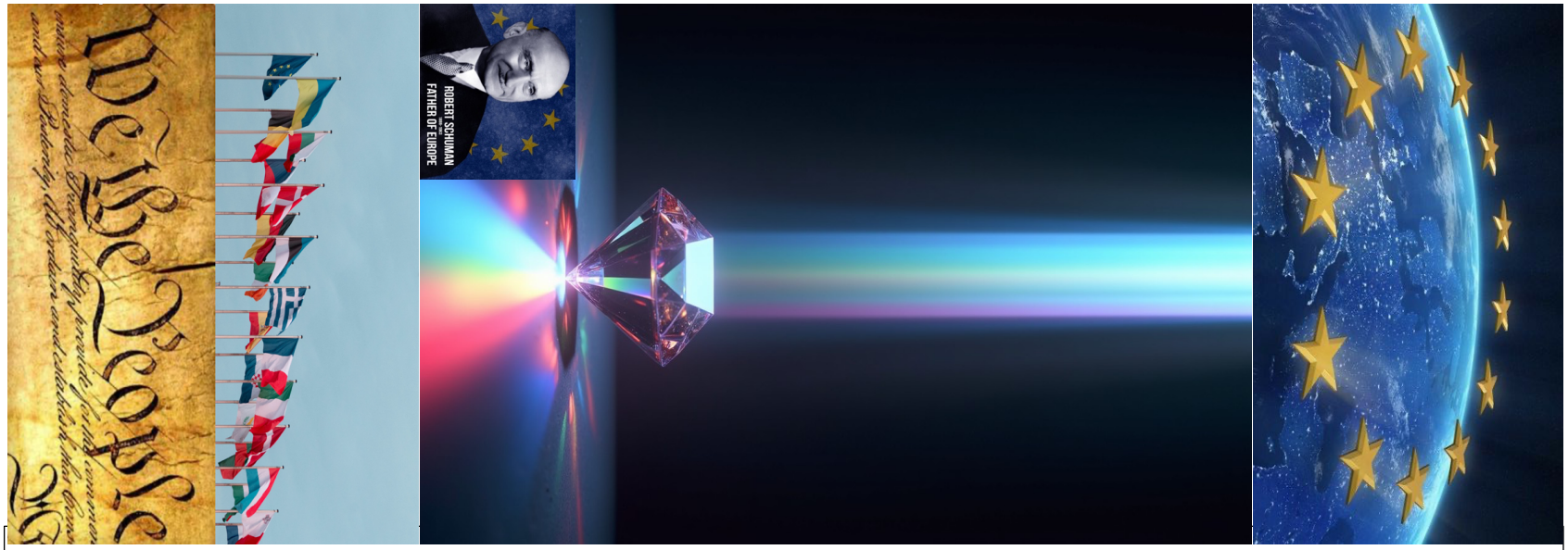


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Working Paper 9

The Chinese Great Leap Challenge:

from component manufacturer to ‘ Product as a Service’

Can Europe meet the challenge?

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from component manufacturer to “Product as a Service”

Can Europe meet the challenge?

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Abstract

The paper provides a compelling, highly realistic diagnosis of the structural mismatch between Chinese and Western, in particular European industrial ecosystems. Its central thesis, is that China’s dominance is no longer driven solely by cheap labor, but by hyper-dense local clustering, rapid iteration speed, vertical integration, and the strategic shift to Product-as-a-Service (PaaS). Supported by a clear and logical cost breakdown, several suggestions are proposed to tackle reduce the competitive gap. However, the challenge is high and requires a rethinking of the European architecture.

When China opened its borders in the late 1970s, a new Long March was set in motion, though this time economically and globally. China started with the volume production of simple components and gradually became the factory of the world. The West designed using advanced software, while China made the components and put them together, much cheaper than the West could. Western companies evolved too. Car manufacturers usually now only handle final assembly and sales. Components are manufactured worldwide (whether in China or not) and supplied via "Just-In-Time" logistics chains. As a result, the risk was also shifted more onto the suppliers. Western manufacturers also produce in China, even if they put their own name on the product.

