment processes—functions that span all sectors and stages of production. Digitalization is thus a catalyst for the internationalization of value chains: it facilitates both the fragmentation of tasks within the chain and their coordination between geographically dispersed participants and locations, whether part of the same company or involving suppliers and subcontractors.

Digital transformation is not limited to the value chain itself: it extends to the entire corporate business model, from online customer acquisition and new value propositions (transition from proprietary solutions to services: “X as a service”, or XaaS) to financing (online banking, subscription). These innovations relating to the value chain

27. K. Ulrich, “The Role of Product Architecture in the Manufacturing Firm”, *Research Policy* 24, No. 3, 1995, p. 419–440.

or business model itself lead to a growing integration of services in industrial production. Indeed, this “servicification” is one of the characteristics of the internationalization of value chains whose intermediate inputs involve a significant reliance on services (logistics services, legal, insurance, etc.). In most OECD and G20 economies, the proportion of services incorporated into exports of manufactured goods ranges from 25% to 40%. For France the figure is over 35%. Moreover, a proportion of the value added of these services is non-domestic in origin (more than 10% for exports of French manufactured goods). We can therefore see that interdependencies are formed not only around components or equipment, but also involving services, including for industrial production.²⁸

Already significant beforehand, the digitalization of the economy has increased during the health crisis. According to the OECD, digital-intensive sectors accounted for about half of value added in G20 countries in 2017. In Germany and the US, these sectors accounted for 54% of value added.²⁹ Measures later taken by governments to combat the Covid-19 pandemic have strengthened this trend toward digitalization. Lockdowns, closures of shops and places of leisure, and restrictions on freedom of movement all favored online models for both work and consumption. From online shopping and video conferencing tools to data storage or exchange and cultural-content platforms (for series, films, music, etc.), the pandemic has accelerated the digitalization of personal and professional life. This is evidenced by the statistics on application downloads. Compared to the weekly average for the last quarter of 2019, the third week of March 2020 saw an explosion of downloads: up 30-fold for Houseparty, 20-fold for Zoom Cloud Meetings and Google Meet, and 16-fold for Microsoft Teams.³⁰

Beyond videoconferencing, GAFAM’s revenue growth is testament to the increased use of digital solutions. In addition to the sales growth observed between 2019 and 2020, data for the second half of 2021 are also very promising for Alphabet (Google’s parent company), Amazon, and Facebook, which close their accounts on 31 December. Apple’s first three quarters of 2021 already exceed year-end results from September 2020 and the effects of the pandemic will largely have offset the decline seen in 2019. Microsoft shows similarly marked growth, reporting a 33% increase in turnover over the last two years. Digitalization is largely working to the advantage of foreign companies, often American.

28. *The Changing Nature of International Production: Insights from Trade in Value Added and Related Indicators*, TiVA Indicators, OECD, 2018.

29. *A Roadmap Toward a Common Framework for Measuring the Digital Economy*, OECD, 2020.

30. L. Sydow, “Video Conferencing Apps Surge from Coronavirus Impact”, App Annie, March 30, 2020, available at: www.appannie.com.

In addition to the United States, Chinese providers are also becoming leaders in certain digital service domains. To give just a few examples: as of 2018, China was home to five of the best teams in the field of facial recognition; the voice recognition capabilities of the Chinese company iFlytek are easily equal to or superior to those of their American counterparts, even when it comes to the English language; and Huawei's position as market leader in the telecommunications equipment sector (with about 30% market share) over Nokia and Ericsson (around 15% each) is now well-established.³¹ Europe has nothing comparable to the US GAFAM, or Chinese BATX (Baidu, Alibaba, Tencent, and Xiaomi).

High levels of European dependency in digital services

Given the impact of digitalization on industrial and service value chains, the fact that digitalization favors non-European stakeholders serves to increase the dependency risks and vulnerability of all value chains, far beyond the IT and digital sectors alone. However, despite strong ambitions for digital sovereignty expressed at the highest level of government and renewed by representatives of the nation in several parliamentary reports,³² France is struggling to realize its goal. Renewal of the contract between the General Directorate for Internal Security (DGSI) and Palantir was thus a source of much debate and criticism, as was the decision to entrust Health Data Hub's data storage to Microsoft, and the data of companies receiving state guarantee-supported loans backed by the BPI to Amazon. The difficulties encountered by the French company OVH following a data center fire further testify to the challenges of structuring a national sector. Although national providers do exist, French and European dependencies in terms of cloud computing remain significant.³³

In May 2021, the Ministry of Economy announced its strategy for trustworthy cloud computing. Rather than proposing a fully sovereign solution, it promotes partnerships between French and American companies, enabling technologies to be used under license while reducing the risks of exposure to extraterritorial regulations such as the Cloud Act and the FISA Act (Foreign Intelligence Surveillance Act). A

31. G. Allison and E. Schmidt, "Is China Beating the US to AI Supremacy?", Harvard Kennedy School - Belfer Center, August 2020, available at: www.belfercenter.org.

