



INDUSTRIAL POLICY IN THE EUROPEAN UNION

**TOWARDS A PROGRESSIVE
AGENDA**

**WITH A PREFACE BY MARIANA
MAZZUCATO**

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PREFACE

By Mariana Mazzucato

Industrial policy has returned to the European Union's agenda with remarkable force. For decades, economic governance in Europe was dominated by the belief that the role of the state was simply to fix market failures while leaving the direction of growth to market forces. Today, that view is no longer tenable. The climate emergency, the digital revolution, geo-economic rivalries, and the war in Ukraine have made clear that markets do not automatically produce socially desirable outcomes. They must be shaped—by design, with purpose, and through capable public institutions.

This is the essence of the [entrepreneurial state](#): not a passive fixer of problems, but an active shaper and co-creator of markets. From the internet to renewable energy, history shows that transformative innovations did not emerge spontaneously from the private sector alone. They were catalysed by bold public investments, risk-taking, and coordination across different sectors. Recognising this role does not diminish the importance of business or civil society; it elevates the need for [genuine partnerships](#) in which the public sector sets direction and crowds in innovation.

The EU has already taken steps in this direction. The European Green Deal, the Green Deal Industrial Plan, and the [missions framework in Horizon Europe](#) all signal an ambition to use industrial policy as a tool for transformation. But these ambitions risk being diluted if they are reduced to competitiveness slogans or captured by vested interests. As the [Draghi Report on European competitiveness](#) starkly underlines, Europe has fallen behind the US and China in critical technologies. Yet the response cannot be a race to the bottom in subsidies or deregulation. Industrial policy must be rooted in a distinctly European vision of [public value](#): innovation that advances sustainability, inclusion, and resilience, not just short-term profits.

This is why [missions](#) matter. Missions are not abstract aspirations; they are practical instruments for transforming our economies. A mission like achieving 100 carbon-neutral cities by 2030 forces us to think across silos, [mobilising innovation](#) in energy, transport, housing, and digital infrastructures. It also requires mobilising finance, regulation, and citizen engagement in ways that open new pathways for inclusive, sustainable growth. Missions orient both public and private investment around a shared purpose, ensuring that resources are directed where they can have the greatest systemic impact.

But missions cannot succeed without the right [public sector capacities](#). Too often, governments are tasked with delivering transformative strategies without the skills, structures, or resources to do so. Fragmented agencies, rigid procurement rules, and short-term funding cycles undermine the state's ability to experiment, learn, and adapt. What is needed is investment in the [dynamic capabilities](#) of the public sector: the ability to anticipate and shape technological

change, to coordinate across levels of government, to partner effectively with citizens and trade unions, and to govern ambitious programmes over the long term. Without such capacities, missions risk becoming declarations without delivery.

The debate on industrial policy in Europe increasingly emphasises strategic autonomy. This is understandable in a world where dependencies in energy, raw materials, and digital technologies have been weaponised. Yet autonomy should not be mistaken for isolationism. The question is not whether Europe can decouple from the world, but whether it can shape globalisation around values of sustainability, equity, and democracy. That means building resilient domestic capacities while forging fair partnerships with the Global South, and ensuring that industrial policy serves people and planet rather than narrow corporate interests.

As this volume shows, Europe now faces a crossroads. One path is a narrow, defensive industrial policy centred on competitiveness and security, with the risk of entrenching incumbents and exacerbating inequalities. The other is a [progressive industrial policy](#), mission-oriented and inclusive, designed to accelerate the green and digital transitions while spreading their benefits fairly.

Three priorities stand out:

First, Europe must double down on missions. Ambitious, measurable goals provide the compass for industrial policy. They galvanise innovation and direct investment towards solving our biggest challenges, rather than scattering resources or reacting piecemeal to crises.

Second, Europe must strengthen its public sector capabilities. Missions cannot be outsourced. They require public institutions that are empowered, skilled, and confident in their role as co-creators of markets. This means changing how we design and fund agencies, how we govern procurement, and how we evaluate success—not by cost savings alone, but by the public value created.

Third, finance must be aligned with purpose. Europe's fiscal and monetary frameworks should enable long-term, mission-oriented investment rather than constrain it. Institutions like the European Investment Bank and the European Central Bank must be mobilised to support patient capital, crowd in private finance, and ensure that funding flows where it matters most.

The renaissance of industrial policy is an opportunity for the EU to lead—[not by copying the US](#) or China, but by forging a model that is distinctly European: democratic, sustainable, and inclusive. This requires courage to set direction, capacity to deliver, and commitment to ensuring that industrial policy works for all.

The contributors to this book rightly remind us that industrial policy is not an end in itself. It is a tool for shaping our economies towards outcomes that matter for society. Europe must resist the temptation to reduce industrial policy to a competitiveness race or a security shield. Instead, it should seize this moment to embrace a mission-oriented approach, underpinned by capable public institutions and guided by the values of justice and sustainability.

If Europe can do this, it will show the world that markets are not forces of nature to be obeyed, but human institutions to be designed—for resilience, prosperity, and shared progress. This is the true promise of a progressive industrial policy: not only to confront today's crises, but to shape a better future.

THE RENAISSANCE OF INDUSTRIAL POLICY IN THE EUROPEAN UNION: AN INTRODUCTION

By Werner Raza, Christa Schlager, Viktor Skeyrman, Michael Soder

The EU's renewed embrace of industrial policy risks prioritising security and competitiveness over social justice and climate action—but a progressive alternative remains possible.

After decades of marginalisation, industrial policy has returned to the European Union's political agenda with remarkable force. While this shift in economic discourse deserves welcome in principle, progressives must urgently examine the fundamental questions driving this renaissance: why pursue industrial policy, how should it operate, and—crucially—who benefits? What motivations underpin these initiatives? Which objectives take priority? Who sits at the decision-making table, and who bears responsibility for implementation?

These pressing questions animate the contributions to this volume. Though our authors span different institutional and disciplinary backgrounds, we share a common purpose: shaping an industrial policy agenda that effectively promotes the green and digital transformations (*aka* twin transformation) while ensuring social balance and democratic legitimacy.

The European Union's contemporary industrial policy measures initially emerged from two existential challenges: the climate crisis and the digital revolution. Recently, however, the liberal international order's crisis and intensifying rivalries between great powers—particularly the United States and China—alongside the war in Ukraine, have led European policymakers to embrace an increasingly geopolitical approach to economic policymaking. Security considerations now overshadow green and social agendas.

This shift is threatening to fundamentally reconfigure initiatives such as the European Green Deal, the Important Projects of Common European Interest (IPCEIs), and numerous member state policies developed over the past five years. Concern about the EU economy's lacklustre dynamism and its technological lag behind the US and China—analysed comprehensively in the Draghi Report—has prompted the new European Commission to refocus debate on promoting the EU's global competitiveness. While these programmes typically emerge through close cooperation with the corporate sector, the interests of other stakeholders—particularly trade unions and civil society—receive far less consideration.

Most worryingly, by re-establishing competitiveness as a primary objective, the new Commission apparently intends to retreat from its social and environmental agenda. Security and competitiveness objectives are becoming the central motivations for future industrial poli-

cy. Industrial policymaking in the EU thus stands at a critical juncture, with its strategic trajectory for the coming years under intense discussion.

THE CASE FOR INCLUSIVE INDUSTRIAL POLICY

Against this evolving background, this edited volume intervenes in the debate from a critical perspective. Our basic premise holds that sustainable and successful industrial policy requires an inclusive approach based on democratic deliberation and participation. Progressive industrial policy must integrate the interests of all affected stakeholders, including workers and civil society.

The volume pursues three objectives: first, to assess existing industrial policy initiatives and programmes, identifying weaknesses and deficits in both design and implementation; second, to introduce additional elements critical for inclusiveness and thus long-term success, spanning company, sector, governance and macroeconomic levels; and third, to propose an action programme for progressive industrial policy in the coming years, both within the EU and globally.

The book's five sections systematically examine the challenges and opportunities facing European industrial policy. Section I begins by assessing EU economic dependencies across three critical domains. *Dario Guarascio, Jelena Relic and Francesco Zezza* examine the EU's energy dependencies; *Bernhard Tröster, Simela Papatheophilou and Karin Küblböck* analyse critical raw materials; while *Christian Reiner and Roman Stöllinger* investigate the technological dependencies.

These contributions reach a shared conclusion: while the EU has begun confronting these external dependencies, progress remains markedly slow. More effective and determined action will prove necessary to achieve the EU's targets for strategic autonomy through industrial policy. Reducing dependencies—whether on energy imports or critical raw materials—will require, above all, more rapid transition to a renewable energy system and a fully-fledged circular economy within the EU. Internationally, just and sustainable cooperation with partners, particularly in the Global South, will prove crucial.

Section II addresses the employment impacts of the twin transformation. *Marialuisa Divella, Valeria Cirillo, Lydia Greco and Eustachio Ferrulli* provide a preliminary assessment of the Just Transition Initiative and its implementation in Italy, Spain and Germany. Despite the Commission's claims that it "leaves no one behind", the initiative's scope remains too limited. Implementation has proved slow, marked by institutional capacity constraints and lacking comprehensive, forward-looking regional planning. The authors emphasise the need for longer-term programme horizons, strengthened administrative capacities and more inclusive territorial planning processes that genuinely involve trade unions and civil society.

Béla Galgóczi's analysis reveals that employment transition challenges extend beyond managing job losses in carbon-intensive industrial sectors. The slow pace of building green industries and economic activities that provide new employment poses equal concern. EU industrial policy must therefore accelerate green transformation by promoting green sectors and jobs. The competitiveness so dear to the new Commission will critically depend upon creating new competitive advantages in a shifting global economy where other powers—particularly the US and China—already enjoy technological leads in green and digital technologies.

Section III examines deficits and challenges in the governance of EU industrial policy. *Werner Raza* argues that long-term societal support for industrial policy promoting the twin transformation will critically depend on both input and output legitimacy. The current institutional policy setup needs major reform on both accounts. Conditionalities, including social conditionalities, emerge as instruments with potential to improve EU industrial policy legitimacy across both dimensions.

Wolfgang Polt highlights significant deficits in EU industrial policymaking regarding both strategic outlook and governance systems, including lack of leadership, poor coordination across multiple levels, and missing implementation capacities. *Rainer Kattel* examines deficits in the EU innovation system, characterised by institutional fragmentation, bureaucratic processes and limited innovation generation. The essay argues that policymakers at all European governance levels should focus on designing and developing organisational ecosystems for innovation, fostering dynamic capabilities and allowing experimentation.

Section IV addresses the macro-financial framework for effective industrial policy in the EU, particularly the existing investment funding gap. *Viktor Skyrman* discusses various options to increase EU-level funding capacities for the twin transformation. Observing the limited success of the prevailing de-risking approach, *Skyrman* calls for conditionalities linking company subsidies to profit reinvestment, suggests expanding EU-level taxation—particularly on financial transactions, wealth and capital gains—and proposes leveraging Europe's development banks for scaled-up credit allocation and equity funding.

Following a critical assessment of the new EU fiscal rules, *Philipp Heimberger* discusses options to expand fiscal space for additional public expenditure supporting the twin transformation. Besides advocating modifications to key technical assumptions underpinning the new rules and expanding national co-financing for EU programmes, he proposes establishing a permanent EU investment fund financed by issuing bonds on EU capital markets.

Gaston Bronstering, *Agnieszka Smolenska* and *David Barmes* explore monetary policy and the European Central Bank's role. Their analysis reveals that the ECB's measures supporting green transition remain fragmented and insufficiently connected to the broader EU sustainability agenda. The chapter identifies practical pathways, including the ECB using EU sustainability definitions (Taxonomy, Green Bond Standard), greening its collateral frameworks, and implementing Green Targeted Longer-Term Refinancing Operations (Green TLTROs).

BUILDING A PROGRESSIVE AGENDA

The final section presents proposals for a progressive industrial policy agenda promoting the twin transformation. *José Miguel Ahumada* and *Fernando Sossdorf* identify critical elements for promoting green industrial policy in the Global South. These include putting foreign direct investment to use for productive diversification, building regional production networks and stronger regional funding structures, ensuring digital sovereignty, and strengthening institutional capacities for industrial policy.

Synthesising all contributions, the concluding chapter by *Werner Raza*, *Christa Schlager*, *Viktor Skyrman* and *Michael Soder* proposes a progressive agenda for EU industrial policy based on six pillars: enhancing spaces of participation; ensuring fair distribution of benefits and costs; accelerating the twin transformation agenda; promoting a governance framework with capacities

and capabilities; closing the funding gap; and cooperating with partners on global twin transformation.

Democratic politics in the EU stands at a crossroads. Using public money and industrial policy for military rearmament while cutting social spending and deprioritising the green transformation will not deliver economic growth and employment. Instead, this path will deepen the ecological crisis and social inequities while exacerbating geopolitical conflicts. Such an approach ultimately plays into the hands of authoritarian populists.

Industrial policy in the EU should instead promote a new economic model serving both planet and people. Our hope is that this collection will contribute to that vital project.

PART ONE
EXTERNAL DEPENDENCIES OF THE EUROPEAN UNION AND HOW TO TACKLE THEM

CHAPTER 1

EUROPE'S ENERGY DIVIDE: WHY THE GREEN TRANSITION RISKS LEAVING HALF THE CONTINENT BEHIND

By Dario Guarascio, Jelena Reljic, and Francesco Zezza

As fossil fuel dependency threatens sovereignty, the EU's fragmented response deepens existing inequalities.

The war in Ukraine has made one thing painfully clear: reducing Europe's dependence on fossil fuels is no longer just about fighting climate change. It is equally about preventing future inflationary shocks — like those that eroded European workers' purchasing power between 2022 and 2024 — and regaining the EU's economic sovereignty.

While decarbonisation and climate goals remain extremely urgent, accelerating the shift towards a fossil-free and technologically autonomous energy system — from batteries to solar panels — has become crucial for restoring competitiveness and ensuring a socially sustainable growth model. Yet this is anything but an easy task. [The path ahead is riddled with obstacles](#): external dependencies, internal asymmetries, and fiscal constraints that continue to limit the EU's capacity to invest where it is needed most.

First, the EU remains heavily dependent on imports for most of the raw materials, technologies, and components needed to accelerate the green transition. This vulnerability partly results from almost two decades of [neglecting industrial policy](#) and underinvestment in clean technologies. During this period, industrial priorities were shaped by the interests of dominant exporting sectors — particularly large (mostly German) car manufacturers — which, blinded by their immense diesel-related profits, remained reluctant to shift towards greener alternatives.

Second, the lack of a common EU budget and [fiscal rules](#) that constrain public investment capacity make progress even harder, especially because those ahead in this technological race (notably China) can count on vastly superior resources. Trump's trade and technology wars are likely to further complicate the European situation, introducing new layers of complexity.

Third, the EU faces [deep internal divides](#). The countries expected to face the highest restructuring costs from the green transition often lack both the productive-technological capabilities and the fiscal capacity needed to support the workers and territories most affected.

Despite the proliferation of policy initiatives — the Green New Deal, REPowerEU — aimed at accelerating the green transition, resources [remain insufficient](#) to meet the European economy's

needs. Likewise, there appears to be [little awareness](#) about the importance of reconciling decarbonisation efforts with reduction of internal divides.