The Great Leap Forward

However, China has not stood still. To keep its export machine running, a complete logistics ecosystem was built that brought the continuous flow of goods quickly and cheaply to the customer. China produces more cheaply, and Western companies also profit from this. Every step between the manufacturer and the end customer has its own margins and costs, meaning a component costing 1 euro is sold for 10 euros or more. The customer does not see those intermediate steps. A frequently heard explanation for China's low-cost price is that wages are low there. That is true compared to our high Western wages. Everything is cheaper in China. The West is expensive. The real reason is that China has also innovated in design, production, and within the logistics chain. Some factories are even fully robotised. Product development in China proceeds iteratively, much less top-down than is often still the case in the West. Well-educated people, in whom China also invests heavily, quickly turn an idea into a first prototype in weeks or months. That prototype is then iteratively improved into a fully-fledged product. Note that Tesla and SpaceX successfully follow a similar process. Another aspect is that production in China works in clusters. Shenzhen and Dongguan, for example, house most technological companies. Major players like BYD are vertically integrated there. BYD not only develops and produces cars, but also batteries, motors, and even chips. Suppliers are just a stone's throw away. They can deliver within an hour or a few days. The result is that Chinese

production is much cheaper not only in cost price but also in time. Speed is a major competitive advantage. Today, they are therefore a technological generation ahead. For instance, BYD recently released a new version of its Seagull electric car for under 10,000 euros. This is not a toy car, but a fully-fledged 5-seater compact that outperforms many Western cars for a fraction of the price.

Today, Chinese companies are taking the next step. They no longer restrict themselves to cheaply bringing a product to the market where the distribution chain or the final producer outside China walks away with most of the margins. They are switching to "Product as a Service" (PaaS). Products are sold directly at cost price or with a minimal margin, sometimes essentially for free but combined with a software or maintenance subscription that provides recurring revenue. Today, more than ever, software is what gives a hardware product its true functionality, and with AI it becomes a "smart" product. That software and the AI functions run in the cloud on servers. Many products are essentially computers with sensors, intelligence, and internet communication, even if they retain the form of their mechanical predecessors. Software evolves, which makes continuous updates and control almost essential. This ranges from simple kitchen robots to cars and complete production machinery.

This strategic shift is not just smart marketing. It is an economic weapon, much like the dominant position in rare earths. It is a model made possible by the hyper-dense and collaborative way in which Chinese production is organised. Crucially, it represents a structural boundary that established Western companies cannot easily match. They are trapped in slow, fragmented, long-distance supply chains.

The engine of the ecosystem: local clustering

The reason why Chinese brands can confidently sell a highly advanced device for almost no profit is the result of a long-term vision. In cities like Shenzhen and Dongguan, the entire electronics supply chain is densely packed into a small geographical area. Component suppliers, injection moulders, SMT (Surface-Mount Technology) lines, firmware engineers, and packaging facilities operate within a short drive of each other.

'Local clustering' completely transforms traditional product development:

- **Eliminating logistical friction:** In Shenzhen, a hardware designer can sketch an adjustment in the morning, walk across the street to get a modified printed circuit board or mould by midday, and test a production sample by evening. Freight costs, customs delays, and international transit times are effectively reduced to zero.
- **Less "legacy":** While Western manufacturers are often stuck with a proven design and existing production chains, Chinese designers frequently have the freedom to simplify the design to suit a state-of-the-art production chain. Costs decrease, while performance and reliability increase.
- **Aggressive vertical integration:** Many emerging Chinese consumer brands develop many components in-house. They directly own their component factories or hold a controlling majority in local suppliers. This eliminates intermediate margins, enabling them to produce hardware at a base price that Western companies cannot achieve even with massive economies of scale.

- **Rapid iteration cycles:** Because the physical distance between engineers and the factory floor is non-existent, Chinese companies can design a product at the speed of a software startup. If a component price drops or a design flaw is discovered, the production line is adjusted immediately.

This extreme cost efficiency acts as a financial cushion. It enables Chinese companies to view advanced hardware not as a primary source of profit, but as a tool to acquire customers. The software subscription delivers permanent recurring revenue.

Why the West and Europe cannot follow

When Western companies try to counter this strategy, they hit a structural wall. The dominant Western production paradigm, built over decades of globalisation, relies on highly fragmented and geographically stretched supply chains.