32. French MPs have produced numerous reports on this subject, including: C. Morin-Desailly (rapporteur), "L'Union européenne, colonie du monde numérique?", report No. 443, Committee on European Affairs, Senate, March 2013; G. Longuet (rapporteur), "Rapport fait au nom de la Commission d'enquête sur la souveraineté numérique", report No. 7, Senate, October 2019; P. Latombe (rapporteur), "Bâtir et promouvoir une souveraineté numérique nationale et européenne", report No. 4299, National Assembly, June 2021.

33. A. Pannier, "The Changing Landscape of European Cloud Computing: Gaia-X, the French National Strategy, and EU Plans", *Ifri Briefings*, Ifri, July 22, 2021.

more detailed analysis of the technical and legal aspects of these partnerships is required in order to judge the wisdom of this solution: is it an intermediate step toward increased technological independence or will it generate technological and commercial dependencies that prove difficult to reverse?

Considering the increasing digitalization of value chains and the economy, France's and, more broadly, Europe's ability to develop more autonomous solutions represents an important challenge. This is especially the case given that mastery of digital technologies and the value chains that underpin them appears to be a key factor in the power struggle between the US and China. As Raphaël Danino-Perraud highlights in particular, a large number of the technologies and raw materials necessary for the production of batteries are geographically concentrated and controlled by China, whose companies have established themselves in producing countries and/or have gradually gained a dominant position in the exploitation and processing of these raw materials.³⁴ Studies carried out by the European Commission on 137 critical import products also show that more than half of the total value of these imports comes from China (52%).³⁵

The case of semiconductors is also well documented: while the United States and China account for around 60% and 15% of the market respectively in terms of design, Taiwan dominates semiconductor production and assembly, with a market share of over 50%. China, the United States, and South Korea account for most of the remaining 50%. The European share of the market is negligible, exposing Europeans to significant vulnerabilities.³⁶ The risk therefore exists that the ecological and digital transitions called for by many could in fact increase technological, industrial, and therefore ultimately political dependencies on China or the United States, especially in the event of a demand or supply shock (geopolitical tensions, natural disaster, blockage of straits, etc.).

US-China polarization is particularly pronounced in the digital field and makes it more difficult to advance toward national or European sovereignty. If, as some would have it, "France and the European Union remain technological vassals"³⁷ their ability to take

34. R. Danino-Perraud, "Géoéconomie des chaînes de valeur – les matières premières minérales de la filière batterie", *Études de l'Ifri*, Ifri, August 2021.

35. "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions. Updating the 2020 New Industrial Strategy: Building a Stronger Single Market for Europe's Recovery", European Commission and the Directorate General for Internal Market, Industry, Entrepreneurship and SMEs, SWD/2021/351 final, May 5, 2021.

36. D. Fiott (ed.), "European Sovereignty: Strategy and Interdependence", *Chaillot Paper series*, No. 169, European Union Institute for Security Studies, July 2021.

37. "Rethinking Our Defense in the Face of the 21st Century Crises", Report, Institut Montaigne, February 2021.

the reins of their digital sovereignty depends not only on domestic efforts but also on the other powers involved and their respective strategies. The fact that the EU itself is a factor in the Sino-American rivalry must be recognized when it comes to enhancing French and European autonomy. The EU not only represents an important potential market but also a reservoir of assets and innovative capacities (universities, companies, etc.) which could potentially be exploited in the technological confrontation between the two superpowers. This is evidenced by the issue of 5G and the opening up of this market to a Chinese player such as Huawei, or that of the GAIA-X initiative to non-European players. It should be noted that French and European dependencies on digital technologies have implications not only for economic sovereignty and value chains, but also for the very essence of sovereignty as a condition for democracy. Indeed, many of these technologies and the foreign entrepreneurs and companies that own them are responsible for the digital agora populated by social networks, and are consequently closely involved with the formation (or even deformation) of the political ideas and opinions they serve to convey.³⁸

The inaugural joint statement of the Trade and Technology Council (TTC) meeting held on 29 September 2021 perfectly illustrates the consideration of these technological, democratic, and commercial issues on a transatlantic scale. The United States and the EU confirmed their common desire to increase mutual cooperation in many strategic areas:

- Investment screening mechanisms, in particular for emerging technologies;
- Export controls over dual-use technologies;
- Trustworthy artificial intelligence (AI);
- Mapping and targeted investment to secure global supply chains, in particular for semiconductors;
- International trade, with the particular goal of facilitating trade between the two sides of the Atlantic in products or services deriving from emerging technologies.

Numerous measures pertain to digital technologies and the security of their supply chains at the transatlantic level, covering critical materials, components (semiconductors), 5G (and 6G), undersea cables, and data centers.³⁹ The agreed cooperation also extends to data

38. P. Cardot, *De l'adaptation de l'État de droit aux défis du numérique: Analyse du cas particulier de la France*, Entremises, May 2021; F. DeCloquement and A. Luttrin, "Traitement de nos données en France: L'atteinte à nos intérêts fondamentaux", Cercle K2, October 22, 2021.

39. "U.S.-EU Trade and Technology Council Inaugural Joint Statement", White House, September 29, 2021, available at: www.whitehouse.gov.

governance and online platforms. In this context, the EU's ability to strengthen its strategic autonomy by reducing its technological and industrial dependencies on third parties would appear dubious to say the least.