An emblematic example is the redirection of significant cohesion funds towards financing green initiatives — undermining support for the very regions most in need of structural investment. In this context, understanding how EU member states are positioned in terms of energy vulnerability and resilience — how prone they are to energy shocks, what socio-economic costs are likely to arise, and how fast they can recover — becomes crucial for evaluating the adequacy of current green industrial policies, both at national and EU levels.

EU ENERGY VULNERABILITY AND RESILIENCE: A HIGHLY MIXED PICTURE

In a [recent study](#), we provide detailed mapping of the structural factors shaping energy vulnerability and resilience across the EU. Building on this mapping, we assess whether current green industrial policies are likely to exacerbate internal divides — further weakening the EU in the new global context — or instead promote convergence, enabling periphery regions to catch up in terms of productive-technological capabilities and growth.

Energy vulnerability refers to the degree to which a country is exposed to energy shocks — whether due to overreliance on imports, fossil fuels, or a handful of suppliers. Resilience, on the other hand, reflects a country's ability to adapt — to diversify sources, ramp up domestic capacity, and protect households and firms from economic fallout.

These are not symmetric concepts. A country can be highly vulnerable (dependent on Russian gas, for instance) yet still resilient (due to strong fiscal capacity or renewable infrastructure). Conversely, a country with low vulnerability can still lack the resilience needed to cope with a shock.

We rely on a rich set of indicators grouped into five main dimensions: energy availability (import dependency, supply mix); energy affordability (electricity prices, vulnerable households); technological capabilities (green patents, R&D); energy intensity (energy used per unit of GDP); and environmental sustainability (CO₂ emissions, land use). This information allows us to rank EU countries in terms of their relative energy vulnerability and quantify their room for manoeuvre in facing future crises.

Even though the share of renewables in the energy mix has risen since the early 2000s, the EU as a whole remains highly dependent on fossil fuels (see Figure 1). In 2022, oil and gas accounted for 60 per cent of the EU's energy supply, whilst imports covered over 63 per cent of its gross available energy.

Yet, as is often the case, EU-wide averages mask stark national differences. Member States vary widely in terms of import dependency (Figure 2) as well as across several other key dimensions, including energy intensity, affordability, and technological capacity (Figure 3).

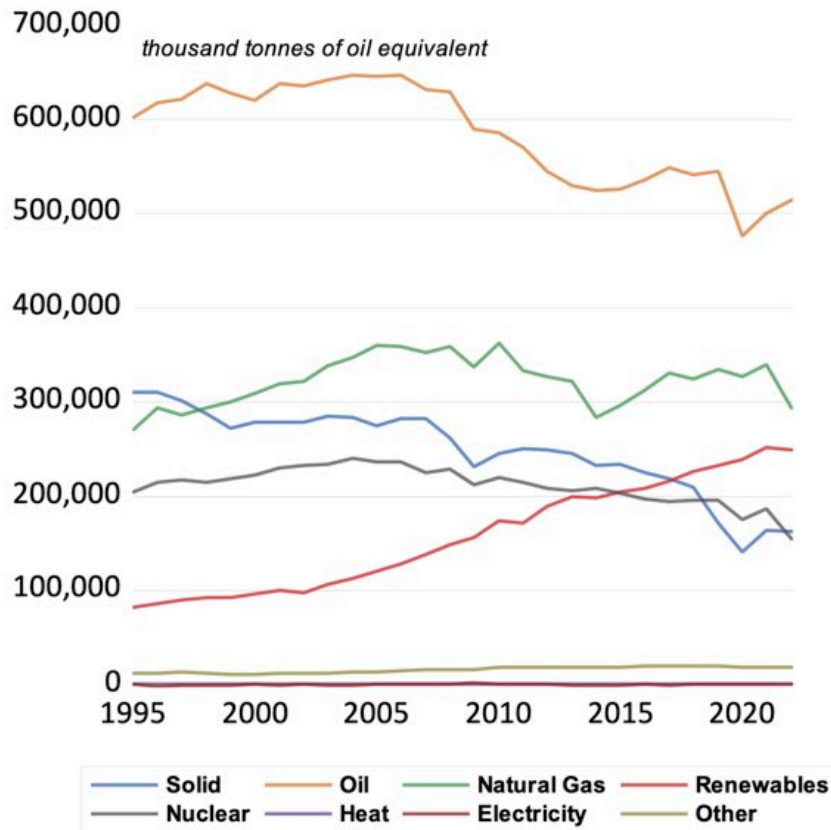


Figure 1. EU energy portfolio by source (1995–2022). Source: Eurostat. Source: [Guarascio et. al. \(2025\)](#)

Energy and carbon intensity — indicators of efficiency and sustainability — vary significantly across the EU. Bulgaria and Poland remain amongst the most carbon- and energy-intensive economies in the EU, whilst countries like Italy, Germany, and Austria perform considerably better. Poland also shows low innovation capacity and limited investment in green R&D, raising concerns about its readiness to decarbonise.

Import dependency ranges from below 10 per cent in Estonia to nearly 100 per cent in Malta and Cyprus. Yet vulnerability depends not only on dependency levels but also on diversification. Lithuania and Slovakia, for example, combine high dependency with concentrated supplier bases, leaving them particularly vulnerable to external shocks.

Large EU economies show divergent profiles. Italy and Spain are exposed on multiple fronts: both face high electricity price volatility, large shares of vulnerable households, and relatively low levels of renewable energy deployment. Italy also lags behind in green patenting and public R&D. France presents a more balanced picture but still underperforms in renewable deployment relative to its potential. Germany stands out for its strong resilience: despite high import dependency, it leads in innovation, manufacturing capacity, and public green investment.

These asymmetries are not new, but they are becoming more problematic in a global context marked by "weaponised interdependencies", trade wars, and risks of further inflationary shocks. Without greater coordination and targeted support, green policies may deepen fragmentation — and weaken the EU's collective capacity to manage future energy crises.

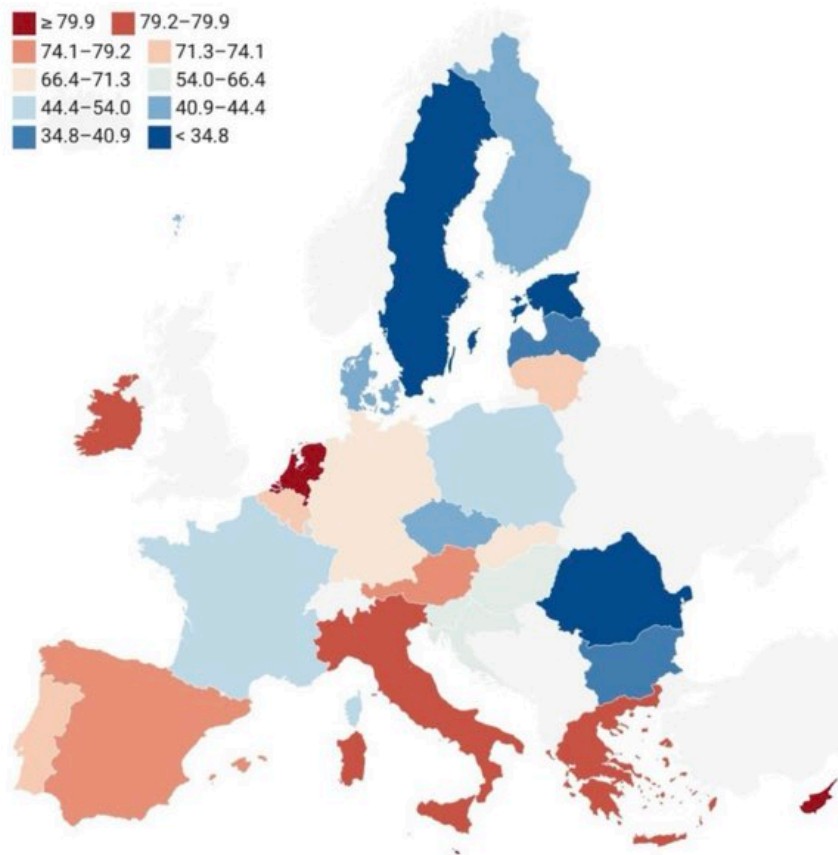


Figure 2. Energy import dependency by country, 2022.. Source: [Guarascio et al. \(2025\)](#);
 Note: EID = net energy imports / gross available energy.

Decarbonisation is often presented as a virtuous way to combine environmental sustainability and energy security. However, without an adequate supply of green goods and technologies, this means replacing old dependencies (oil and gas) with new ones.

Take solar energy: whilst deployment is surging, also thanks to rather generous demand-side policies (subsidies), 96 per cent of EU photovoltaic panel imports come from China. Relatedly, of the 400,000 workers employed in the EU solar industry, just eight per cent work in manufacturing. The rest are in installation and services — jobs that, whilst essential, do not necessarily reflect a strengthening of industrial capacity.

Wind energy tells a similar story. Domestic manufacturing capacity exists — especially in Germany, Spain, and Denmark — but it cannot fully meet demand, leading to increasing imports.

The situation is even worse for lithium batteries, which are critical for producing electric vehicles. According to ACEA, in 2023 China accounted for 83 per cent of global lithium battery production, whilst the EU share stood at a meagre seven per cent (with 75 per cent of the companies involved in production being headquartered in South Korea). That same year, the EU imported \$27 billion worth of batteries from China alone.

Internally, production is significantly concentrated: six countries (Germany, Hungary, Sweden, France, Poland, Spain) host nearly all EU battery factories. Two elements clearly stand out: a generalised weakness of the European economy concerning productive capabilities in key in-

dustrial domains; and persistent internal asymmetries that could be exacerbated if demand-side policies are not matched by vigorous and well-coordinated green industrial policies.

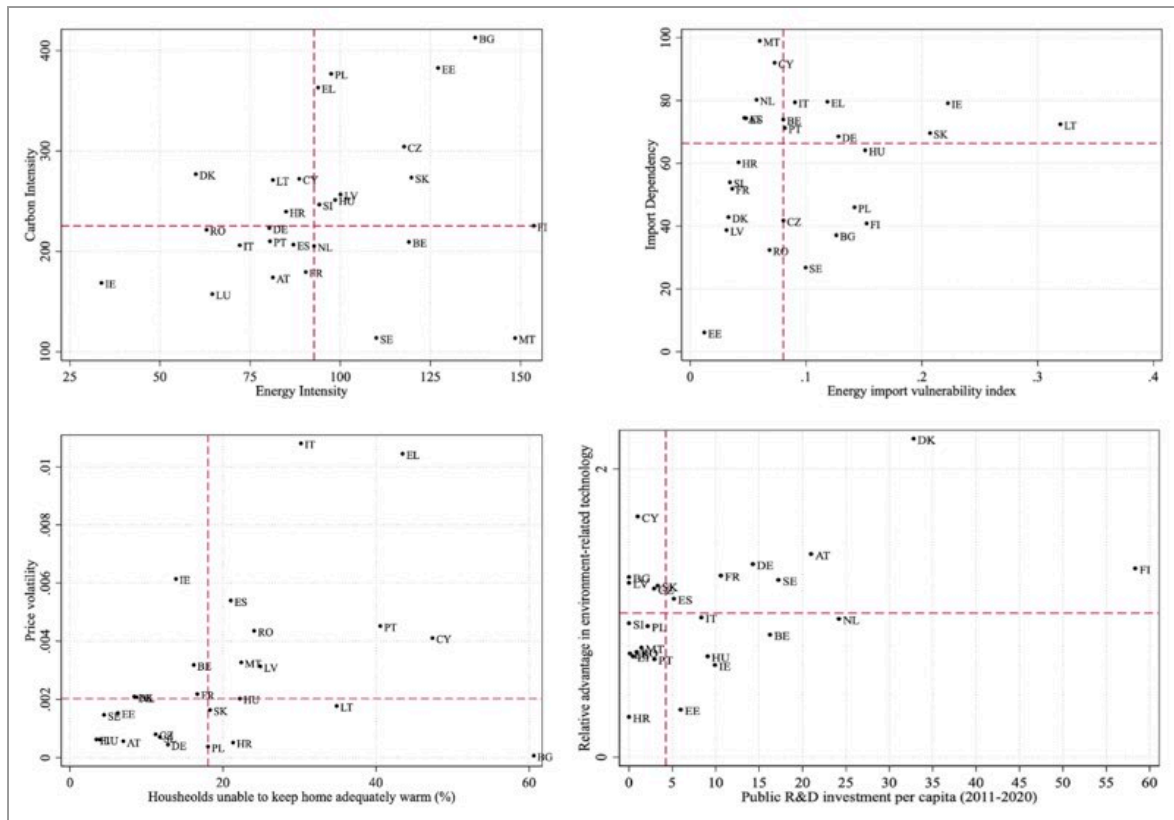


Figure 3. Mapping of energy vulnerability and resilience dimensions. Source: Guarascio et al. (2025) Note: dashed lines denote median values

DIFFERENTIAL EU POLICY RESPONSES MARKED BY LACKING TECHNOLOGICAL CAPACITIES AND FINANCIAL RESOURCES

Among other factors, one element helps explain such asymmetries: public investment. Countries that have consistently funded green R&D — such as Sweden, Denmark, Austria, and Germany — also show the strongest patent specialisation in environmental technologies. The correlation is clear: more green R&D leads to more innovation and, ultimately, to more resilience.

Yet not all Member States have the same fiscal capacity to sustain those investments. Between 2010 and 2020, Germany and Austria spent two to three times more than countries like Italy or Portugal — economies that are highly vulnerable, heavily dependent on energy imports, and constrained by high public debt and restrictive EU fiscal rules.

In this sense, the current EU framework, which limits state aid to avoid "market distortion", often ends up reinforcing existing inequalities.

The EU has launched a broad range of initiatives to respond to the energy and climate crisis — from the European Green Deal to REPowerEU and the more recent Net-Zero Industry Act (NZIA). These strategies aim to reduce emissions, accelerate the deployment of renewables, and strengthen domestic supply chains in clean technologies.

Yet ambition alone does not guarantee impact. Many of these policies remain vague in implementation and uneven in reach. Crucial gaps persist — particularly regarding supply-chain resilience, critical raw materials, and cohesion across Member States.

The roll-out of national recovery and resilience plans has also been markedly asymmetric: whilst some countries have advanced rapidly, others have yet to launch significant green investments. Without clear targets and binding mechanisms, the EU risks falling short of its own goals — and of its promise to leave no one behind. The response to the 2021–2023 energy shock exposed these structural divides.

All Member States [intervened](#) to protect households and firms, but their approaches — and their fiscal capacities — differed dramatically. Nordic countries relied on well-targeted income support. By contrast, many Southern and Eastern European governments turned to generalised price caps and broad subsidies: fast and politically viable, but less effective and more fiscally burdensome over time.

This asymmetry also extended to longer-term investment. Germany and the Netherlands, with ample fiscal space, launched large-scale programmes to support green industry and domestic supply chains. Meanwhile, Italy and Portugal — amongst the most vulnerable and most dependent on energy imports — were unable to match these efforts. Without reform, such fiscal imbalances will continue to entrench inequality and undermine the EU's collective transition capacity.