When a Western brand builds a product, the journey is long and complex, as well as vulnerable to international conflicts:

- Chips are designed in the United States.
- Wafers are manufactured in Taiwan.
- Packaging takes place in Malaysia.
- Final assembly takes place in China or Vietnam.
- Software is developed in India
- Finished goods travel across the ocean via container ships.

This extensive footprint introduces serious vulnerabilities that make the low-margin model and service subscriptions financially unfeasible for Western companies, even if final assembly is heavily automated. The first barrier is time constraints. A product adjustment that takes 48 hours to implement in China can take a Western company weeks or months due to time zone differences, logistical bottlenecks, customs clearances, and language barriers. By the time a Western brand responds to a market trend, its Chinese rival has already shipped a second-generation version.

The second barrier is asymmetric margin pressure. Because Western companies rely on outsourced contract manufacturers, transport companies, and international distributors, every node in the supply chain demands its own profit margin. A Western brand cannot sell a device at cost price because they must pay the physical overhead of international transport, storage, import tariffs, and distribution margins upfront. If a Western company tries to subsidise hardware to pursue a subscription model, they quickly bleed their working capital dry, leaving them vulnerable to a ruinous churn of subscribers.

The new competitive landscape

As a result, the global hardware landscape is splitting into two distinct camps. Chinese companies are exploiting their production clusters to lower initial hardware costs to unprecedented levels, shifting the profit phase to the software ecosystem or the service fees. Western established companies, unable to match this speed and cost structure, are forced to retreat into premium branding. They must charge high upfront prices for their hardware based

on design, product warranties, and prestige, and then attempt to stack subscriptions on top of that. Note that this is not entirely new. The model is also applied here, usually when a company has acquired a quasi-monopoly. Think of printers, design software, and prestige car brands. Premium products are typically not high-volume markets, and sooner or later an innovative newcomer undermines the monopoly. However, China is now going a step further. Every product is eligible because software and AI have become a major differentiator. China controls the entire chain of raw materials, design, component manufacturing, assembly, and value-added software. In the West, a manufacturer usually has to piece that together worldwide.

Ultimately, China's transition to a Product-as-a-Service model proves that manufacturing dominance is no longer solely about cheap labour. It is about speed, logistical integration, and the ability to turn physical products into a predictable, software-driven revenue stream. For Western companies, surviving this shift requires more than just reshoring factories or introducing counterproductive import tariffs and regulations.

It requires a complete restructuring of how physical products create value over the long term, how they are produced, and how they are brought to market. Such an upheaval in Europe is not straightforward. It is capital-intensive and entails a completely different way of organising. It also requires the cooperation of the political environment, which must provide the space to permit clustering. A fairly restrictive permit policy and heavy regulation are not helpful when time is running out. China has built this step-by-step yet rapidly over a few decades, with Shenzhen evolving from a fishing village into a hyper-modern technological megacity stretching over a few hundred kilometres. In the old European continent, this is barely conceivable.

Quantitative data and wider markets.

The PaaS (Product as a Service) business model is not really new and was initially called HaaS (Hardware as a Service). It is also practiced by western companies. The product range is also extensive ranging from traditional consumer products like security cameras and 3D printers, health related products like glucose monitors to heavy equipment like trucks, buses and machinery.

Originally most of these products generated recurrent revenue by requiring additional consumables like printer cartridges or coffee capsules or by combining it with an extensive service like for example for industrial tools or even vehicles. The user pays a periodic fee rather than directly owning the product. It reduces the upfront capital expenditure and ensures a smooth Quality of Service as the vendor takes care of product maintenance and replacement. This is particularly interesting for industrial equipment.

What changed this model is that increasingly products have a permanent link to internet cloud servers. Security cameras upload the pictures and videos. The manufacturer periodically installs over-the-wire security software upgrades, algorithmic improvements and additional functionality while removing the need for the user to manually follow-up the product releases and apply the upgrades. In addition, his initial acquisition cost is low, sometimes even zero.