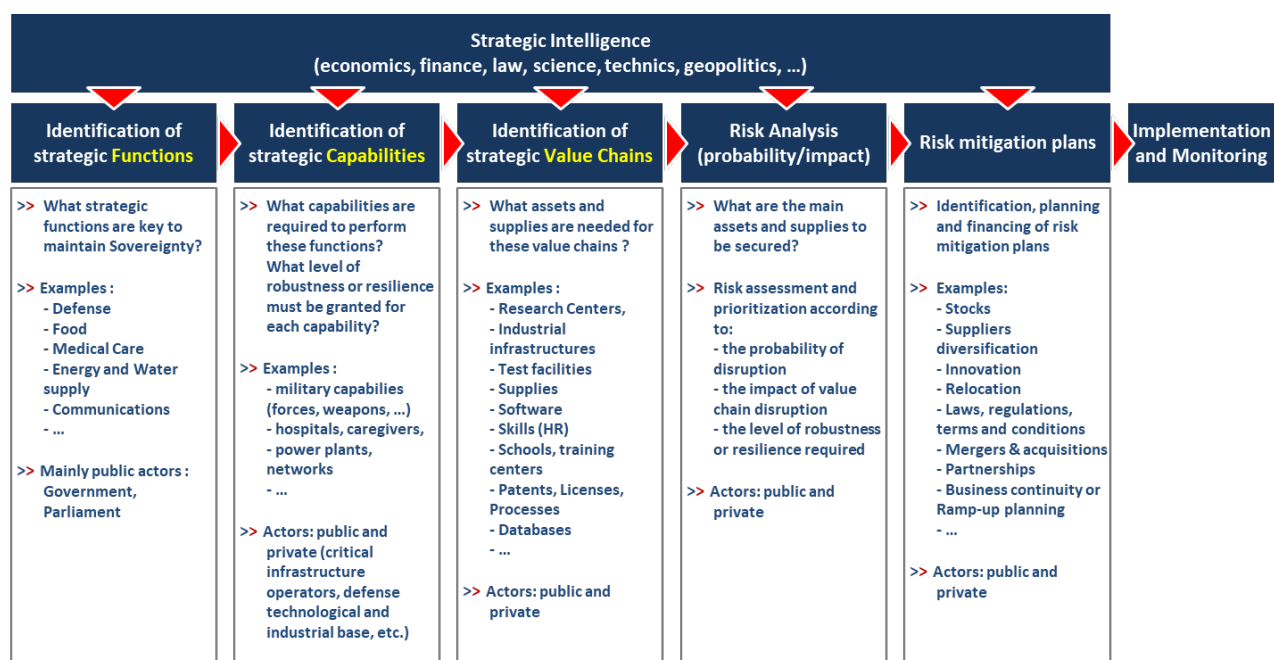
Avenues for strengthening sovereignty

While the internationalization of value chains already affects the most strategic sectors, it will likely be further enhanced by the digitalization taking place in all industrial and service sectors. However, France and the EU appear dependent or behind in many areas, such as software, critical components or equipment (semiconductors, batteries), and facial or voice recognition. The achievement of national or European technological and industrial sovereignty thus remains a major challenge. We propose several possible avenues for addressing it.

The strengthening of sovereignty, and of the technological and industrial autonomy that this implies, requires better management of the vulnerabilities associated with global value chains, such as the concentration of supplies in the hands of a few specialized providers, dependence on foreign export control regimes, and so on. Vulnerabilities can be reduced by:

- Precisely identifying and mapping the value chains underlying strategic capabilities and functions, with both a present- and a future-oriented outlook;
- Assessing the criticality of these value chains based on the availability of the assets and supplies on which they depend;
- Drawing up plans to secure the most critical value chains (strategic stocks, diversification, innovation, etc.);
- Organizing and defining the role of the various actors: public, private, national and European.

Summary of the proposed approach



Source: author.

Identifying and mapping strategic value chains to assess their criticality

Managing the dependencies that can generate vulnerabilities and harm sovereignty requires first of all identifying these dependencies, targeting sectors that are deemed strategic. In France, the list of sectors required to give prior notice of their intention to accept foreign investment represents a good place to start. These activities include in particular: defense, information and communication systems security, supply grids and associated operators (water, energy, transport, etc.), health, food, and media.⁴⁰ The Office of the High Commissioner for Planning has also established a largely similar list of strategic sectors.⁴¹ Regrettably, the banking, financial, and insurance sectors are striking in their absence, despite being vital for the proper functioning of the economy. In the United States, a presidential decree promulgated by Joe Biden in February 2021 and entitled “America’s Supply Chains” lists the supply chains to be audited as those concerning semiconductors, batteries, rare earth elements and critical raw materials, pharmaceuticals, the defense industrial base, information and communication technologies, energy, transportation, and agriculture. The resulting audit of these

40. “Les secteurs d’activité dans lesquels les investissements sont soumis à autorisation préalable”, Directorate General of the Treasury, November 25, 2021, available at: www.tresor.economie.gouv.fr.

41. “Produits vitaux et secteurs stratégiques: Comment garantir notre indépendance?”, opening note, High Commissioner for Planning, No. 2, December 18, 2020.

supply chains was made public in June 2021.⁴² It recommends the mobilization of several levers: investments, public sector mobilization, incentives for private consumption, strategic stocks, research and development (R&D), relocation (especially for the production of critical ores), transparency and supervision measures for supply chains, trade policy, partnerships, etc.