A POLICY ROADMAP IS URGENTLY NEEDED

Our findings suggest a clear and urgent policy roadmap. First, invest where it matters most. Countries with high vulnerability and low resilience — notably Italy, Greece, Hungary, and parts of Eastern Europe — need tailored support. EU resources must be channelled towards building capacity in renewables, green manufacturing, and energy efficiency. Where national disparities are acute, such as between Northern and Southern Italy, investment should also aim at narrowing internal regional divides.

Second, break the cycle of [technological dependency](#). Reducing fossil fuel imports is essential, but so is ending reliance on a small group of foreign suppliers for solar panels, batteries, and turbines. That calls for reshoring, diversified sourcing, and coordinated EU-level procurement strategies.

Third, rethink fiscal and state aid rules. Today's framework constrains green investment in the very countries that need it most. Reforming EU fiscal governance is not only about stability — it is about enabling the strategic investments needed for convergence, competitiveness, and decarbonisation.

Fourth, connect energy policy with social justice. The energy transition must [work for all](#) — not only the most resilient ones. This means addressing energy poverty directly through income support, building retrofits, and ensuring equitable access to clean technologies. It also means engaging civil society to build trust and legitimacy around climate action.

Finally, turn geography into an advantage. Southern and Eastern Europe have some of the highest solar and wind potential in the EU — but they remain underutilised. Supporting clean-

tech industry development in these regions — not just renewable deployment — can generate jobs, strengthen strategic autonomy, and promote truly balanced growth.

Europe's energy transition stands at a crossroads. The choice is not just between fossil fuels and renewables — it is between a fragmented Union of divergent paths and a more cohesive bloc, capable of rising to shared challenges.

A resilient Europe must also be a fair one. If vulnerabilities are uneven, so too must be the policy response. Otherwise, the next energy crisis risks not only straining economies but also deepening mistrust and disillusionment with the European project itself.

The stakes are high. But so is the opportunity. A just and resilient transition is within reach — if we choose to bring everyone along.

CHAPTER 2

EUROPE'S CRITICAL RAW MATERIALS STRATEGY DEMANDS EQUITABLE GLOBAL PARTNERSHIPS

By Bernhard Tröster, Simela Papatheophilou and Karin Kiiblböck

The EU's industrial ambitions hinge on transforming extractive relationships into sustainable partnerships with resource-rich nations.

The properties of certain mineral raw materials underpin virtually every aspect of modern life. From smartphones to wind turbines, these materials enable the technologies that power our economies and promise to deliver our climate goals. Others prove irreplaceable for digital infrastructure, aerospace engineering, and defence systems. Building new industrial capacities in these sectors depends fundamentally on securing both access to these raw materials and the capabilities to process them.

Europe's dependence on imported raw materials stretches back decades, punctuated by periodic supply crises that briefly thrust resource security into the spotlight. [Discussions](#) during the oil shocks of the 1970s echo today's debates in striking ways. Yet once each crisis passed, the issue retreated to the political margins. Through the 1990s and well into the 2000s, confidence in global market reliability ran so high that Europe actively [dismantled its domestic extraction and processing capabilities](#), outsourcing these industries without concern.

A FIRST EU POLICY SHIFT

China's meteoric rise since the early 2000s shattered this complacency. Beijing's rapid transformation into the dominant force in global raw material extraction and processing created an environment where securing certain materials became increasingly expensive and difficult for European manufacturers. The EU responded in 2008 with the [Raw Materials Initiative \(RMI\)](#), built on three strategic pillars: securing access to global deposits, promoting European sources, and increasing resource efficiency through recycling.

This strategy centred on identifying "critical" raw materials—recognising that vulnerability of supply, not import dependence alone, posed the real threat. The EU has applied [criteria for criticality](#) since 2011, weighing economic importance for European industry against supply shortage risks relative to other assessed materials. Yet these criteria and their metrics involve considerable subjective judgment.

In 2011, the EU classified 14 materials as Critical Raw Materials (CRMs), including gallium, cobalt, magnesium, rare earth elements, and tantalum. [By 2023](#), that list had ballooned to 34,

reflecting both evolving industrial needs and mounting geopolitical pressures.

FUNDAMENTALLY NEW CHALLENGES

Three converging dynamics have fundamentally transformed the EU's relationship with CRMs in recent years. First, the global push toward green and digital transformation is driving unprecedented demand. Wind turbines, electric vehicles, batteries, and semiconductors all depend heavily on rare earth elements, lithium, cobalt, and other specialised materials. [Projections](#) indicate that global demand for minerals essential to energy and mobility transitions will at least double by 2050. The EU's [demand for certain minerals](#) is expected to multiply several times over. Lithium and graphite consumption in Europe could increase more than twentyfold during this period.

Second, geopolitical instability has exposed the fragility of assumptions about supply chain reliability. The COVID-19 pandemic revealed the vulnerability of just-in-time logistics. Russia's invasion of Ukraine weaponised energy dependencies. Rising tensions between Washington and Beijing have transformed technology supply chains into strategic battlegrounds.

Most troubling for Europe, China's dominance in processing critical materials—coupled with its increasing willingness to leverage that position in trade disputes—represents an Achilles heel for EU supply chains. A [JRC study](#) identified that 53 of 70 supply chain steps for 15 key twin transformation technologies are vulnerable, including all raw material processing stages. The EU, once confident in the resilience of global trade, now confronts urgent questions about securing essential inputs when major suppliers may become unreliable or even hostile.

Third, the EU has responded to these challenges with policies like the [Net Zero Industry Act](#), aiming to rebuild production capacities in Europe for key green and digital transformation products. This push for "strategic autonomy" requires securing the raw materials indispensable for these production capacities. Simultaneously, growing demand for military and space technologies intensifies the need for critical resources with dual-use applications.

A SECOND EU POLICY SHIFT

These fundamental changes demanded new elements and strategic reorientation in EU resource policy. During the 2010s, RMI-based measures focused primarily on the external pillar, limited mainly to incorporating energy and raw material chapters into free trade agreements. New policies introduced fresh instruments for external engagement whilst targeting internal primary and secondary sources.

Central to this shift is the new subgroup of [Strategic Raw Materials \(SRMs\)](#) within the CRM list. Materials earn strategic designation based on their significance for relevant strategic technologies in green and digital transitions, defence, or aerospace applications. The assessment also considers projected global demand growth and potential production constraints. Unlike CRM metrics, SRM criteria incorporate forward-looking elements. The 17 materials meeting these criteria include rare earths, copper, lithium, natural graphite, and tungsten.

The 2024 [Critical Raw Materials Act \(CRMA\)](#) created, for the first time, a legal framework for expanding extraction and processing of SRMs within Europe. The CRMA [sets ambitious tar-](#)

gets: by 2030, the EU should extract 10 percent of its strategic raw material needs domestically, process 40 percent, and recycle 25 percent. No single country should supply more than 65 percent of any strategic material.

While these targets aren't legally binding, they serve as political guidelines, supported by incentives including streamlined permit timelines for raw material projects across the EU. Yet even if achieved, these goals underscore Europe's continued import dependence: 90 percent of required SRMs would still be mined outside Europe, with 60 percent processed in third countries.

STRATEGIC PARTNERSHIPS AS NEW APPROACH

To improve access to raw materials from non-EU countries, the strategic approach has evolved from seeking "[access to raw materials on world markets at undistorted conditions](#)" to pursuing fair and sustainable access through "[raw materials diplomacy focused on reaching out to third countries through strategic partnerships and policy dialogues](#)". New and adapted [external policy instruments](#) include the Raw Materials Club, Strategic Partnerships, and Energy and Raw Material Chapters in free trade agreements.

[Strategic Partnerships](#) on raw materials are particularly tied to EU industrial policies. These non-binding agreements between the EU and resource-rich countries aim to link European production capacities with raw material supply chains in partner nations. The EU positions itself as an alternative partner, offering incentives such as sustainable mining support, increased investment, and mutual economic benefits. These partnerships also signal to European industries that long-term supply from partner countries can be secured.

Since 2021, the EU has concluded [14 Strategic Partnerships](#) on raw materials with diverse partners ranging from the Democratic Republic of the Congo, Rwanda, and Zambia to Norway, Australia, and Serbia. Whether these agreements will deliver enhanced supply remains uncertain. The EU's incentives remain non-binding and difficult to implement, primarily due to unenforceable sustainability standards and the absence of a coherent strategy for promoting investment and value creation in the respective raw materials sectors.

RE-ORIENTATION TOWARD OLD POLICY FOCUS POSSIBLE

In early 2025, the new Commission introduced [Clean Trade and Investment Partnerships \(CTIPs\)](#), reflecting a general shift in priorities from the Green Deal toward enhancing competitiveness. These partnerships aim to complement or enable free trade agreements, improving raw material access through trade and investment regulations and regulatory cooperation. This signals that traditional instruments like free trade agreements and regulatory cooperation remain EU priorities.

Consequently, no current EU raw materials policy instruments or strategies effectively align European interests with the development needs of resource-rich partner countries, particularly in the Global South. This misalignment jeopardises the EU's access to raw materials essential for building domestic green production capacities.

CIRCULAR ECONOMY AS CRUCIAL LONG-TERM FACTOR

Such alignment becomes even more critical when considering the long-term [pathway toward a circular economy and CRM supply through secondary sources](#). While rapid development of a digital and green EU economy initially depends heavily on raw material imports, secondary materials could eventually become the primary source as products reach end-of-life and recycling technologies mature. This creates a profound challenge for resource-rich countries: after ramping up extraction to meet Europe's short-term surge in demand, they could face collapsing markets as circular systems take hold.

Building a resilient and responsible raw materials strategy requires the EU to fundamentally rethink its approach to international partnerships. Raw materials policy must be recognised as integral to—and a key enabler of—Europe's broader green and industrial transformation.

In the short to medium term, this means genuinely enforcing environmental and social standards in extractive sectors and actively supporting resource-rich countries' efforts to move beyond unprocessed raw material exports, particularly in the Global South. Looking ahead, as Europe transitions toward a circular economy, these partner countries must not be abandoned. The long-term shift from primary extraction to secondary material use must incorporate international cooperation on recycling technologies, waste management, and resource efficiency. Only by integrating these nations into future circular systems can the EU ensure an equitable and sustainable raw materials transition for all.

CHAPTER 3

EUROPE'S QUEST FOR TECHNOLOGICAL SOVEREIGNTY: A FEASIBLE PATH AMIDST GLOBAL RIVALRIES

By Christian Reiner and Roman Stöllinger

The European Union must pursue robust industrial policies to counter technological dependencies and safeguard its future prosperity and stability.

The era of unbridled [hyperglobalisation](#), characterised by a relaxed attitude towards dependencies on other countries' resources, productive capacities, and technological competencies, has ended. Recent global disruptions – from critical product shortages during the COVID-19 pandemic to energy price surges following Russia's invasion of Ukraine, and the intensifying geopolitical and geoeconomic rivalry between China and the United States – have forced the European Union to reassess its traditionally liberal approach to trade, investment, and technology. A surge in protectionist policies, coupled with the pervasive influence of Silicon Valley's "surveillance capitalism" and the increasing willingness to weaponise economic dependencies, now threatens the EU's autonomy and sovereignty. This is particularly critical in areas vital for its future prosperity and stability, such as the green and digital transitions, and healthcare. The erosion of domestic productive and technological competencies due to outsourcing and offshoring, leading to the expansion of efficient but fragile, highly concentrated, and often [China-centric global value chains](#), is now recognised as a primary concern demanding industrial policies previously considered undesirable.

Consequently, economic and, specifically, technological dependencies have become a significant threat to both the EU's economy and its autonomous policymaking. As the [Draghi-Report](#) aptly acknowledges, "If the EU does not act, we risk being vulnerable to coercion." Countries with strong technological foundations benefit from path dependencies, positive dynamic scale effects arising from accumulated knowledge, and crucial network effects, particularly in digital technologies. Thus, [technology-gap models](#) of economic development suggest that a lack of competencies in key technologies can precipitate a vicious circle of relative decline and divergence.

FROM TECHNOLOGICAL DEPENDENCE TO TECHNOLOGICAL SOVEREIGNTY?

Given that mastery and availability of technologies are essential for a successful twin transition and sustained productivity growth, technological dependencies are viewed as a significant source of structural vulnerability for the EU's socioeconomic development. In 2019, former Internal Market Commissioner [Thierry Breton](#) cautioned against an "over-reliance on foreign

technology in strategic sectors of the economy". He advocated for the EU to strive for "technological sovereignty", a concept initially applied to digital technologies, such as 5G, but since extended to other critical technologies.

A widely accepted [definition](#) proposes that technological sovereignty is a jurisdiction's ability "to provide the technologies it deems critical for its welfare, competitiveness and ability to act, and to be able to develop these or source them from other economic areas without one-sided structural dependency." This does not equate to national autarky, as sourcing technology from abroad remains a viable option. In the case of imports, technological autonomy is achieved when there are no non-competing imports of goods and services related to key technologies. This implies that domestic firms should be capable of providing substitutes and surge capacity for key technologies in the event of supply chain disruptions or geopolitical tensions. While this may incur short-term static inefficiencies and costs, it is essential to retain the "ability to act" in accordance with European values in a world marked by geopolitical conflict and assertive national self-interest. More broadly, technological sovereignty can be considered a prerequisite for the wider concept of economic sovereignty, which in turn underpins the EU's objective of [strategic autonomy](#).

Technological dependence is likely to be high when technology serves as a critical input and domestic [capacities, mastery, or availability are lacking](#). Standard indicators used to analyse technological capabilities include research and development (R&D) activities, patents, scientific publications, and trade and production of technology-intensive products. This analysis begins with a general overview of the EU's technological dependencies by examining international flows of R&D resources and the position of EU firms among the top 1,000 global innovators, before focusing on a portfolio of key technologies, with an emphasis on digital technologies.

THE EU IS FALLING BEHIND IN R&D INVESTMENTS

Technological capabilities and absorptive capacity are determined by available resources and their efficiency. [In 2023](#), measured in constant US dollars at purchasing power parity, the US and China spent 63 percent and 55 percent more on R&D than the EU, respectively. Furthermore, R&D investments in the EU are growing more slowly than in China and the US, resulting in China outspending the EU on R&D since 2015. Regarding [financial flows](#), China and Japan receive only approximately one to two percent of their R&D financing from foreign countries, whereas for the EU and the US, this figure stands between 20 percent and 24 percent.

That said, developments are more intricate in the age of global value chains, as R&D inputs are also embedded in intermediate goods that may be shipped multiple times between countries before reaching their final use. Following this reasoning, a [recent study commissioned by the European Commission](#) uses the share of imported R&D to total R&D as a technology dependency indicator, which accounts for trade in intermediate goods within global value chains. The results indicate that in 2020, only about two percent of the total R&D used in the US was imported, making the US the least dependent country. The respective figures for Japan (five percent), the EU (11 percent), and China (22 percent) are higher. Of the 11 percent of imported R&D for the EU, less than 10 percent originates from China. While China relies more on imported R&D than the EU or the US, it has reduced this dependence by approximately 30 per-

cent since 2010 due to high growth rates in domestic R&D investments. Concurrently, a significant increase in imported R&D from China in total final goods production for almost all countries, including the EU, has been observed.