What the advent of AI based functionality, this becomes even more attractive and even necessary. The smart product features require a high-power computer and lots of data that can

be shared over multiple products in the field. Moreover, AI based systems can evolve rather rapidly as the data acquired by the sensors steadily grows dataset and the AI models improve every day. By centralizing it, the manufacturers can monitor their products in real-time at a very low cost. The data itself can be a source of revenue for advertising. For the end-user, it reduces up-front capital needs while providing a smooth and efficient operational cost. This is in particular of interest for high ticket products like agricultural or industrial machinery, heavy vehicles or products that are deployed in large swarms like drones and video surveillance systems.

Western companies however are confronted with a much higher product development and manufacturing cost. Some of these companies have also set up factories in China, subcontracted to China and buy their components in China. While this provides some relief, it also increases the vulnerability, for example due to instabilities of the world-wide economy as we have seen with the recent tariff wars and shipping lane disturbances due to war.

Let's compare different strategies in cost for a hypothetical prosumer product with a selling price of 800 euro.

Cost Component	**Strategy A: Chinese Local Cluster (e.g., Bambu Lab, Eufy)**	**Strategy B: 100% Western Domestic set-up (Local R&D + Local Factory)**	**Strategy C: Western Hybrid set-up (US/EU R&D + Outsourced to China)**
R&D & Firmware Engineering	**€40** *(Lower software salaries, ultra-fast local prototyping)*	**€150** *(High Silicon Valley/EU engineering wages, slow iteration)*	**€120** *(High Western design costs, slow cross-border firmware handshakes)*
Bill of Materials (BOM)	**€140** *(Sourced directly from local Shenzhen component clusters)*	**€280** *(Imported chips/molds with duties, lack of component density)*	**€160** *(Contract manufacturer markup on Chinese components)*
Factory Labor & Assembly	**€20** *(Highly optimized, automated domestic assembly lines)*	**€90** *(Strict local labour laws, high hourly factory wages)*	**€25** *(Chinese factory labour rate via contract manufacturer)*
Contract Manufacturer (CM) Profit Margin	**€0** *(Company often vertically owns the factory or has local equity)*	**€0** *(In-house production or local factory flat overhead)*	**€35** *(Foxconn/Pegatron style 15–20% markup on assembly & BOM)*
International Logistics & Duties	**€15** *(Bulk sea freight distributed directly via local hubs)*	**€5** *(Domestic trucking or intra-EU rail)*	**€45** *(Air/sea freight, customs clearance, import tariffs, port fees)*

Warranty & Reverse Logistics Liability	**€25** *(Direct replacement swap model utilizing cheap parts buffer)*	**€115** *(High local repair labor costs, expensive domestic parts)*	**€50** *(Complex cross-border return paths, localized customer service)*
Total Cost to produce 1 Unit	**€240**	**€640**	**€435**

Sources:

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The results are surprising. The production cost is almost one third to half vs. what a western manufacturer can reach even when outsourcing to China. Let's analyse the three strategies:

Strategy A: The Pure Chinese Local Cluster

- Total product cost is roughly €240.
- The advantage: This strategy wins through density and speed. Because the factory is next door to the design team, they do not pay a "communication or management fee." They bypass the standard 15-20% contract manufacturing markup because the brand and the supply chain are often part of the same corporate ecosystem.
- The PaaS business: Because the production cost is only €240, they can sell this €800-value product for an aggressive €299 upfront price. They break even immediately on the hardware sale and pocket 100% of the subscription fee moving forward.

Strategy B: 100% Western Domestic Set-up

- Total product cost jumps to €640.
- The disadvantage: Engineering and labour in Silicon Valley, Munich, or Eindhoven is 3 to 4 times more expensive than in Shenzhen. Furthermore, because component ecosystems (injection moulding, specialized sensors, display controllers) are physically located in Asia, a Western factory must import the pieces. This incurs severe delays, customs paperwork, and transport fees before assembly even begins.
- The PaaS business: A PaaS model is impossible without massive capital injection. If the company tries to sell the hardware at a subsidized €299, they lose €341 on every single box shipped. A few cancelled subscriptions (churn) will bankrupt the business. They are forced to charge a premium upfront price of €799+ just to survive.