At the European level, the EU also moved to identify dependencies, establishing a hierarchy of vulnerable sectors based on several criteria: a concentration index for extra-European imports, a dependency index for extra-European inputs, and an index showing how readily imports can be substituted by European production. These criteria made it possible to identify the products on which the EU is particularly dependent. The Union then investigated six specific areas in greater depth: raw materials, the active pharmaceutical ingredients, Li-ion batteries, hydrogen, semiconductors, and cloud and edge computing.⁴³

These approaches are highly instructive and show a strong convergence as to what qualifies as strategic on both sides of the Atlantic. Given the extent of ambitions for autonomy however, and the limited nature of resources available, it no longer appears advisable to consider entire sectors as strategic. Not everything in a given sector is necessarily strategic. What is more, the very notion of value chains and intermediate inputs points to interdependence between different sectors. Take the digital sector: rather than constituting a discrete sector, it runs across all the others. For instance, cloud storage capacities are potentially useful in many sectors, including health, finance, defense, and education. Since identifying whole sectors is ultimately too unwieldy, it would seem more relevant to zone in on functions, capacities, and assets.⁴⁴

An initial step in securing value chains could thus begin by defining:

- **The functions** which are strategic in terms of sovereignty: defense, communication, information, energy supply, food, medical care, finance, and transport, for example. While the Executive is ultimately responsible for defining those strategic

42. “Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-Based Growth: 100-Day Reviews Under Executive Order 14017”, White House, June 2021.

43. “Commission Staff Working Document. Strategic Dependencies and Capacities Accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Updating the 2020 New Industrial Strategy: Building a Stronger Single Market for Europe’s Recovery”, SWD/2021/352 final, May 5, 2021, available at: <https://eur-lex.europa.eu>.

44. This proposal is partly inspired by methodology put forward by ASD, an association representing the European space and defense industry, available at: www.asd-europe.org.

functions, this definition can be subject to debates and diverse political opinions, therefore the Parliament is increasingly involved.

- **The capacities** necessary for the fulfillment of these functions: networks, equipment, materials, software, etc. The identification of these capacities cannot be based solely on political or administrative considerations; rather, it requires the mobilization of fairly broad technical and operational expertise.
- **The assets and supplies** mobilized in the value chains in order to design, produce, operate, maintain, and update these key capacities, whether in terms of infrastructure (laboratories, factories, test or simulation facilities), technologies, know-how, or human resources. This stage is probably one of the most complex and involves structuring specific processes, tools, and organizations to coordinate all the public and private actors concerned.

Unlike sectoral approaches that tend to generate information “silos”, the approach detailed above should make it possible to identify the strategic assets and supplies mobilized by several capacities, and ultimately several strategic functions. Some raw materials, components, and items of equipment (semiconductors, batteries) or software form part of several strategic capacity value chains. Once identified, these nodal or transverse assets and supplies should then be subject to detailed mapping to detect possible risks regarding disruption to supply.

This mapping of value chains and foreign dependencies remains a difficult exercise. As mentioned, we need to go beyond a simple analysis of trade deficits, as this mainly provides information on dependencies affecting the last stage or task of the chain prior to import, but does not identify upstream tasks. In this context, many countries have significant deficits with China, owing to the assembly tasks carried out there. By way of an example, analysis of the trade deficit generated by the iPhone between the US and China shows that of the 1.9 billion dollars imported from China, the proportion of Chinese value added was only 73 million, far behind Japan (685 million), Germany (341 million), and South Korea (259 million).⁴⁵

Progress made in the field of statistics over the past several years has made it easier to measure international trade in terms of value added.⁴⁶ It is therefore possible to identify relationships of economic

45. Works by Meng and Miroudot cited in the report “Trade Patterns and Global Value Chains in East Asia: From Trade in Goods to Trade in Tasks”, WTO/IDE-JETRO, 2011.

46. In particular the OECD TiVA database, available at: www.oecd.org.

interdependence by assessing the value added by each country at different levels of the value chain. While Germany is the number one destination for French exports, the US is France's biggest client when it comes to value added.⁴⁷ In other words, part of the French value added exported to the United States is not exported directly from France but passes through other countries that use these French inputs prior to re-exporting them themselves to the United States (or via other intermediate countries). Although this measure of value-added trade indicates real progress, it currently classifies activities into a total of only thirty-six discrete sectors, therefore giving a very aggregated view of the internationalization of value chains and interdependencies between countries. It is not possible to identify foreign dependencies for a particular product or service using this method.

Some studies go further by incorporating the use of customs data. One such recent investigation by the *Observatoire économique de la défense* (OED) looked at 1,873 different goods and their associated import and export flows.⁴⁸ Although the data garnered have the immense merit of establishing a far more detailed picture, the research does not elucidate all the stages and tasks of the value chains beyond the leading customer or supplier country. The ideal would be to look more closely at one particular product or service, breaking it down into all its tasks and component parts, and tracing its entire value chain. While this may be relatively easy for a fairly straightforward product, it quickly becomes a gargantuan—or even impossible—task for more complex products or services. Thus, hybrid methods have arisen, which break only initial equipment down into component elements, especially in the case of computer products,⁴⁹ or which mix industrial data for tier 1 and make assessments based on input-output matrices for the following tiers.⁵⁰

47. "Trade in Value Added: France", Country Note, OECD, December 2018.