As firms are central to innovation systems and global value chains, focusing on the role of EU companies is particularly important. Notably, the EU's R&D shortfall compared to China and the US primarily stems from [inferior R&D performance by the EU's business sector](#). The R&D intensity (defined as R&D as a percentage of GDP) of EU firms is only half that of their US counterparts and 75 percent of that of Chinese firms. The share of EU firms among the top 1,000 global firms in terms of R&D investment declined from 20 percent to 19.2 percent, and from 24 percent to 21.7 percent for the group of top 250 firms (see Table 1). An even faster decline can be observed for the US and Japan, but the US still holds a much higher share of leading R&D firms than the EU. In contrast, China has increased its proportion among globally leading firms from almost zero to approximately 20 percent, nearly on par with Europe. Even more telling is the percentage of R&D investment: in 2005, about 26 percent came from EU companies, which declined to 22 percent in 2023. Conversely, US firms managed to maintain their share of approximately 42 percent. This was possible because US firms more than doubled their R&D intensity (measured as R&D over sales) from 4.4 percent to over nine percent. Meanwhile, EU firms increased their R&D intensity by merely 34 percent, significantly less than Chinese firms, which boosted their R&D intensity by 60 percent between 2015 and 2023. This divergence between EU companies on one side, and US and Chinese companies on the other, can largely be explained by structural change: while dominant R&D-intensive EU firms continue to operate in broadly the same economic sectors, Chinese firms rapidly shifted from more traditional sectors in 2005 to ICT-related activities in 2023, which exhibit much higher R&D intensities than more traditional, medium-tech sectors like automotive or industrials.

2005					
	% no. of firms in top 1,000 firms	% no. of firms in top 250 firms	% in R&D Top 1,000	% R&D to sales	Top 3 sectors*
EU27	20.0%	24.0%	25.5%	3.6%	Automobiles & parts, Pharmaceuticals, Industrial machinery
CN	0.5%	0.4%	0.8%	0.6%	Oil & gas producers, Telecommunications equipment, Semiconductors
JAP	19.5%	19.6%	21.0%	3.8%	Chemicals, Automobiles & parts, Electronic equipment
US	41.8%	42.4%	41.2%	4.4%	Semiconductors, Software, Biotechnology
2015					
	% no. of firms in top 1,000 firms	% no. of firms in top 250 firms	% in R&D Top 1,000	% R&D to sales	Top 3 sectors*
EU27	21.7%	24.0%	23.7%	4.2%	Pharmaceuticals & Biotechnology, Industrial Engineering, Automobiles & Parts
CN	8.9%	6.8%	7.3%	2.5%	Automobiles & Parts Construction & Materials, Industrial Engineering
JAP	15.9%	17.6%	17.0%	4.2%	Electronic & Electrical equipment/Software & Computer Services
US	35.1%	37.2%	40.8%	6.2%	Technology Hardware & Equipment, Software & Computer Services, Pharmaceuticals & Biotechnology
2023					
	% no. of firms in top 1,000 firms	% no. of firms in top 250 firms	% in R&D Top 1,000	% R&D to sales	Top 3 sectors*
EU27	19.2%	21.2%	21.7%	4.9%	Pharmaceuticals & Biotechnology, Automobiles & Parts, Industrial Engineering
CN	21.6%	18.8%	18.3%	4.0%	Software & Computer Services/ Electronic & Electrical Equipment, Automobiles & Parts
JAP	10.4%	10.4%	12.3%	4.5%	Automobiles & Parts, Electronic & Electrical Equipment, Chemicals
US	34.9%	36.8%	43.1%	9.1%	Software & Computer Services, Pharmaceuticals & Biotechnology, Technology Hardware & Equipment

*Table 1: Performance of top 1000 world leading firms in R&D, 2005-2023. Source: Authors' own calculations based on EU Industrial R&D Investment Scoreboard data. *Defined as the three sectors with the largest numbers of companies. Sectors are ordered in descending order of importance.*

DEPENDENCIES ON FOREIGN DIGITAL TECHNOLOGIES ABOUND

A more nuanced picture emerges when shifting from the country level to the technology level. Following the [German Commission of Experts for Research and Innovations](#), 12 key enabling technologies can be distinguished across production, materials, digital, and bio- and life sciences. A country's relative strength in a technology can be measured by its revealed comparative advantage in the trade of that technology. Empirical analysis reveals that the EU has a comparative advantage in only two of 13 key technologies: advanced manufacturing and life sciences. Notably, the EU lacks a comparative advantage in any of the six key digital technologies. China, conversely, commands a comparative advantage in all six key digital technologies and only lacks one in life sciences.

Focusing on patents as another key indicator for technological prowess, divergent dynamics appear. In 1990, the EU possessed approximately half as many ICT patents as the US and has been unable to close this gap since (see Figure 1). Despite a rise in annual patent applications from about 500 in 1990 to 8,000 in 2020, the EU was overtaken by Japan and China in ICT patents in the 2000s and 2010s, respectively. The most striking development, however, is China's catching-up and leapfrogging: it outperformed the US and, with almost 30,000 patent applications in 2020, advanced to become the most productive country in ICT patenting.

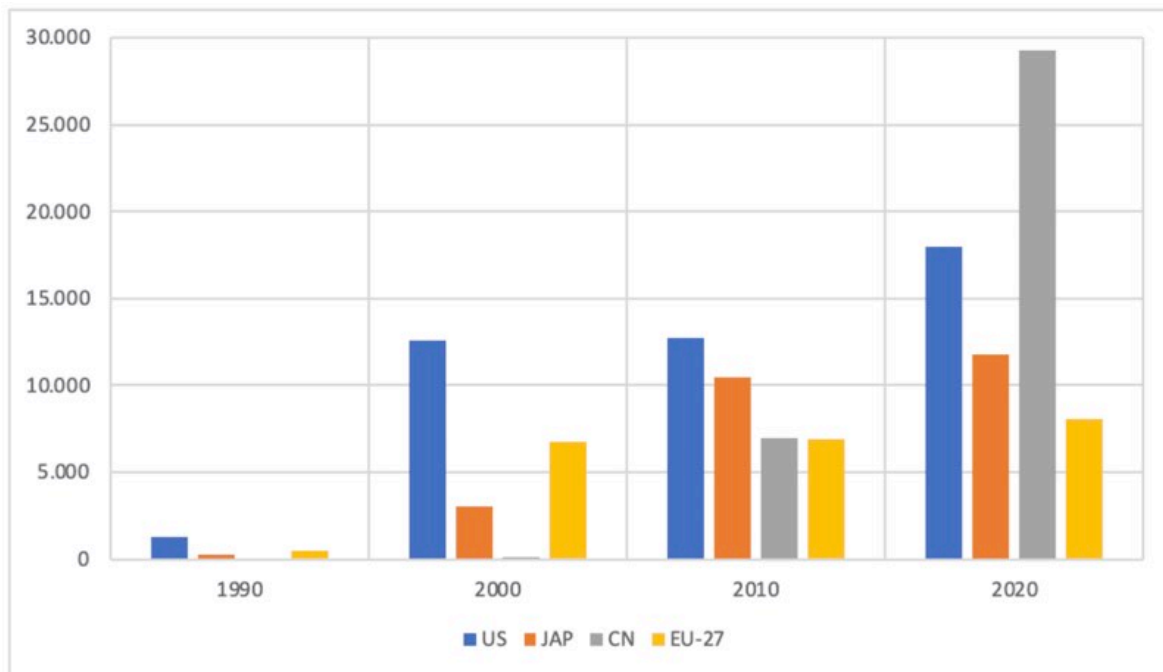


Figure 1: Number of ICT-related patent applications. Source: OECD MSTI Database

That said, it would be inaccurate to portray the EU as entirely lacking strengths in digital technologies. Firstly, the EU possesses a relatively strong scientific base, including in digital technologies. [For instance](#), the EU's 15 percent share in global AI-related publications in scientific journals outweighs the respective share for the US (10 percent), even though it falls short of China's output (34 percent). Yet, for AI-related patents, the US outperforms the EU (22 percent versus five percent), with China once again demonstrating superiority (48 percent). This weakness in translating scientific excellence into commercial applications has been termed the "[European paradox](#)".

As a second example, consider the [global value chain for semiconductors](#), a technology relevant to almost all technology-intensive goods, which has been central to the [European Chips Act](#). As is often lamented, the EU faces difficulties gaining a foothold in the chips market, accounting for only [10 percent](#) of global semiconductor production. What is typically overlooked, however, is that the [Dutch company ASML](#) and the [German company Siemens EDA](#) are dominant providers of critical inputs for the design and fabrication of chips. ASML, for example, holds a quasi-monopoly in producing lithography systems, machines that print patterns onto silicon wafers for the production of the most advanced microchips used for AI. Despite having these technology leaders in the semiconductor value chain, insufficient domestic production capacities and associated dependence on foreign suppliers such as Taiwan and the US have become problematic in an increasingly hostile geopolitical environment. This is exacerbated by the fact that import substitution by building domestic capacity for chip production takes considerable time and requires substantial upfront investment, with the cost of a new foundry amounting to [some \\$20 billion](#).

The [Galileo project](#) serves as an illustrative example that the EU can catch up in the digital domain, both technologically and commercially. Although a late entrant, Galileo successfully established itself as one of the four currently operating global navigation satellite systems (GNSS). Initiated as part of the EU Space Programme, the Galileo system excels in technologi-

cal sophistication, being the most precise GNSS. In this context, it should be mentioned that the [US strongly opposed](#) the creation of a European navigation system, arguing that the costs of such a huge infrastructure project would far outweigh the benefits, given that Europe could rely on the US Global Positioning System (GPS) for such services.

However, success is not guaranteed, as exemplified by the [Gaia-X project](#), announced in 2020 by the European Commission as part of the European Data Strategy. The aim was to create a federated European cloud infrastructure to ensure that "[Europe remains in control of its digital future](#)". Indeed, the [market for cloud infrastructure](#) is dominated by Amazon (AWS), Microsoft (Azure), and Google (Google Cloud), with China's Alibaba Cloud ranking fourth. Yet, due to a lack of funding, no clearly defined mission goal, and obstruction by US tech giants, this ambitious objective has, at least for now, [failed](#).

POLICY IMPLICATIONS

Due to intense geopolitical rivalry, a decline in international cooperation, and the challenges of the EU's twin transition, industrial policies designed to foster technological sovereignty in key technologies are clearly warranted. Our analysis demonstrates that IT-related technologies are certainly one field where the EU is at a disadvantage and technologically dependent on US and Asian firms. [In this context](#), cloud computing, AI, semiconductors, cybersecurity, 5G technology, and quantum technologies are among the most frequently cited examples. Green technologies for the energy transition represent another critical area where the EU suffers from a lack of technological sovereignty. In particular, the EU lacks technological and production capabilities in [batteries](#) and [photovoltaic cells](#).

Beyond such broad technological classifications, identifying the exact areas where technological dependencies pose serious economic and political risks is challenging. Firstly, while data are available at aggregate product or technology levels, actual dependencies may be domain-specific and vary across time, as well as along different segments of global value chains. Secondly, companies are typically better informed about markets and technologies than bureaucrats, and they have every incentive to overstate the importance of their role as suppliers of key technologies to receive subsidies or preferential regulatory treatment. Thirdly, not every dependency should be considered equally problematic. Considering a portfolio of technologies, dependencies can be two-sided, and different countries represent different risks. Finally, the relationship between technological and productive and raw material dependencies needs to be taken into account. For technical and political reasons, mastery of technology without productive capabilities in the EU might be viable for some areas, but not for others.

Consequently, "one-size-fits-all" policies are not advisable. Instead, the EU needs to build-up in-house competencies for permanent monitoring and for forecasting technological dependencies in key technologies as a solid basis for policy formulation. To this end, we suggest the creation of a new organisational unit: the Department for Technological Sovereignty (DTS). The identification of technological dependencies is, of course, very challenging, as it must consider technological, economic and political aspects.

What is more, insights provided by the DTS support political decisions about regulations, subsidies, and other incentives, which potentially have significant impact on the profitability of specific sectors and companies. As a result, any institutional design has to make sure that rent-

seeking activities of particular sectoral or technology interest groups are minimised, while the principle of embedded autonomy should be upheld. The latter implies that the identification of technological and industrial bottlenecks is jointly performed on the basis of a broad set of corporate and non-corporate stakeholders of the innovation system.

Institutionally, the DTS could be set up as a new unit within the Joint Research Center (JRC), a department of the European Commission. According to its [mission statement](#), the JRC “provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society.” The JRC has well-established expertise in related fields ([scientific portfolios](#)) such as AI and data, strategic technologies or green and just transition. Ideally, the DTS is supplemented by an external advisory body which brings together experts from member states. The aim of this body is to update and complement the work of the DTS with insights and intelligence from a national perspective.

After the DTS has identified critical dependencies, EU industrial policies for technological sovereignty can be designed and should be predicated on the following general principles: clear objectives, realistic technological ambition, effective governance structure, more funding at the EU level, as well as openness and competition.

The improved strategic intelligence capabilities of the EU via the proposed setup of the DTS and the efforts to strengthen the scientific and innovative base, ought to be supplemented with progressive, forward-looking, and targeted industrial policies. Vertical industrial policy initiatives such as the European Chips Act, the Clean Industrial Deal, or the Important Projects of Common European Interest and the more strategic use of trade and investment policy are steps in the right direction. While the path to technological sovereignty is will neither short nor cheap, it is absolutely necessary to reduce the EU’s technological dependencies in selected technological domains.

PART TWO
EMPLOYMENT AND LABOUR MARKET CHALLENGES OF THE TWIN TRANSFORMATION

CHAPTER 4

EUROPE'S GREEN JOBS CRISIS: WHY SLOW DECARBONISATION THREATENS EMPLOYMENT MORE THAN CLIMATE ACTION

By Bela Galgoczi

Lagging investment in clean technologies poses a greater risk to European jobs than the green transition itself.

While the green and digital transitions will inevitably lead to job losses, the real danger lies elsewhere. A lack of investment in green technologies risks seeing new low-carbon industrial jobs created outside Europe, leaving the continent behind in the race for clean-tech dominance.

Decarbonising the economy and bringing human activity back within planetary boundaries is having—and will continue to have—profound impacts on employment and skills. The policies necessary to correct our current resource-depleting production and consumption model affect the world of work both qualitatively and quantitatively. Whilst the transition to a net-zero carbon economy will create millions of jobs, many will also disappear or relocate to other regions. This will alter the aggregate composition of employment, including unionisation rates and collective bargaining coverage.

This unprecedented wave of restructuring intersects with technological change—digitalisation, automation and the growing role of artificial intelligence—and unfolds in a newly conflictual geopolitical context. The effects will be unequal across multiple dimensions: skills, gender, age, economic activity and region. History shows that changes and shocks tend to generate further inequalities. This is particularly true of the dominant green transition model, which relies on the concept of green growth, is technology-driven and assigns a key role to market forces. Without addressing the inequalities likely to emerge from the decarbonisation imperative, we cannot avert the existential threat of climate change—social conflict will block or slow necessary changes.