Strategy C: The Western Hybrid Set-up (Outsourcing to China)

- Total product cost is €435.
- The disadvantage: This is where most Western tech companies sit, and it highlights the hidden costs of globalization. While they capture cheap Chinese labour and components, they pay heavy penalties in logistics, markup, and management friction:

- The middleman fee: A contract manufacturer (like Foxconn) does not work for free; they add a 15–20% margin to the components and labour.
- The distance fee: Moving heavy physical hardware across oceans adds up to €45 per unit in shipping container fees, fuel surcharges, port congestion costs, and import tariffs.
- The Iteration Delay: A firmware bug or hardware tweak can take weeks of midnight video calls and shipping physical prototypes back and forth across the Pacific.
- The PaaS business: They can run a hardware subscription, but their margins are dangerously tight. If they sell the hardware for €399 to be competitive with Chinese rivals, they are taking a loss of €36 per unit upfront. They must maintain a very low churn rate to recover that loss via software or services over the first 6 to 9 months. If the churn rate is high, then the company must maintain a customer lifespan of up to 30 months.

The impact of western protective measures

China has evolved from a cheap factory for the West to a formidable competitor. It should also be clear that this is not a question of lower wages. China has worked in depth. It is a long-term strategy that is now resulting in a supremacy both in innovation and in market penetration. The US and the EU are now experiencing growing trade deficits as a result, in the order of one billion a day for Europe.

Import tariffs have been imposed by the US as well as Europe. Their major effect is that they increase the cost of goods as well as of imported components The reseller or manufacturer can reduce his margins but that will reduce the profits and ultimately the financial situation. One can also expect a reduction in demand from customers. In addition, Chinese companies have a much larger operational margin because they produce at one third or half the western price. Some Chinese companies can tolerate the financial penalty by shipping from intermediate countries like Vietnam of Mexico, pursue a strategy of inverse acquisition of ailing western companies or set-up assembly in the target country. It is clear however that import tariffs are only a short-term remedy. They don't solve the structural handicap, even if the import from China declines (as is the case in the US). Moreover, China is still a dominating supplier of components and raw materials. Hence, the Chinese government reacted by imposing export restrictions. This is mainly the case for rare earth materials that are subjected to export licenses. It also applied import tariffs on western good like pork meat and luxury goods. Similarly, the US has applied export restrictions on semiconductors and the manufacturing equipment. China has responded by being smarter and developing their own technology.

Non-trade barriers are also applied. As many products are now connected to a cloud server, the fact that the server is located in China whereby the manufacturer has data and control access to all products sold, is seen as a security and privacy risk (AVG/GDPR rules). This can force Chinese suppliers to use cloud servers located in the US or Europe, which is an extra cost. In some cases, like the DJI drones in the US, their sales are completely banned. Having to comply with strict technical certifications is another imposed barrier, especially in Europe where manufacturers often have to cope with regulations that are country specific on top of EU regulations.

Chinese companies often cope with these measures by offering a complete service, especially in high value product markets. Examples are public transport e-buses (BYD) whereby BYD offers not only the buses at low cost but also the megawatt charging stations and the telematics software. The same approach is used for example in Windmill parks (Goldwing) and heavy e-trucking (Windrose). What is offered is a complete and guaranteed level of service, rather than just the product. Note that western companies also offer such business proposals (Rolls-Royce, Scania, Caterpillar, …) mostly in markets where they still have an established leading position and brand legacy and trust being barriers to change. Chinese companies however benefit from a much lower production cost as we have seen. Once they develop products of similar or even superior quality and decide to enter these markets, one can expect this to be disruptive for western suppliers who often lack large financial buffers.

Conclusion

From above analysis, it is clear that China's increasingly leading economic position is not only the result of its cheaper labour cost. It is the result of a long-term strategy that was executed over the last decades. Leaving aside the US, who consider China more as a political than an economic threat, Europe's problem goes deeper with a billion euro trade deficit a day as a clear symptom. The economic decline of the EU, as documented in Draghi's report, is also evident when compared with the US that is clearly more resilient partly due to the strength of the US dollar, but also because of an entrepreneurial and investors culture. The case of SpaceX and Tesla clearly show what is possible.