48. S. Moura, "La fragmentation mondiale des chaînes de production en biens militaires de la France", *Ecodef*, No. 175, February 2021.

49. G. Linden, K. L. Kraemer, and J. Dedrick, "Who Captures Value in a Global Innovation Network? The Case of Apple's iPod", Personal Computing Industry Center, 2008.

50. This method has been used in particular for the mapping of the "oceanic deterrence" industrial sector.

Summary of value chain mapping methods

	Customs data analysis	Input/output matrices	Hybrid method	Specific case studies
Principle	Analysis of imports, exports, and concentration of supplies by product as per customs nomenclature	Cross-checking of input/output matrices of several countries to account for intermediate consumption and identify the value added by each national economy	Use of detailed corporate data for the value added of the prime contractor and distribution of first-tier supplies, beyond which input/output matrices are used	Precise mapping of each of the components or subsystems of a product and identification of its price
Pros	Detailed nomenclature, good first-tier visibility (suppliers and direct customers)	Picture of international trade in value added, regardless of a country's position in the chain	Balance between accuracy (individual data) and efficiency (difficulty in mapping comprehensively beyond tier 2)	Accounts well for what is specific to each product: fine mesh
Cons	Takes intermediate consumption and value-added trade into account	High aggregation levels: lacks the precision necessary to study specific products	Availability and confidentiality of data, lack of accuracy beyond first tier	Feasibility: availability and confidentiality of data, lack of accuracy beyond first tier
Examples	S. Moura (2021) X. Jaravel, I. Méjean (2021)	OECD and WTO research mentioned above	H. Masson (2017)	G. Linden, K. L. Kraemer, J. Dedrick (2008)

Given these difficulties in accurately mapping value chains, it is essential to first of all target and prioritize the strategic assets or supplies to be studied. Once these assets have been identified and their corresponding value chains mapped, a criticality analysis must be conducted to target the vulnerabilities to be addressed as a priority. Like any classical risk analysis, criticality analysis combines the probability of a breakdown in supply taking place with a measure of its impact on strategic capacities and functions (power outages, unavailability of military equipment, impossibility of providing medical care, etc.). Criticality must then be compared against desired robustness or resilience levels, as the risk and duration of a breakdown or shortage in supply will not have the same level of severity for all strategic capacities. We must draw a distinction here between that which is *strategic* in terms of objectives (assets, value chains, capacities

contributing to sovereignty), and that which is *critical* in terms of risk (assets or supplies where a shortage is more likely and would have serious consequences). Vulnerability criteria include:

- The location (France, EU, abroad) and the number of countries involved in the value chain;
- The concentration of supplies (proportion from each country or supplier company);
- The length of the value chain (number of actors involved);
- Exposure to foreign regulations (export control regimes), some of which may be extraterritorial;
- Supplier company size (SMEs, mid-size, large);
- Supplier shareholder situation (public/private, national/foreign, risk of change);
- Degree of financial fragility of suppliers;
- Risk of losing certain competencies;
- The existence or otherwise of alternative sources.

Once vulnerabilities have been identified and assessed, a security plan can be established. This could be part of the “strategic independence plan” referred to by the Office of the High Commissioner for Planning.⁵¹

Defining risk management plans: A wide range of instruments

Among the risk management levers, domestic relocation presents itself as an attractive solution and is frequently backed in political speeches.⁵² However, its feasibility and impact should not be overestimated. The (re)location of a business entails being able to guarantee its competitiveness, in particular to cope with rising production costs. Moreover, being located in the national territory is not necessarily a guarantee of robustness and resilience of production in the face of major supply and demand shocks, as in the case of the pandemic for example.⁵³ While a domestic location

51. “Produits vitaux et secteurs stratégiques: Comment garantir notre indépendance?”, opening note, High Commissioner for Planning, No. 2, December 18, 2020.

52. “To my mind, today more than ever, we need to produce more in France, on French soil. This crisis is teaching us that the strategic nature of some goods, products or materials makes European sovereignty a necessity. We need to produce more domestically so as to reduce our dependence and provide for ourselves in the long term”, speech by President Emmanuel Macron, Saint-Barthélemy-d’Anjou, March 31, 2020.

53. S. Miroudot, “Resilience vs. Robustness in Global Value Chains: Some Policy Implications”, in: R. Baldwin and S. Evenett (ed.), *COVID-19 and Trade Policy: Why Turning Inward Won’t Work*, London: CEPR Press, 2020.

mitigates several risk factors, it cannot do away with all of them, in particular due to the extra-territoriality of certain regulations or the influence of foreign shareholders investing in assets on French soil. To be relevant, other control mechanisms (such as shareholding, potentially) should accompany the location of a particular activity on domestic soil, which should be reserved for particularly strategic assets and involve appropriate supervision of the critical size and competitiveness of the activity concerned.