The transition to a zero-carbon economy is fundamentally redefining comparative advantages. Leadership in combustion engines offers no template for the era of electromobility. Similarly, expertise in carbon-intensive steel production provides little employment security in the age of green steel. Whilst concerns often focus on potential job losses from industrial decarbonisation, the more pressing issue is how lagging decarbonisation efforts may threaten jobs in a world where competitiveness in clean technologies becomes increasingly decisive.

The discourse has centred on fears of "carbon leakage"—the notion that higher environmental and climate standards might drive carbon-intensive activities abroad. However, the real risk is that insufficient investment in green technologies will result in new low-carbon industrial jobs

being created elsewhere, beyond Europe's borders. This is why we cannot discuss the employment dynamics of the green transformation in isolation from simultaneous economic, technological and geopolitical trends.

THE CONTESTED CONCEPT OF "GREEN JOBS"

The term "green jobs" has entered mainstream discourse, embraced by trade unions, environmental NGOs, the International Labour Organization (ILO) and policymakers alike. According to the United Nations Environment Programme (UNEP 2018), green jobs are defined as "positions in agriculture, manufacturing, R&D, administrative, and service activities aimed at substantially preserving or restoring environmental quality". "Green" has become shorthand for processes, products and services relating to sustainability and the environment.

Yet aligning this terminology with established statistical classifications remains challenging, despite various attempts. Studies and statistical approaches have tried, with varying success, to identify products and services meeting criteria for a green economy. A European Commission expert [document](#) focuses on "greening occupations" and identifies structural labour market changes linked to four key processes:

- **Job creation:** new jobs emerge to reduce environmental pressures or increase resource efficiency (such as positions in renewable energy generation)
- **Job substitution:** shifts in economic activity within or across sectors, from resource-intensive to more circular activities (the automotive sector exemplifies this, as combustion engine jobs disappear whilst positions in software development and battery manufacturing emerge)
- **Job destruction:** job losses with no direct replacement, typically in sectors with significant adverse environmental effects (such as fossil fuel-based energy generation)
- **Job redefinition:** existing jobs changing their skill sets and profiles as part of the transition to a more sustainable economy (the construction industry provides a clear example, as building retrofitting and low-carbon construction technologies require new skills and work processes)

The OECD 2024 [Employment Outlook](#) distinguishes between "green-driven occupations" and "greenhouse gas-intensive occupations". The former category includes:

1. Occupations emerging from the green transition that didn't previously exist (such as carbon trading analysts or wind turbine service technicians)
2. Green-enhanced skills occupations—existing roles whose skills and tasks are changing due to the green transition (such as plumbers now specialising in heat pump installation)
3. Green-increased demand occupations providing goods and services required by green activities (such as construction workers or chemists)

The report emphasises that whilst greenhouse gas-intensive occupations (comprising seven per cent of total employment) face the most expected job losses, they share similar skill requirements with other jobs, including green-driven occupations. This suggests transitions are possible with targeted retraining. However, the report notes that moving towards emerging green-

driven occupations proves more challenging for workers in low-skilled positions than for the highly skilled, demanding urgent policy action to ensure no one is left behind.

Regarding job distribution estimates, the report finds that more than a quarter of jobs across the OECD face strong impacts from the net-zero transition. Twenty per cent of the workforce is employed in green-driven occupations, of which:

- 46 per cent are existing occupations whose skill sets are being altered by the green transition ("green-enhanced skills occupations")
- 40 per cent are existing jobs that will be in demand because they provide goods and services required by green activities ("green increased demand occupations")
- Only 14 per cent can properly be described as "green new or emerging occupations"

FORECASTS ON GREEN JOB CREATION

Most European Commission communications announcing climate policy initiatives begin with forecasts portraying the green transformation as a win-win scenario with net positive employment effects. According to [projections](#) from 2021, delivering a 55 per cent reduction in greenhouse gas emissions by 2030 compared to 1990 levels would result in a net increase of up to 884,000 jobs—a 0.45 per cent rise by 2030 compared to business as usual.

A further [study](#) by Ernst and Young (2021), analysing investment projects under the EU Next Generation Recovery Fund devoted to the green economy, found that these projects represent €200 billion in aggregate investment and could create 2.3 million jobs.

Cedefop (2021) [estimated](#) that implementing the European Green Deal would create an additional 2.5 million jobs—more than one per cent growth—by 2030, not only in sectors driving the green transition but also in administrative and support services, legal, accounting and consulting services, and computer programming and information services.

With the announcement of the Green Deal Industrial Plan (European Commission 2023), the Commission's [factsheet](#) stated: "The green transition could create up to 1 million additional jobs in the EU by 2030. For example: by 2030, solar energy employment could reach 1 million jobs. In the battery sector approximately 800,000 workers will need to be trained, upskilled, or reskilled by 2025 to meet the demand of this sector for new workers."

The main shortcoming of such forecasts is their target-based nature, assuming that policy objectives (such as 2030 climate targets) will be met through EU manufacturing capacity. These projections fail to account for industrial, trade and investment policy repercussions and view developments in isolation from global dynamics.

FRAGMENTED EVIDENCE ON THE GREEN JOBS LANDSCAPE

Even with most studies projecting a moderate but clear net positive employment effect at aggregate economic level, regional and sectoral differences can be enormous. Three main sector categories emerge: those facing significant operational reduction (such as fossil energy), those requiring profound transformation (such as the automotive sector), and those with the greatest job creation potential (circular economy sectors).

Evidence shows that whilst jobs have indeed been created, the rate of creation remains muted and uneven. More troublingly, jobs in key clean technology sectors actually fell between 2018 and 2022.

Data compiled by the Bruegel think tank (2024) [provides](#) a more detailed, though still fragmented, picture. As of 2022 (the latest available data), the EU-27 had 347,000 jobs in solar energy, 273,500 in wind and 416,200 in heat pumps—just over one million in total. These jobs concentrate in ten member states shown in Figure 1 (averaging around 80 per cent of the EU total). Germany leads in solar and wind power jobs (87,000 and 86,000 respectively), whilst Italy dominates heat pump employment (135,000), followed by France (80,000).

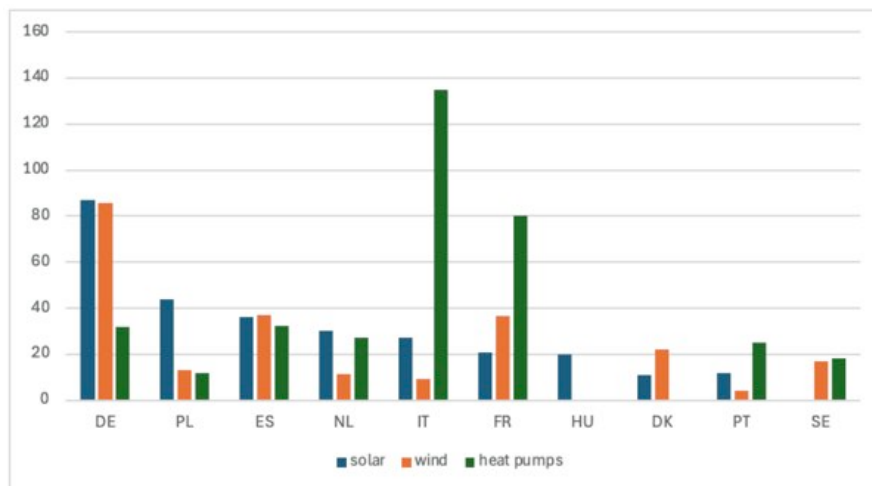


Figure 1. Number of workers in the solar, wind energy and heat pump sectors (2022, thousand persons (FTE)). Source: [Jugé et al. \(2024\)](#).

Whilst Figure 1 offers only a 2022 snapshot, it's crucial to note that Germany, Italy and Denmark all experienced job losses in these sectors between 2017 and 2022. Based on the Bruegel database (not shown in Figure 1), manufacturing employment in Germany's wind energy sector plummeted from 140,800 in 2017 to 86,600 by 2022. Over the same period, Denmark saw a decline from 34,200 to 22,400, whilst Spain remained steady at around 37,000. Italy, despite leading in heat pumps with 85,000 jobs in 2022, had lost 6,000 positions by that year. Spain witnessed heat pump job losses from 68,000 in 2018 to 32,000 by 2022, and Portugal's numbers fell from 80,000 in 2019 to 25,000 by 2022.

Whilst these losses had multiple causes, the trend highlights challenges in both investment activity determining deployment rates (the demand side for manufacturing) and European manufacturers' market share in meeting this demand.

Even with limited data availability, it's clear the last decade failed to deliver the expected boom in Europe's key clean energy sectors. This slow and volatile job creation indicates that Europe's transition to net-zero emissions remains suboptimal from an employment perspective. Figure 2 illustrates the challenges facing the EU clean industry sector. The contrasting job distribution within the solar sector between the EU and China reveals a stark reality: whilst two-thirds of China's solar jobs are in manufacturing, a mere seven per cent of EU solar jobs involve manufacturing, with 84 per cent in deployment—essentially fitting imported solar panels on European roofs. Since the collapse of EU solar panel manufacturing, this has become the cautionary tale to avoid in other clean industry segments.

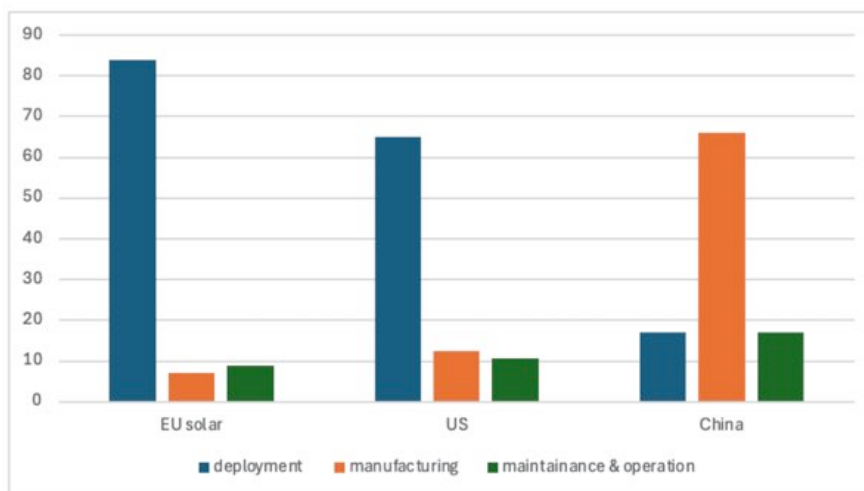


Figure 2. Distribution of employment by type of activity in the solar sector. Source: [Jugé et al. \(2024\)](#).

CONCLUSION

The green transformation produces three broad types of employment change. Fossil fuel-based energy generation and related activities will be phased out, and these jobs—in their current form—will disappear, though they represent a small share of European employment. Existing industries undergo deep decarbonisation whilst a new clean technology-based manufacturing landscape emerges. These two segments—energy-intensive industries and clean industry—are deeply intertwined and inseparable.

The challenge lies in the absence of coordinated, cooperative global decarbonisation. Countries and regions pursuing more ambitious paths—like the EU—face higher initial costs and suffer temporary competitiveness losses. This phenomenon, labelled carbon leakage, can be partially addressed by creating a level playing field, which the EU's Carbon Border Adjustment Mechanism (CBAM) aims to achieve. But this isn't enough.

Far more comprehensive industrial policies are needed to manage these industries' technological transformation, which will generate competitive advantages in the longer term. Without such policies, affected industries resort to calling for reduced transition pace (such as regarding the [2035 phase-out of combustion engines](#)), easing financial burdens (such as subsidies for [electric energy in Germany](#)), or relocating production within the EU to exploit energy cost differentials (such as [ArcelorMittal](#)).

The question becomes: how can Europe tap the job creation potential of the green economy? If new jobs in clean industries emerge too slowly and transformation becomes protracted and chaotic, international competitors may capture larger market shares in critical clean industry segments—ultimately costing Europe more jobs in the long term.

One lesson emerges clearly: there is no one-size-fits-all just transition policy. Europe needs targeted, integrated transformation policies combining labour market measures, social protection to cover transformation risks, secured investment, and sensible industrial and trade policies. Without this comprehensive approach, the continent risks losing not just the climate race, but the employment opportunities that should accompany the green transition.

CHAPTER 5

EUROPE'S GREEN TRANSITION: A FUND UNDER PRESSURE

By Valeria Cirillo, Marialuisa Divella, Lidia Greco, Eustachio Ferrulli

The EU's flagship Just Transition Fund, designed to mitigate social inequalities, faces significant challenges in achieving its ambitious goals.

In line with the Paris Agreement, the European Union (EU) aims to achieve climate neutrality by 2050. This objective necessitates profound shifts in energy production, technological development, and national economic structures, inevitably leading to significant social consequences, including job displacement. To ensure a fair and inclusive transition, the European Commission has introduced measures to support potentially affected regions, industries, and workers. The Just Transition Fund (JTF) stands as a pivotal initiative for this purpose.

Approved in 2021, the JTF targets regions whose economies are reliant on coal extraction and highly polluting industries. Its remit includes diversifying these economies, fostering clean energy activities, promoting environmental remediation, and ensuring that workers receive appropriate training to adapt to new economic conditions, while also creating new employment opportunities.

Conceived as a cornerstone of the EU's climate strategy, the JTF is a policy instrument designed to ensure that the transition to climate neutrality does not exacerbate existing social and territorial inequalities. It forms part of the broader European Green Deal and is a pillar of the Just Transition Mechanism. The JTF initially received a budget allocation of €17.5 billion, which was later increased to €19.3 billion. Today, it represents one of the main efforts to reconcile climate ambition with social justice – at least in theory. Indeed, this twofold objective, supporting decarbonisation while ensuring fairness, demands more than mere financial transfers. It requires a fundamental rethinking of economic development itself, particularly in territories historically dependent on fossil fuel industries. The JTF aims not merely to cushion the blow of transition but to create the conditions for long-term structural change. Yet, as implementation proceeds, a growing body of evidence points to a significant gap between the fund's ambitious rhetoric and its practical application.

A NEW GENERATION OF INDUSTRIAL POLICY?

The JTF marks a departure from traditional forms of industrial and cohesion policy in Europe. It can be understood as a “third generation” industrial policy: one that is explicitly socially in-

clusive, territorially embedded, and transformative. Earlier waves of industrial policy often focused narrowly on enhancing competitiveness, technological upgrading, or correcting market failures. By contrast, the JTF's underlying logic is profoundly political – it acknowledges that the green transition will produce "losers" and that addressing their needs is essential to preserving social cohesion and democratic legitimacy.

What makes the JTF unique is its territorial dimension, which often refers to a sub-regional unit. Funding is distributed based on Territorial Just Transition Plans (TJTPs), developed by national and regional authorities in consultation with local stakeholders. These plans are intended to map the economic, social, and environmental profile of each region, identify at-risk sectors, and articulate a strategy for creating new opportunities. The JTF embodies a place-based approach that promotes development, participatory governance, and coordination across institutions.

At its best, the JTF provides a template for how the EU can pursue a green transition that is not only efficient but equitable. At its worst, it risks becoming a fragmented and technocratic instrument, disconnected from the real needs and aspirations of local communities. As discussions on the future of the JTF unfold, it is worth analysing some preliminary evidence.