The Cost of Goods comparison has highlighted several domains where Europe is lagging. One of the root causes is the world-wide outsourcing of the supply chain. This was beneficial as long as western brands were dominant, logistic routes affordable and the world was a stable place. Meanwhile, Chinese product innovation and a world in turmoil present western companies with multiple challenges. Can Europe address these issues and what needs to be done? The cost of goods might need to be reduced with a factor 2 to 3, while still competing in quality and functionality. Let's base our analysis on the cost comparison table above.

Cost Component	**Strategy A: Chinese Local Play**	**How can Europe adapt?**
R&D & Firmware Engineering	*(Lower software salaries, ultra-fast local prototyping)*	• *Reducing labour costs: low tax on salaries and other financial levies* • *Small local teams working in agile mode* • *Proximity with factory* • *Use of AI*
Bill of Materials (BOM)	*(Sourced directly from local Shenzhen component clusters)*	• Create local regional clusters • Low latency logistics ⇨ Decentralise but assure critical mass
Factory Labor & Assembly	*(Highly optimized, automated domestic assembly lines)*	• Automated factories • Designed for change • Reusable components and platforms
Contract Manufacturer (CM) Profit Margin	*(Company often vertically owns the*	• *Economy of scale by vertical integration* ⇨ Requires massive financial leverage

	factory or has local equity)	
International Logistics & Duties	*(Bulk sea freight distributed directly via local 3PL hubs)*	• Internal market • Intra-community high-speed, high volume transport ⇨ Requires massive investments in infrastructure
Warranty & Reverse Logistics Liability	*(Direct replacement swap model utilizing cheap parts buffer)*	• Low labour costs • Set-up of local service centres • High-speed logistics

In summary, the objectives must be:

- Lower labour costs, mainly through much lower tax and levies on labour
- Shorter development times, mainly through agile and competent teams using AI
- Lower logistic costs mainly through geographic clustering, high-speed logistics and vertical integration
- Lower production costs through automation and reuse

Additional measures can also strengthen the European positioning in the market:

- Europe based servers to ensure interoperability and data sovereignty
- As regional clusters will be difficult to set-up (by lack of virgin space), networked micro-clusters in combination with high-speed logistics can offer the same speed benefits
- Building up a competitive semiconductor sector (Europe is now dependent on mostly the US for high-performance chips)
- Reducing the dependency on rare earth materials and energy import
- Focus on high value B2B markets whereby the initial hardware cost has a lower importance than quality, expertise and trust dominate.
- Redesign the European regulatory framework for speed and minimal overhead.

In the geographically distributed European continent this poses several challenges.

Lowering the labour costs mainly means drastically lowering labour taxes and various social security contributions. As most EU countries already run a budget deficit with a large public sector, this comes down to reducing the public sector. The public sector must not only refocus on its essential role, but also deliver its services in an efficient way.

At the same time, the industry must reorganize in local focused clusters. Large companies must focus on their core business and strength, integrating vertically rather than expanding horizontally. Flexible automation is key. Note that the EU often operates in a centralized way contrary to these objectives. Stringent, often bureaucratic regulations are imposed adding to the development and production costs. But even R&D programs are centralized based on rigid, not always relevant anymore, workplans and large EU-wide distributed consortia.

The required changes are essentially structural and will require substantial investments. Are European capital markets ready for these? How can the public sector be streamlined without creating public unrest while this is already the case today? Can the EU bureaucratic regulations machine regulate itself for efficiency and alignment with these goals? Can the EU find a way to pool its financial resources to make the necessary investments over a sustained period of time? We note that several of the recommendations in Draghi's report formulate similar recommendations.

We remark that the required changes are in line with the proposal made by Schuman2030. In the Europe of Schuman2030, bottom-up subsidiarity is a key element as it shortens the feedback loop. Member states keep their competences as much as possible, which is in line with the need for local technology and product clusters. Such specialisation is already partly present in the various countries. This can be a stepping stone if the local companies are vertically reorganised and the local public sectors are sanitized allowing lower taxes. At the same time, the EU needs to bundle its resources for competences that should be federated. These competences have EU-wide importance and require long term planning and action. In the context of this paper, we highlight the need for a fast European high-speed logistics ecosystem and the need for long-term planning across the whole supply chain. Energy and raw materials are another domain that requires attention.