Analysis of the value chain of nuclear ballistic missile submarines (SSBNs) testifies to this capacity for preserving a high degree of technological and industrial autonomy for reasons of sovereignty. In this example, autonomy is assured thanks to the significant majority of relevant activity being carried out in-house by Naval Group in France, with 99% of supplies procured from first-tier companies located in France (i.e., direct suppliers). Estimates made using corporate data and input-output tables from *the Institut national de la statistique et des études économiques* (French National Institute for Statistics and Economic Research) show that at least 90% of value added in the manufacturing of SSBNs is created in France, in over eighty *départements*.⁵⁴ This example shows that the goal of strategic autonomy can have real repercussions in terms of industrial policy and the creation of value added in the national territory.

However, location or relocation is not always a realistic option, or cannot be achieved in satisfactory economic conditions. For this reason, it is important to expand the range of levers that can be mobilized. Possible measures include (but are not limited to):

- **The diversification of supply sources**, both at the level of company and country: diversifying the sources of supply for gas, oil and uranium for example;
- **Building up strategic stocks** so as to offset any strain on production: stocks of fuel, masks, active ingredients for medicines—the stockholding obligation for drugs of major therapeutic interest for example can be up to four months;
- **Plans to step up industrial production** so as to anticipate a potential increase in demand (reservation of production resources, a skills development plan);
- **Innovation** aimed at replacing a foreign product with one that is developed and produced independently: replacing imported hydrocarbons via domestic hydropower development, nuclear

54. H. Masson, “Impact économique de la filière industrielle ‘Composante océanique de la Dissuasion’ - Part 1. SNLE”, The Foundation for Strategic Research (FRS), Research & Documents, No. 01/2017, January 2017.

energy, exploitation of shale gas or renewable energy (provided that the value chains involved in equipping them are themselves secured);

- **Legislation:** the imposition of proxy boards composed of French nationals in the event of a foreign takeover, location criteria for data storage, clauses governing secure procurement for sensitive public contracts, and shareholder agreements, for example;
- Public or private **investment** in order to exercise shareholder control (including the use of golden shares to block another shareholder's acquisition of a majority stake): purchase of companies, industrial assets, intellectual property rights;
- **Strategic partnerships** aimed at pooling, codeveloping, or exchanging key assets: cooperative weapons programs, test infrastructure sharing, defense agreements, etc. This lever is employed by the US and the EU through the Trade and Technology Council (TTC) in particular, which addresses issues such as security of supply, key technologies, foreign investment control, and data governance.

Mobilizing these different levers involves coordinating public policy and corporate strategy by efficiently mobilizing a great variety of actors.

Coordinating actors for a renewed sovereignty

At the national level

The development of a strategy for identifying, assessing, and managing risks related to strategic value chains requires the involvement and cooperation of many public and private actors. While many mechanisms exist already—particularly in the field of defense, with the Directorate General for Armaments and its department for industrial affairs and economic intelligence—the multisectoral nature of the capacities which contribute to sovereignty makes it necessary to facilitate greater fluidity between sectors and actors. While defining strategic functions in the context of sovereignty and identifying the capacities they require is undoubtedly a prerogative of the state, parliament cannot be excluded from this process. Indeed, parliament is not only the custodian of national sovereignty, but also plays a key role in voting on the budget and overseeing government action. It thus holds influence over the provision of capacities deemed strategic and the financing of levers for securing value chains.

Mapping these chains, the assets they use, and their vulnerability also entails the coordinating of multiple actors: on the one hand, companies, which can mobilize their business intelligence services and purchasing departments, especially when it comes to large corporations; and on the other, numerous government agencies and departments (such as internal and external intelligence services, the Directorate General for Armaments, customs, the treasury, the Directorate General for Enterprise including its strategic information and economic security arms, etc.).

It is less about adding new participants and more about coordinating the many that are already in existence, so as to ensure good coverage of all strategic assets and of the risk or opportunity factors to be investigated: scientific, technical, competitive, legal, financial intelligence, etc. Under the authority of the prime minister and working on wide-ranging matters of defense and national security, the General Secretariat of Defense and National Security (SGDSN) could see its role enhanced to include responsibility for such coordination. This cross-sectoral collaboration is vital, since sovereignty is a product—rather than a sum—of factors: if one is headed toward zero, the whole is weakened. Just as there is no military sovereignty without technological and industrial sovereignty, there is no technological and industrial sovereignty without legal, economic, and financial sovereignty. Ensuring such coordination is effective therefore requires the overseeing of collaboration across:

- **Sectors:** defense, health, energy, agribusiness, transport, digital, etc.;
- **Functions:** strategic intelligence, mapping, risk analysis, decision-making, implementation, monitoring and auditing;
- **Expertise:** economic, scientific, technical, legal, and financial.

One mechanism aimed at enhancing the economic security of strategic functions in the field of sovereignty involves strengthening the “strategist-state” and its capacity to anticipate and manage risks—something which has been placed under increasing strain over recent years, with events testing crisis management capabilities to the full (terrorist threats, social movements, pandemic). Beyond these various public actors, another interesting avenue for exploration would be to encourage certain companies to map their own value chains and share the associated risk analyses (in the strictest confidentiality of course). Several mechanisms could be enhanced or explored to this end: the addition of contractual clauses in the context of public procurement, introducing a legal obligation to map and monitor dependency risks, and standardization (awarding of certain public contracts conditional on compliance with standards),⁵⁵ for example.