ITALY, GERMANY, AND SPAIN: TOWARDS A JUST TRANSITION

To assess the fund's effectiveness, we examined its implementation in a [recent paper](#) through semi-structured interviews with key stakeholders, including the Just Transition Platform (JTP) Coordinator at the European Commission's Directorate-General for Regional and Urban Policy, officers from the Managing Authorities of the JTF in selected regions, and representatives of the German Trade Union Federation, an umbrella organisation of eight trade unions in Germany. This qualitative research was complemented by a desk analysis of official documents, focusing on three countries: Italy, Germany, and Spain. Each case highlights the complex interplay between the existing economic and social fabric, local institutional capacity, and national political priorities.

The analysis revealed a highly heterogeneous implementation of JTF actions, although progress has been slow across all territories. At the EU level, as of March 2024, only a small portion of the total JTF allocation had been spent, approximately six percent, with upskilling and reskilling initiatives appearing even more delayed.

In Italy, the city of Taranto (Apulia) hosts the former Ilva integrated steel plant, one of the largest and most polluting in Europe. Despite its massive environmental impact and the health risks posed to the local population, the former Ilva – since 2021, the legal name of the company has been Acciaierie d'Italia S.p.A., though it is still commonly referred to as 'Ilva' or 'ex-Ilva' – remains central to the region's economy.

JTF resources cannot be allocated to large, polluting companies investing in the modernisation of steel plants, nor can they be used to support the closure of major polluting firms. As a result, the fund risks failing to bring about a significant transformation of the existing industrial structure – particularly in single-industry areas like Taranto – and may hinder efforts to diversify the local economy. In Taranto, the JTF's vision of a 'just transition' appears limited. While it provides resources for environmental remediation and workforce reskilling, it falls short of supporting a comprehensive alternative economic model. The local development strategy re-

mains fragmented, and public institutions continue to struggle with chronic capacity shortages. As a result, the fund's transformative potential is weakened. Implementation in the area has been delayed by the late approval of both the territorial plan and the corresponding executive plan, only finalised in early 2025, highlighting the difficulties faced by local institutional and economic actors in formulating concrete projects and articulating a long-term development vision.

A second Italian territory addressed by the JTF is the Sulcis-Iglesiente region (Sardinia). In recent years, this region has seen a reduction in pollution emissions, including a 4.6 percent decrease in CO₂ from local ETS facilities, alongside the emergence of sustainable tourism – especially slow tourism and archaeological heritage – as a promising growth sector. Nevertheless, a successful reconversion plan remains critical, particularly one that addresses workforce requalification. The JTF for Sulcis identifies three strategic priorities: expanding renewable energy, promoting economic diversification, and managing the social impacts of decarbonisation. Active labour market policies receive significant support, including funds for upskilling unemployed individuals, at-risk workers, and aspiring entrepreneurs. For example, Action 1.7 of Sulcis' territorial plan specifically earmarks training and retraining measures, offering a two-month programme with attendance allowances, targeting especially women and youth. However, the Sulcis experience underscores a broader JTF challenge: while funding allocations are ambitious (for example, €30 million for Action 1.7.1), procedural bottlenecks – such as prolonged approval phases for calls like Action 1.7.2 (soon to be published as of June 2025) – risk undermining timely impact. Moreover, further funds addressed to the same beneficiaries of the area also weaken the effectiveness of the intervention.

Germany's JTF-relevant regions are undergoing a carefully orchestrated transition away from lignite mining and a petrol-based economy. Thanks to decades of industrial experience and strong federal support, local institutions seem well equipped to manage change. The German government complements the JTF with national funds and facilitates dialogue between trade unions, employers, and civil society through long-standing stakeholder platforms. However, several interrelated challenges remain. First, the process is criticised as top-down, with federal actors dominating decision-making and marginalising regional and local stakeholders. Second, the JTF is perceived as merely financing pre-existing measures rather than providing additional support, frustrating regional governments. Due to the tight deadlines of the JTF, requiring 70 percent of funds to be allocated by 2026, local actors have limited space for effective long-term planning. Moreover, territorial inequalities arise as the JTF focuses on lignite-dependent regions, excluding other industrial areas (for example, automotive sectors) facing similar transition pressures. Small and medium-sized enterprises (SMEs), a key target, struggle with limited capacity to identify skill needs, plan training, and shift to green technologies. These hurdles underscore the need for more holistic, regionally tailored strategies – a challenge where Spain has emerged as a leading European example.

By implementing a comprehensive Just Transition Strategy, Spain has addressed similar obstacles in regions heavily impacted by decarbonisation, such as Asturias, Galicia, and Andalusia. These areas are experiencing the socio-economic consequences of closing coal mines and phasing out coal-fired power plants, a shift that has heightened Spain's temporary energy dependency and exacerbated existing issues like depopulation and economic fragility. In response, Spain established the Institute for Just Transition (ITJ) in 2020, under its Strategic Framework for Energy and Climate, to coordinate support through European and national funding mecha-

nisms, including the JTF and the Next Generation EU recovery plan. The Spanish TJTP (2021–2027) and Just Transition Programme, approved by the European Commission in December 2022, build on prior national efforts.

A cornerstone of the Spanish approach is the development of 15 regional Just Transition Agreements (*Convenios de Transición Justa*), which outline concrete, locally tailored actions to sustain economic activity, foster diversification, and retain employment in vulnerable regions. These agreements rely on inclusive stakeholder participation, with commitments to support local development through SME investments, industrial redevelopment, environmental restoration, and workforce retraining. Institutional backing is reinforced by both the ITJ and the Institute for the Diversification and Saving of Energy (IDAE), which have coordinated efforts such as early retirement schemes for coal workers and over €338 million in funding for 400 territorial projects. The Territorial Plan also promotes renewable energy, sustainable mobility, circular economy, and the rehabilitation of historical and environmental assets. It emphasises vocational training and labour integration for displaced workers, especially women, older workers, and people with disabilities, ensuring their inclusion in the transition to a green economy.

CRITICAL IMPLEMENTATION CHALLENGES

Despite its progressive ambition, the JTF encounters several implementation challenges that risk undermining its overall effectiveness. A primary concern lies in gaps in institutional capacity across many target regions. Successful transition planning demands interdisciplinary expertise spanning from industrial strategy to territorial planning, environmental remediation, workforce development, and financial oversight. Yet, local authorities often lack the necessary staff, resources, and technical know-how to meet these complex demands. As a result, both the design and implementation of TJTPs are frequently undermined. Compounding this issue is the absence of a coherent strategic vision for the post-carbon economy. What will these regions produce in the future? At this stage, no clear answers have emerged.

While the JTF assumes that localities will identify viable sectors for development, many plans fall back on generic objectives – such as green jobs or digital transformation – without articulating concrete pathways to realise them. This lack of specificity dilutes the transformative potential of the fund and leads to fragmented, uncoordinated investments.

Additionally, the social measures embedded in the JTF are often poorly integrated into broader development strategies. Training initiatives tend to be generic and misaligned with the actual skills required in emerging industries, while income support schemes offer temporary relief without facilitating durable reintegration into the labour market.

Beyond such specific aspects, the broader geopolitical context is also reshaping the landscape in which the JTF operates. In the wake of Russia's invasion of Ukraine, the EU has launched new initiatives like ReArm Europe, now Readiness 2030, to bolster its defence capabilities and energy independence. These programmes are expected to command significant financial and political attention in the coming years. There is growing concern that such priorities will divert resources away from green transition efforts. Moreover, the securitisation of EU policy could marginalise social and environmental objectives, reducing the ambitious goals of the JTF. Already, debates around budget allocations for the next Multiannual Financial Framework (2028–2035) suggest a pivot towards defence and security, with climate policies facing renewed

scrutiny. At the same time, the economic context has changed. Rising inflation, supply chain disruptions, and monetary tightening have increased the cost of transition projects. What seemed financially viable in 2020 may no longer be realistic. Without an expansion in funding or a recalibration of goals, the JTF may struggle to achieve its mission.

CONCLUSIONS AND POLICY RECOMMENDATIONS

While the JTF offers a groundbreaking framework for a more equitable climate transition, bridging the gap between its ambitious vision and concrete implementation requires greater attention, particularly in light of a future revision of the fund. Some targeted policy interventions might be useful for this scope.

First, it is essential to strengthen local institutions by providing targeted technical assistance, adequate staffing, and comprehensive training to enhance their administrative and strategic capacity. Without capable local authorities, even the best-designed plans risk faltering in implementation.

Second, territories must be encouraged and supported in developing clear and realistic strategic objectives that are rooted in local assets and aligned with future economic demands. Vague aspirations are insufficient for driving systemic change.

Third, there is a pressing need to better integrate social and economic policies – specifically, reskilling programmes, labour market interventions, and industrial strategies must be closely coordinated to ensure that displaced workers are not merely compensated but meaningfully reintegrated into evolving and growing sectors. To this aim, the active involvement of trade unions and workers would be essential. Indeed, a more effective participation of social partners in the design of Territorial Just Transition Plans would help to better tailor development strategies to concrete local workforce needs.

Fourth, the environmental legacies of polluting industries must be addressed directly within the TJTPs through comprehensive remediation efforts and restructuring of harmful infrastructures.

Lastly, the integrity of climate funding must be protected: resources allocated for the green transition should not be diverted to meet new geopolitical priorities, which would undermine the transformative capacity of the JTF.

Ultimately, the fund is more than a financial tool; it is a litmus test of the EU's commitment to a fairer, greener, and more resilient future. As climate pressures and global instability intensify, the urgency for decisive and inclusive action has never been greater.

PART THREE
GOVERNANCE CHALLENGES OF PROGRESSIVE INDUSTRIAL POLICY

CHAPTER 6

INDUSTRIAL POLICY MUST INCLUDE CITIZENS AND WORKERS

By Werner Raza

Europe's twin transformation needs social conditionalities to prevent corporate capture and build democratic legitimacy.

The green and digital transformations will produce deep changes to our modes of production and consumption, indeed to our entire way of life. Along this transformative journey, some segments of society will profit handsomely, whilst others—particularly large numbers of workers in shrinking industries—will find themselves negatively affected, at least during the transitory period of the next two to three decades. Thus, whatever the specific motivation for industrial policy, to be accepted by societal stakeholders, it must be considered legitimate by those it affects.

Given the fundamental uncertainty of the process and the associated social concerns, sustained political support critically depends upon a positive, if not optimistic, vision of the future. Citizens as well as affected workers will need to be convinced of three essential points: first, that the twin transformation is not only necessary but indeed desirable for their futures; second, that they are genuine stakeholders in this process with a meaningful chance to co-shape its direction; and third, that their aspirations and concerns are taken into serious consideration, ensuring that the distribution of benefits and costs during the transformation remains fair and balanced.

THREE PILLARS OF LEGITIMATE TRANSFORMATION

These three requirements for a legitimate political approach to managing the twin transformation can be substantiated through three concepts from political theory: hegemony, input legitimacy and output legitimacy. Hegemony, interpreted here in the Gramscian sense, refers to the requirement for a vision of change—or grand narrative—underlying the political management of the twin transformation that succeeds in convincing people and garnering active support from civil society. Such a vision should inspire hope and optimism for a better future, not merely acceptance of inevitable change.

Apart from this ideational element, support at the macro level and particularly at the micro level of the workplace and the household becomes more likely when combined with two further elements. Input legitimacy implies that citizens and workers are given a genuine stake in

the process and a meaningful chance to voice their interests and concerns. Output legitimacy entails that the instruments and policies employed actually deliver on the promises of the transformation process, and that the social costs arising along the way are managed in an effective and balanced manner. Input and output legitimacy function as complementary forces. Though the balance between them may shift during different phases of the process, both should be continuously employed to secure and maintain legitimacy.

THE VIOLATED SOCIAL CONTRACT OF PUBLIC SUBSIDIES

Industrial policy interventions come in different forms but can be roughly categorised into three main types: financial transfers (including grants, preferential loans, guarantees and public equity), taxes and tariffs, and regulation (encompassing disciplines and prohibitions). The predominant neoliberal policy framework during the last four decades, as codified for example in European Union competition and state aid rules, by and large displayed a restrictive stance towards public transfers to the private sector. Subsidies needed special justification and were only allowed for a number of specific exemptions, including research and innovation, regional development and particular social purposes. The main economic arguments levelled against subsidisation emphasised competitive distortions, rent-seeking behaviour, and moral hazard—particularly in the case of state-financed corporate bailouts.

At the latest with the arrival of the coronavirus pandemic in 2020 and the war in Ukraine since 2022, this state of affairs has markedly changed. Both the EU and most member states have initiated large-scale funding programmes including hefty handouts to private companies. Motivated by the challenges of the twin transformation as well as geopolitical security concerns, large industrial policy programmes have been initiated in many industrialised countries, including the United States, the European Union, China and Japan. These programmes typically target certain strategic sectors, such as semiconductors, green technologies or telecommunications.

The principal rationale for mobilising significant public financial resources for the twin transformation relates to influencing the directionality and speed of private investment against a backdrop of existential threats emanating either from climate change or from geopolitical risks. Targeted areas include but are not limited to the build-up of domestic productive capacity in strategic products like semiconductors, or the fundamental switch to energy production based on renewables. Predominantly, this is not achieved through command-and-control measures, but indirectly by offering the corporate sector financial incentives under the condition that public funds are used to achieve a defined objective within a set timeframe. Thus, ideally, a desired process of change, such as the decarbonisation of the economy, can be catalysed, if not substantially accelerated. In practice, however, monitoring and control regarding success are often lacking, and public authorities frequently do not dispose of effective means to ensure compliance. In other words, whilst carrots are plentiful, sticks remain conspicuously blunt.

From the perspective of democratic legitimacy, the [implicit social contract underlying such an industrial policy approach led by an entrepreneurial state](#) is violated by such a state of affairs. Given the required scale and speed of the twin transformation, the necessary adjustment requires a collective effort encompassing all members of political society, with each making their contribution according to their abilities. Adjustment burdens exceeding individual possibilities must be shared throughout the community, in particular by offering public financial support

where needed. Receiving public money thus obliges the recipient to honour their part of the implicit social contract. This includes using the money for the defined purpose, in conformity with the respective legal framework conditions, and sharing any benefits eventually accruing from the investment, whether with the direct stakeholders of the company (namely owners and workforce), or with the general public at large (through tax contributions, free licensing of new technical knowledge, and similar mechanisms).

With the government in a liberal democracy acting as the collective agent of society, it bears the obligation to implement such an agreement. This is typically done through a funding contract, which stipulates the conditions under which the beneficiary is entitled to receive the financial transfer. Such conditions may come in multiple forms, including through performance standards—targets to be achieved by the beneficiary relating to production, investment or employment. In addition, process conditions might be employed that oblige the beneficiary to accept or introduce changes to its corporate governance system, for instance public ownership or co-ownership, introduction of collective bargaining, or special transparency or reporting mechanisms (see Table 1 below for a comprehensive overview).