55. Such as the ISO 28000:2007 standard, relating to “supply chain security management systems”.

What role for the European Union?

In addition to mobilizing national actors, the EU can play a role in securing strategic value chains, provided that its value added is well identified.

Between American smart power and the Chinese silk roads, the EU is within reach of two spheres of influence that are more interested in swallowing up the European market and its assets than in allowing an independent power to emerge. However, as we have seen before, Europe's failure to keep up is significant, especially in the digital field. Getting the twenty-seven member states to reach a unanimous agreement—to adopt a common strategy and optimize the allocation of their resources accordingly—is by nature a far more haphazard process than in the case of other large international powers such as the US, China, and Russia. Although these latter are subject to their own internal tensions, the fact of being nation-states gives them an advantage, a priori, in terms of agility and speed in decision-making and resource allocation.⁵⁶ Beyond the technological and economic considerations involved, one could even question the meaning and political purpose of a “European sovereignty” when a large majority of member states in fact rely on the North Atlantic Treaty Organization (NATO)—i.e., on external partners—to safeguard their vital interests. What sense does it make to be autonomous in the cloud if we have ceased to be so in matters of airspace and territorial defense?⁵⁷

For over ten years, the European Commission has been increasingly committed to industrial policy issues (space, batteries, cloud, semiconductors). This increasing engagement can be seen in none other than the sovereign sector of defense.⁵⁸ More broadly, Regulation

56. Some authors argue in particular that “among the large economic powers, the EU is unique in its institutional characteristics, as there is a separation between economic and foreign policymaking that exists neither in the United States nor in China. This separation defines EU trade and commercial policy and is a relic of the historical context in which the EU was founded. The rise of China and of US-Chinese tensions calls for further reflection on the need for the EU to adapt its institutional set-up, as well as sharpen its instruments”. See G. Wolff, N. Poitiers, and P. Weil, “Sovereignty and Digital Interdependence”, in: D. Fiott (ed.), “European Sovereignty: Strategy and Interdependence”, *Chaillot Paper series*, No. 169, European Union Institute for Security Studies, July 16, 2021.

57. As Daniel Fiott observes: “Those EU member states that are not competitive in key strategic areas may be tempted to forgo a serious push for EU technological sovereignty if it means risking the United States’ broader security guarantee to Europe. It should not be overlooked that Europe’s dependence on American technology is, in many respects, a conscious decision designed to shore up US military support in Europe. Thus, calls for EU digital or technological sovereignty imply reducing the EU’s dependence in all critical technology sectors (including the defense and space sectors)”. D. Fiott, “Strategic Sovereignty: Three Observations about a New and Contested Term”, in: D. Fiott (ed.), “European Sovereignty: Strategy and Interdependence”, *Chaillot Paper series*, No. 169, European Union Institute for Security Studies, July 14, 2021.

58. The adoption in 2009 of the “defense package” promoting the opening-up of national markets (Directive on public defense and security procurement 2009/81/EC) and exchanges

2019/452 establishes a framework for the screening of foreign direct investment in the EU. Alongside high-level statements and speeches, these measures illustrate not only an awareness, but also the taking of concrete measures toward enhancing the EU's strategic autonomy, including in technological and industrial matters. As we have seen, innovation and public investment are major levers for reducing dependencies and securing value chains. The search for economies of scale at the European level is therefore a laudable objective. Similarly, the pooling of investments often appears indispensable in the face of Chinese or American competitors with oft-superior resources.

Although it is still too early to judge the effectiveness of the most recent initiatives, certain limitations are already apparent and ought to be corrected.⁵⁹ Indeed, the realization of these theoretical assets faces several obstacles. The first is undoubtedly the slowness of the European decision-making processes, which penalizes the twenty-seven member states compared with larger, more unified powers. For example, it took the EU more than eighteen months to develop a “Strategic Compass”, yet France took less than three months in 2017 to define and adopt its *Strategic Review*. Moreover, the principles on which the single market is based place a strong emphasis on competition and free trade, sometimes to the detriment of the formation of European champions capable of competing on a global scale. The European Defense Fund is particularly indicative of this confusion between competitiveness and competition: rather than strengthening or consolidating current champions, it is more concerned with “opening up supply chains”, enabling the emergence of new players and providing the various entities of a single multinational company with a framework for access, while at the same time encouraging geographical dispersion, including to third countries.

If the European instruments are to function as real levers at the service of strategic autonomy, changes to certain modalities and areas of application would seem necessary. The commonly held view that “France no longer has the means” is not enough to justify seeking solutions at the European level: the EU must also bring a real added value in terms of efficiency.⁶⁰ Moreover, several small states show that

between member states via the directive on intra-Community transfers (2009/43/EC); the launch in 2016 of a preparatory action on defense research (PADR), and then in 2018 of a European Defense Industrial Development Programme (EDIDP); and most recently in 2021 of the European Defense Fund (EDF).

59. F. Mauro, E. Simon, and A. I. Xavier, “Review of the Preparatory Action on Defense Research (PADR) and European Defense Industrial Development Programme (EDIDP): Lessons for the Implementation of the European Defense Fund (EDF)”, European Parliament, Subcommittee on Security and Defense, May 2021.

60. We agree with the idea that European strategic autonomy cannot be based on multiple renunciations at the national level, nor serve as an outlet for certain countries' relative decline: “One could interpret the call for strategic sovereignty as a symptom of the helplessness of

the ability to develop key technologies in a sovereign manner does not depend only on size, high GDP, or demographics. Israel or Singapore's DTIB is testament to this, as is Taiwan and South Korea's predominance in the field of semiconductors. Agility, along with the ability to set long-term policy objectives and to define a strategy consistent with available resources, would appear just as important as overall investment capacity.

It is therefore necessary to target areas where the EU can be a real catalyst for securing strategic value chains. To this end, several economic criteria can be proposed on the basis of prior experience of cooperative programs (differing operational needs, or policy on workshare, which may adversely affect choice of the best actors, increased structural costs, etc.). For the European instruments to be as efficient as possible, it would appear preferable to ensure that:

- Needs are identical or highly similar;
- Non-recurring costs are proportionally very high relative to recurring costs (to make pooling attractive), and that the number of units is large enough to generate real economies of scale;
- The governance structure is as light as possible and promotes efficient industrial project management, in the hands of a single prime contractor where possible.

By adhering to these criteria, it would appear that the EU stands to see high value added in the development of technological solutions generating strong network effects, especially in the digital or space arena, as was the case with Galileo. Where these criteria cannot be met (e.g., the inability of various states to agree on need or timeframe, insufficient increase in economic gains relative to loss of national economic return and/or additional cost of governance structures), bilateral cooperation may be preferred, with partners in Europe or beyond.

Indeed, value chains can also be enhanced via strategic partnerships with non-European states which share the same ambition to preserve or even strengthen their autonomy vis-à-vis the United States or China. This strategy for the geographical reorganization of supplies could even be tied to development aid policy to support activities useful for securing value chains. In the case of critical raw materials, for example, it may prove useful to establish partnerships with African, Latin American, or even Asian countries (seeking to limit

individual states in an interdependent and more geopolitically charged international environment. Critically, calls for EU strategic sovereignty can be read here as a *cri de coeur* to rescue the nation state in the EU [...]. D. Fiott, "Strategic Sovereignty", in: D. Fiott (ed.), "European Sovereignty: Strategy and Interdependence", *Chaillot Paper series*, No. 169, European Union Institute for Security Studies, July 12, 2021.

their exposure to tensions between China and the United States), to help them progress along the value chain and thus “short circuit” China’s monopoly on the exploitation of their resources.

This strategy to secure supply chains would aim at:

- Shortening value chains to reduce points of vulnerability;
- Reducing dependence on China;
- Promoting development and therefore stability in nearby countries (especially in Africa);
- Ensuring the adoption of more humane and sustainable conditions for the exploitation of resources.

Conclusion

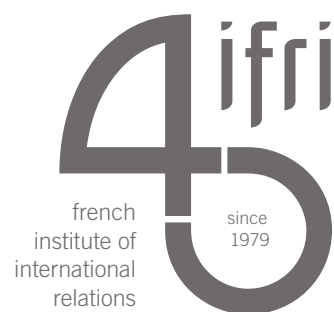
The Covid-19 pandemic and supply shortages have prompted an awareness of the vulnerability of value chains and their strategic consequences which seems doubly paradoxical. First, because this awareness comes very late, at a time when the internationalization of value chains appears to be losing momentum. And second, since the focus on relocations, while understandable, does not seem very well thought through, given the existence of other levers that could be mobilized and the potential impact of relocating in terms of costs and resilience. In both cases, the pandemic is less indicative of systemic vulnerability than of a lack of preparation and failure to manage the vulnerabilities inherent in current productive processes.

In addition, a quick analysis of the dynamics at work at the technological, economic, and geostrategic levels suggests that digitalization will continue to promote the internationalization of value chains. It also seems increasingly likely that this dynamic will be a key factor in the rivalry between China and the United States and their quest for technological supremacy and power. The idea that a counter process of “de-globalization” might resolve these issues thus seems illusory. The pathways we propose here are not concerned so much with removing interdependencies, as identifying and prioritizing those that are most critical, in order to implement levers aimed at minimizing the risks of supply disruption.

We recommend the updating of state mechanisms and the strengthening of exchanges between public and private actors, both to map value chains and their vulnerabilities and to select and implement the various mechanisms for securing them (stocks, diversification, innovation, legal levers, investment, partnerships, relocations, etc.).

While awareness of the need for European strategic autonomy is growing rapidly and many European initiatives are to be welcomed, several limitations entail the need for caution as to the EU's real ability to provide solutions in terms of securing value chains. Indeed, differences of opinion over the role of NATO and the transatlantic partnership, the lack of agility and strategic alignment inherent in a twenty-seven-member Union, and at times excessive confidence in the benefits of free and undistorted competition unfortunately risk hampering the emergence of strategic autonomy or European sovereignty.

This observation is not intended to discourage. While it is essential to mobilize European mechanisms and focus their use on areas where they can create real value added, it is equally important to establish international strategic partnerships with other nations wishing to preserve their strategic autonomy in the face of the US-China bipolarization.



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