Performance Standards	Corporate Control
Production, investment, employment and export quotas	Public or domestic ownership
Environmental and safety standards	Promotion of intra-firm or intra-sectoral cooperation
Training and skill programmes	Acceptance of collective-bargaining rules
Technological or local content requirements	Accepting joint ventures
Geographical location	Inclusion of independent directors
	Disclosure of pollution information
	Regulation of intellectual property rights

Table 1: Industrial Policy Conditionalities. Source: author's elaboration, based on [Bulfone, Ergen and Maggor \(2024\)](#).

THE CRUCIAL ROLE OF SOCIAL CONDITIONALITIES

A specific subcategory of particular importance refers to social conditionalities. These include both measures targeting the affected labour force—such as via employment and labour standards, skills acquisition, the establishment of works councils or collective bargaining—and extend to measures that benefit society at large, including the sharing of new technology, the sharing of excess profits, or domestic content requirements (see Table 2 below for a detailed taxonomy).

Performance Standards	Corporate Control
Location guarantees	Establishment of works councils
Employment quotas	Consultation/co-decision rights for works councils
Skill upgrading programmes	Information and monitoring rights for works councils
Sharing of new technology (e.g. compulsory licensing requirements)	Mandatory seats for trade unions/works councils on boards
Domestic content and sourcing requirements	Labour standards (minimum wages, collective bargaining)
	Health and safety standards
	Prohibition of stock buy-backs and dividends
	Sharing of profits (e.g. upside profit sharing)

Table 2: Indicative Taxonomy of Social Conditionalities. Source: author's elaboration

Whilst there is widespread agreement that the green and digital transformations pose extraordinary challenges that require this collective effort—including the transfer of significant amounts of public money to the private sector—the [danger of corporate welfarism](#) is clearly looming in the background. In other words, corporate beneficiaries might see the availability of public money as a windfall opportunity for increasing profits via rent-seeking or moral hazard behaviour, for example by pocketing public money intended for revitalising ailing business activities. In addition, as currently not only the EU but many other countries have set up massive financial support programmes, particularly large transnational corporations might try to play governments off against each other to extract the highest possible subsidy.

The scholarly literature on corporate welfarism emphasises that the privatisation of many state-led activities (such as public services) during the neoliberal period has resulted in a [marked shift of structural power in favour of the corporate sector](#). Unfortunately, in many respects the state has lost its capacity to directly take care of certain activities, and in fact depends on the private sector to perform such essential tasks. This literature thus warns against the prevailing view that the return of industrial policy should be interpreted as a sign of renewed state power. Instead, the prevalence—or notable absence—of strong conditionalities attached to financial handouts to private firms should be the indicator upon the basis of which to assess the actual power balance between the state and private capital.

LEARNING FROM TRANSATLANTIC DIFFERENCES

Preliminary comparative assessments of conditionality policies of the EU and other countries, in particular the United States, highlight the following aspects that merit particular attention. First, the US, notably under the Biden administration, has been markedly more proactive in including social conditionalities than the EU, using a wide array of different instruments (see [here](#) and [here](#) for detailed analyses). Second, [coalition-building](#), in particular with trade unions and civil society organisations, combined with a broadly shared motivation—in the US primar-

ily the geopolitical threat of China to American supremacy—have been critical for successful implementation and monitoring of these conditions. Third, government monitoring and enforcement during implementation proves difficult due to capacity constraints and lacking access to information, but is [significantly facilitated by including monitoring provisions that grant corporate stakeholders, such as works councils and trade unions, access to information](#). Fourth, the legal room to define and include conditionalities into funding agreements is relatively wide, even under EU competition and state aid law. It is ultimately constrained only by fundamental constitutional rights, such as the protection of private property (see analyses [here](#) and [here](#)).

To the extent that information is publicly available, until now the EU and member states have used conditionalities only selectively, and notably not with a focus on social conditionalities. [Examples include](#), amongst others, conditionalities to prevent fraud within the framework of the Recovery and Resilience Facility (RRF). In the Microelectronics Important Project of Common European Interest (IPCEI), a "claw-back" profit-sharing mechanism was introduced, under which companies may be required to redistribute extra profits obtained as a result of EU funding. In the case of a supply chain crisis, the Commission can require semiconductor companies that have received financial support under the EU Chips Act to share information about their production capacities and, if necessary, to prioritise domestic orders for critical products. If companies do not comply with these requirements, the Commission can impose fines or other sanctions. Within the framework of the European Defence Fund, access to funding is restricted to companies established in at least two EU member states, or associated members part of the European Economic Area. Intellectual property rights resulting from funded projects should not be controlled by any third countries or third-country entities. Otherwise, the Commission can claw back the initial funding.

Various reasons are proposed in the literature as to why the conditionality regime in the EU appears relatively weak (see analyses [here](#), [here](#) and [here](#)). Amongst them are, first, the lack of financial power of the EU and its dependency on member states to extend funds. Second, administrative capacity constraints exist both at EU level, but particularly at the level of member states where implementation actually occurs. Third, a comparatively weak security disposition prevails, including opposing views on the nature and extent of the "China threat".

With respect to the notably low profile of social conditionalities, the already relatively high level of labour and social standards in the EU, as well as the systematic exclusion of trade unions from industrial policymaking in the EU, serve as the main explanations. In marked contrast to the US, where trade unions have played an important role in co-designing social conditionalities, and thus have put considerable pressure upon the Biden administration to include them, the [calls of European trade unions to introduce stronger social conditionalities](#) have been mostly ignored by the Commission as well as member state governments.

SECURING DEMOCRATIC LEGITIMACY THROUGH SOCIAL INCLUSION

By way of conclusion, conditionalities, including in particular social conditionalities, represent a central mechanism for guaranteeing the desired directionality of investment, as well as for making certain that the social benefits generated by public support are widely shared across society. Weak or non-existent conditionality indeed invites the kind of adverse behaviour emphasised in the economics literature, such as rent-seeking, moral hazard or anti-competitive

behaviour. Given the relatively weak bargaining position of many EU institutions as well as governments vis-à-vis the corporate sector, and in particular large transnational corporations, it is precisely through conditionalities that the public purpose of financial transfers, and thus their output legitimacy, can be safeguarded.

But social conditionalities also offer the opportunity for achieving a higher degree of input legitimacy. A more inclusive approach to industrial policy, one that gives workers and trade unions a meaningful voice in the process, will at the end of the day mobilise broader societal support for the twin transformation. Last but not least, this broader social support will increase the autonomy of policymakers at national and EU level in pursuing industrial policy even against the resistance of specific social groups. Without such democratic foundations, Europe's industrial policy risks becoming yet another exercise in corporate capture rather than the collective endeavour our shared future demands.

CHAPTER 7

THE EU'S INDUSTRIAL POLICY NEEDS BETTER GOVERNANCE

By Wolfgang Polt

Europe's fragmented approach to industrial strategy undermines its ability to compete with China and the United States.

The European Union stands at yet another crossroads. A "poly-crisis" demands fundamental changes to patterns of production and consumption to meet the challenge of climate crises, keep pace with the economic and societal challenges of the new wave of digital transformation, and ramp up defence production to meet looming military conflicts—all against the backdrop of losing competitiveness in major industries and facing ruptures in international value chains. Any successful response clearly hinges on an elaborate and forceful industrial policy—primarily, though not exclusively, of the mission-oriented type.

The reasons for needing an explicit, well-funded and forcefully implemented industrial policy are manifold. First, many of the goals are societal in nature—such as abating global warming—which markets would not pursue on their own behalf. Second, markets operate with too short-term an orientation for coping with challenges like climate change. Third, European countries find themselves in the position of catching up economically and technologically in an increasing number of industries characterised by huge network economies and strong concentration tendencies. Europe lags especially in sectors with high growth rates that constitute battlegrounds for future competitive advantage, particularly artificial intelligence (AI) and digital services. Hence, there exists ample need and room for "directional" and even "developmental" industrial policy initiatives.

In recent years, there has indeed been recognition of the need for industrial policy at the European level, and this recognition has found its way into a number of policy documents and initiatives, contributing to what the Organisation for Economic Co-operation and Development (OECD) has labelled "strategic orientation". Yet these documents have not been formed into a coherent "industrial strategy" at EU level—which the OECD defines as an overarching document comprising different sub-parts of industrial policy across sectors, instruments, and other dimensions. In fact, the EU remains a latecomer to formulating such a strategy compared to countries like China, Korea, Japan, and most recently the United Kingdom.

As of recently, these policy approaches were not funded sufficiently to match the policies of other countries, notably China and the United States but also those of Japan, Korea and Taiwan. This pertains to the overall volumes—though they have risen in Europe as well—but

also to the much more complicated provision of funding compared to other countries. And finally, apart from the problems of strategic orientation and funding, the main obstacle for a successful industrial policy in Europe lies in the governance structures—which prove insufficient at all levels, from formulating a strategic vision to policy coordination up to implementation and funding.

STRATEGIC ORIENTATION AND GOVERNANCE DEFICITS

European industrial policy has historically been characterised by its horizontal nature, with a focus on creating favourable framework conditions and coordinating policies at the member state level. In recent years, EU communications on industrial policy have been increasingly calling for a change in EU policy towards more active, mission-oriented and directional policies. Likewise, in some member states, these approaches have been gaining ground. The diverse national industrial policies, though, are often only loosely articulated with EU-wide policy goals and initiatives.

What is more, national policies are—in all likelihood—not able to reduce the "size gap" that European initiatives face in comparison to China and the United States. This size gap constitutes a systemic challenge asking for governance structures which would be able to formulate and implement a coherent industrial policy at the European level. Such a strategy—which would be accepted as binding and directional also for the national level—does neither exist as an overarching industrial strategy nor in sub-areas like the Green Deal, although in the latter case there are at least some steps in this direction, such as the Green Deal Industrial Plan or several technology roadmaps.

A good example of the difficulties resulting from lack of governance can be seen in the relationship between the EU missions set up in the EU Framework Programme for Research, Technology Development, and Innovation (RTDI), and one of the main EU industrial policy instruments, the Important Projects of Common European Interest (IPCEI), which also introduce elements of mission-orientation. While the mission-oriented approach has started to gain traction—though still in its early phases of implementation in many countries—it became apparent that industrial participation was less than satisfactory and one of the main deficits of these early phases of implementation.

Both novel policy approaches—EU missions and IPCEIs/industrial alliances—could gain in effectiveness and efficiency if they were developed in better alignment and with more reference to each other. Yet the current governance settings for the two approaches are not conducive for such an alignment and would have to be changed significantly if cross-fertilisation and synergies were sought. Current governance of European industrial policy mainly lies with the Directorate-General for Competition of the European Commission, with a focus on regulatory and cooperation instruments, while actual industrial projects are developed and funded on the member states level. While concordance with overarching EU policy goals and regulations serves as a selection criterion—for example, in relation to compliance with competition and single market rules—actual thematic priorities emerge bottom-up from the member states and their regions.

Conversely, the mission topics of EU research and innovation policy were defined top-down under the aegis of the Directorate-General for Research and Innovation and are implemented

mainly via the EU framework programme and complementary national and regional policy initiatives. Most of these initiatives can be said to still be strongly rooted in the Science, Technology and Innovation (STI) domain and hence fall into the "policy trap", meaning that the sectoral policies that would be crucial for achieving the mission goals are largely left aside.

Both settings have flaws which limit the effectiveness and efficiency of the policy areas they are designed for, but also for a cross-fertilising interplay of the two approaches of missions and IPCEI. Industrial policy governance as it is set up for the most important instruments runs the risk of being dominated by industry and lacking governance structures which would allow for a better articulation between European policy goals and business interests. It also risks a concentration of funds and activities in rich member states and in large enterprises, hence running the risk of further aggravating regional concentration of innovation.

Mission governance, on the other hand, suffers from several critical weaknesses. First, the top-down political processes of selecting mission areas were neither transparent nor guided by clear criteria, resulting in arguably too broad missions of moderate urgency, which do not reflect the needs and capacities of member states properly. Second, very uneven state capacities and processes of policy learning exist for implementing missions in a flexible way over longer periods of time. And third, in particular, there is a lack of coordination mechanisms between the STI, sectoral and regional policies.

When it comes to implementation—funding and channelling of the funding—again, huge governance gaps open up. As industrial policy remains in the domain of the member states, EU funding could only come from other sources, such as the Framework Programme for RTDI or the Structural Funds, or was provided via temporary vehicles like the Recovery and Resilience Facility (RRF), which a number of countries used to finance their national funding for IPCEI participation, amounting to an indirect funding from the EU.

There are clearly visible constraints to this governance of funding and implementation, as the repurposing of funds at the EU level runs into problems of compatibility of the different funding streams, while the dependence on overwhelmingly national sources is likely to exacerbate regional differences in the EU, thus running counter to another longstanding policy goal of the EU, namely regional cohesion. Without a stronger carrot, and potential sticks, the ability to create "directionality" by the EU remains very limited.

PROPOSALS FOR CHANGE

Recently, a number of proposals have been made to rectify these governance problems. Here, I refer to the ones that I see as the most important. On a general level there is certainly the urgent need for pan-European coordination of industrial policies. This could be leveraged, for example, by a singular decision-making body at EU level, and by a stronger "Europeanisation" of the policy instruments, in terms of governance and funding, including by the set-up of dedicated funds and greater roles of the European Investment Bank (EIB) and the European Central Bank (ECB). More specifically with respect to the link between research and industrial policy, there is need for an expansion of the governance of EU's RTDI Framework Programme to include sectoral policies like defence and security, and the establishment of new missions for industrial policy.

Operationally, the implementation of a "new industrial policy" at the EU level would greatly benefit from several concrete measures. First, the creation of dedicated agencies as operational vehicles for the implementation and distribution of funding. This could take the form of an overarching agency—for example, to administer the Competitiveness Fund—or specific agencies addressing energy, environment, or specific sectors. Also, mixed forms are conceivable where the activities of a European Agency—such as the formation of a European ARPA or ARPA-E—are implemented through existing national agencies. This might be the more pragmatic option, as some countries have already started to create dedicated agencies like SPRIND in Germany—again an example of the difficulties to arrive at a coherent European institutional architecture.

Second, the greater "Europeanisation" of the tools and instruments, both with respect to priority-setting and funding. This means, for example, a stronger Europeanisation of the IPCEIs as the main tool of European industrial policy, implying a higher share of European funding, a stronger role of the European Commission in co-defining the priorities together with the European Parliament, member states, industry and societal stakeholders, an increased role of the EIB and even of the ECB in funding, and a much closer coordination with the Framework Programme for RTDI through joint programming, joint priority settings and other mechanisms.

Third, the flexibilisation and harmonisation of EU funding programmes to facilitate their connectivity and coordination, along the principles suggested for a Competitiveness Fund in the next Multi-Annual Financial Framework.

Fourth, the creation of specific European enterprises, like the examples of Euratom, Airbus, Galileo and the European Space Agency (ESA), especially when it comes to addressing infrastructural and dependency logics—for example, for the procurement of raw materials or in defence production. In this vein, the creation of European Public Enterprises of General Interest (EPEGI) has been proposed, which could be vehicles for direct industrial policy at the EU level.

While first steps in these directions do exist—the Joint European Forum for IPCEIs, inter-DG coordination at European level for the EU missions, attempts of whole-of-government approaches in the member states—as of yet these approaches fall short of solving the governance challenges of the "new industrial policy" the EU has envisioned. They also fall well short of the governance structures the United States and China have in place with their simplicity and degree of directionality, respectively. It remains to be seen whether the institutional architecture needed to implement the new Multi-Annual Financial Framework (MFF) will take these necessary steps—or whether the EU will remain a laggard, constrained by its governance deficiencies when it comes to industrial policy.

CHAPTER 8

EUROPE'S INNOVATION AGENCIES NEED RADICAL REFORM TO MEET TODAY'S GRAND CHALLENGES

By Rainer Kattel

Innovation agencies in the EU are no longer fit for purpose. A major overhaul of both the concept of innovation and of institutional structures is urgent.

Europe today faces no shortage of crises. From climate breakdown and geopolitical instability to social fragmentation and digital disruption, the continent is being reshaped by forces that defy easy policy responses. In this increasingly turbulent landscape, innovation is no longer a technocratic pursuit confined to boosting productivity or improving competitiveness, as the consensus of the early twenty-first century prescribed. It has become a political, economic and institutional necessity—one that demands not only new ideas but new ways of organising the public institutions that can turn those ideas into systemic change.

At the heart of this challenge lie innovation agencies. Long the workhorses of science, technology and industrial policy, these agencies—often semi-autonomous and operating at arm's length from ministries—have traditionally focused on supporting firms, facilitating research and distributing grants. Yet over the past decade, their mandates have expanded dramatically. Now tasked with delivering missions such as decarbonising mobility, transforming food systems or building digital sovereignty, innovation agencies are being asked to operate not just as funders or intermediaries but as architects of change across complex socio-technical systems.

This shift is long overdue. In theory, Europe has embraced the logic of mission-oriented innovation. [Horizon Europe](#), the EU's flagship research programme, commits over €50 billion to grand societal challenges. The idea is straightforward: set ambitious, shared goals and allow national and regional actors to develop locally appropriate solutions.

But the reality on the ground is starkly different. At the EU level, implementation remains locked in rigid frameworks of compliance and administrative oversight. At the local and regional level, innovation flourishes—labs, pilots and experiments abound—but rarely scales beyond the project phase. The result is a peculiar imbalance: too much stability at the top, too much agility at the bottom and too little capacity in the middle.

INNOVATION AGENCIES AS ENABLERS OF MISSION-ORIENTATION

Innovation agencies typically occupy that crucial middle ground. Many remain trapped in legacy structures, unable to act with the responsiveness or strategic foresight demanded by to-

day's challenges. Others are attempting to reinvent themselves—embedding user-centred design, adopting agile working methods, forging new coalitions—but face limits in mandate, resources or political support.

What's clear is that the institutional infrastructure of European innovation policy is no longer fit for purpose. The question is no longer just what innovation agencies should do, but how they must evolve to do it.

Some agencies have already begun charting a new path. Sweden's Vinnova, for instance, has transformed from a conventional R&D funder into [a mission-driven organisation tackling systemic challenges](#). One such mission focuses on redesigning Sweden's school food system—not merely as a nutritional issue but as a lever for innovation across agriculture, logistics, health and education.

Delivering on this mission has required the agency to engage actors far beyond its traditional orbit, from municipalities, pupils and parents to waste management services and energy providers. It has also meant adopting new internal routines—drawing on strategic design, reframing policy goals and experimenting with iterative delivery models. Vinnova is still early in this transition, but its trajectory points to a broader rethinking of what innovation agencies can and should be.

The [UK's Government Digital Service \(GDS\) offers another instructive case](#). Created in 2011 to overhaul the British state's digital infrastructure, GDS brought user-centred design and agile development into the heart of government. It didn't just build better websites—it reformed procurement, opened up public contracts to small and medium-sized enterprises (SMEs) and professionalised digital skills across departments. In doing so, GDS transformed the relationship between government and citizen-facing technology, not by acting as a monolith but by embedding new capabilities that gradually diffused across the public sector.

DYNAMIC CAPABILITIES: THE NEW INSTITUTIONAL IMPERATIVE

What both examples share is not a blueprint but a set of evolving capabilities—abilities to scan complex environments, build partnerships, experiment with new solutions and adapt in real time. At the [Institute for Innovation and Public Purpose](#), we've described these as dynamic capabilities: not fixed assets but organisational muscles developed through repeated, contextual practice.

Recent work focused on city governments has helped refine this idea further. Looking across cities like Barcelona, Bogotá and Seattle, we identified five key capabilities: cultivating strategic awareness of emerging issues; adapting focus as priorities evolve; building coalitions with diverse stakeholders; transforming teams and routines internally; and embedding experimentation as a core institutional function.

These capabilities do not develop automatically. They require political commitment, organisational redesign and often a willingness to unlearn. They are also deeply contextual—what works in a central government agency may look very different at the city or regional level. But without these capabilities, innovation agencies will struggle to meet the expectations placed upon them. Missions will remain rhetorical, and public trust in innovation policy—already fragile in many places—will erode further.

The need for capable, adaptive innovation institutions has never been greater. Nowhere is this more evident than in the domain of defence. The war in Ukraine has catapulted questions of strategic autonomy and technological sovereignty to the top of the European agenda. Defence R&D—long underfunded and fragmented in Europe—is suddenly seen as a vital component of resilience. But here too, institutional capacity lags behind ambition. Europe spends roughly 17 times less than the United States on defence R&D and lacks a coherent public infrastructure to coordinate investment, shape markets or steer dual-use innovation.

For years, some have proposed creating a "European DARPA" to emulate the US agency famed for its high-risk, high-reward innovation. But this fundamentally misframes the problem. DARPA's success lies not just in its structure but in its function within a wider system—one that includes strategic procurement, stable political support and a culture of experimentation. Simply replicating its form without its ecosystem is unlikely to succeed.

Instead, Europe should focus on building a distributed network of agencies and programme managers with the capacity to operate in DARPA-like ways—pursuing high-risk projects, engaging diverse partners and working flexibly within clear strategic mandates. This means cultivating a professional cadre of innovation managers, developing support structures to handle legal and procurement complexities, and designing challenge-driven programmes that bridge defence with civilian missions—cybersecurity, green energy, critical infrastructure.

Such an approach is not only relevant in defence but could be replicated around the main EU challenges, specifically around the twin transition.

FROM SILOS TO ECOSYSTEMS: REDESIGNING INNOVATION GOVERNANCE

The broader lesson here is that no single institution can deliver transformation alone. What matters is not just agency reform but ecosystem design. Innovation agencies must be embedded in organisational landscapes that allow them to collaborate, learn and adjust. That means creating clarity about who does what—but also allowing overlaps, redundancies and experimentation that enable resilience. Governance should be designed not for neatness but for adaptability.

To get there, we need to rethink how innovation policy is structured and evaluated. Too often, innovation is managed through compliance-heavy cycles that reward predictability over learning. Agencies are incentivised to spend on time, hit targets and avoid controversy. This discourages experimentation, undermines learning and ultimately weakens impact. What is needed instead is a shift toward learning-centred governance—where agencies are encouraged to reflect, adapt and scale what works, even if it means tolerating failure along the way.

Four principles should guide this transition. First, invest in dynamic capabilities by supporting training, creating new career pathways and embedding new professional standards. Second, design institutional ecosystems, not silos—ensuring that mandates align and organisations complement each other's roles. Third, prioritise reflexive learning over compliance—making room for iteration, feedback and adaptation. Fourth, integrate policy domains—recognising that missions like climate resilience or digital sovereignty cross traditional boundaries, and agencies must be able to follow them across sectors.

These principles are not revolutionary. But they do require political commitment—and a reallocation of attention and resources away from abstract strategy toward institutional practice. Europe already has many of the ingredients for a stronger, more effective innovation system. What it needs now is to cultivate the organisational capacity to use them well.

The crises of the last decade—from the pandemic to war and climate emergencies—have shown what public institutions can do when the stakes are high and the constraints are lifted. The challenge ahead is to make that kind of capacity permanent—not as a reaction to crisis but as the foundation of a more resilient, democratic and mission-driven Europe. That begins with building institutions that can learn, adapt and lead. Innovation agencies, if empowered and equipped for the task, can play a pivotal role in that future.

PART FOUR
FUNDING CHALLENGES FOR PROGRESSIVE INDUSTRIAL POLICY

CHAPTER 9

MIND THE GAP: CAN EUROPE AFFORD ITS GREEN AND DIGITAL FUTURE?

By Viktor Skyрман

Amid vast investment shortfalls, the European Union must rethink its funding strategy to achieve its ambitious goals.

Significant new investment is crucial if the European Union is to meet its decarbonisation and digitalisation targets, yet funding remains the Achilles heel of its green industrial policy. Amid a climate of austerity, policymakers' attempts to subsidise and "crowd in" private investment, mainly through public guarantees, [have failed](#) to close Europe's green investment deficit, which is estimated to be [some €406 billion](#), or 2.6 percent of GDP, in 2024.

A recent report by the former Italian prime minister, Mario Draghi, calls for an additional €750 billion to €800 billion in yearly investments to meet further geopolitical and structural goals, a figure corresponding to around 4.5 percent of the EU's 2023 GDP. Meanwhile, many relatively new programmes dedicated to green manufacturing, such as the Net-Zero Industry Act and the Sovereignty Fund/STEP, do not provide additional money from the EU level but mostly reshuffle funds from existing pots.

While these numbers may sound large, they are dwarfed by the costs governments have borne during wars and financial crises. Historically, public debt has [almost doubled](#) on average in the aftermath of domestic banking crises. As the climate crisis becomes increasingly critical, this article discusses ways to increase the EU's funding of the green transformation beyond the prevailing approach of subsidising private financial intermediaries.

THE CASE FOR PERMANENT EU BONDS

As the centrepiece of the NextGenerationEU programme (2021-2026), the Recovery and Resilience Facility raised €723.8 billion through EU bonds to alleviate the economic hardships of the Covid-19 pandemic. Scholars have referred to the facility as a landmark agreement and an [innovative European investment model](#). Poorer member states received proportionately larger sums dedicated to the green and digital transitions, among other ends.

Despite being a crucial step forward, the temporary nature of the Recovery and Resilience Facility has diminished the effectiveness of some of its resources. The smaller scale of borrowing compared to national governments has also increased its debt costs. Despite being triple-A rated, benchmark 10-year EU bonds have, for most of the last few years, traded at higher rates

than their German and French counterparts. Conversely, the permanent issuance of EU bonds would decrease the cost of debt, improve the EU's fiscal space amid the Stability and Growth Pact, and counteract regional imbalances within the Union.

A PERMANENT INVESTMENT FUND

Many current instruments, including the Recovery and Resilience Facility and InvestEU, have limited lifespans, expiring in 2026 and 2027 respectively. This finite approach is not conducive to the long-term planning required for both private and public actors to carry out the twin green and digital transformations.

Long-term financing mechanisms are therefore essential. A legally simple option to permanently summon public investments would be through the establishment of a permanent European investment fund, such as the "Sovereignty Fund" mentioned in Ursula von der Leyen's State of the Union address in September 2022. Such a fund could provide, for example, "[at least 1 percent of EU economic output per year](#)" to enhance Europe's energy independence and meet its climate investment needs. The fund could prioritise European public goods, such as continental railway infrastructure, pandemic prevention, integrated electricity grids, and an EU-wide 5G network.

PROGRESSIVE EUROPEAN TAXATION

Not only has the ratio of tax revenue to GDP decreased in recent decades, but the burden of taxation has also increasingly shifted from capital to labour. Competition for capital and investments in an era of free capital movement has led governments to successively decrease taxes on profits, capital income, real estate, wealth, gifts and inheritance. This has undermined the fiscal space that could have been used for necessary investments.

Although politically challenging, there have been increasing calls for common European taxation. Suggestions include common taxes on [wealth](#), [financial transactions](#), [capital gains](#) and [carbon emissions](#), along with an EU corporate tax. Together, these could raise resources equivalent to between four and eight percent of the Union's GDP per annum.

SHARING RISKS AND PROFITS

Markets are not apolitical institutions but are co-created by private and public sector actors. By acting as investors of first resort, and by co-creating and shaping markets, states have remained core contributors to radical innovation. However, amid scarce fiscal resources, European policymakers have tried to finance the green transition through financial "de-risking" — the absorption of various business risks by the public sector to increase private investment.

Instead of subsidising profits and socialising risks, a *progressive de-risking* strategy should [include conditions](#) for firms that receive subsidies. Conditionalities could require companies (i) to reinvest profits into R&D, worker training or other productive activities; (ii) to ensure the right to collective bargaining and decent wages; (iii) to agree to private-public profit sharing schemes through royalties or partial government equity ownership; (iv) to grant the public sec-

tor access to, for example, intellectual property rights in exchange for subsidies; and (v) to levy taxes on excess profits and introduce bans on excessive shareholder remuneration, including on dividends and share buybacks.

Conditionalities used under the Biden administration's industrial policies offer some examples. The CHIPS Act partly forbade dividend payments or stock buybacks, while the Inflation Reduction Act put a one percent excise tax on stock buybacks. Meanwhile, a "prevailing wage clause" stipulated that receiving firms must pay decent wages and benefits. Such measures, as the former Italian prime minister, Enrico Letta, pointed out [in a recent report](#), have largely been absent in the EU. Moreover, whereas credit guarantees restrict the European Commission's ability to attach performance criteria or conditionalities to financial support, grants offer EU institutions greater control over profit-sharing mechanisms and performance-based conditions, according to a [policy brief by the Jacques Delors Centre](#).

LEVERAGING EUROPE'S DEVELOPMENT BANKS

Multilateral development banks account for over one-third of climate finance to developing countries and [10 percent of global investments annually](#). European development banks, including Germany's KfW and France's CDC, have likewise been among Europe's major green financiers; the European Investment Bank, for instance, funded 40 percent of Europe's offshore wind capacity as of 2020. The Commission has also proposed an "Industrial Decarbonisation Bank", aiming for €100 billion in funding in 2026, though its final structure remains to be seen.

Further public resources could be allocated to these banks for credit creation, including assets of sovereign wealth funds, public pension funds, central bank assets and IMF Special Drawing Rights. The European Investment Bank could also be leveraged by accepting new member states while receiving increased paid-in capital from existing members.

As Europe lacks equity financing, development banks are also well-suited to take equity stakes in technology start-ups. Why? First, public equity investments help prevent the unsustainable leveraging of firms. Second, public equity stakes enhance the ability of policymakers to steer green technological innovation more effectively. Third, expanding the use of equity instruments enables development banks not only to absorb risks but also to share in the rewards of successfully co-financed innovative firms—returns that can be reinvested to support future projects and lending activities.

REFORMING THE EU FISCAL FRAMEWORK

It is widely believed that the Stability and Growth Pact [has failed to limit European public debt-to-GDP ratios](#). Its contribution to fiscal restraint also depressed demand and was detrimental to the EU's growth performance in the years after the 2008 financial crisis. Public underinvestment was chronic even before the crisis, and public net investment has turned negative or remained stagnant throughout Europe ever since. The need to reform the EU's budgetary framework has also been emphasised by [studies published by the IMF](#).

The 60 percent benchmark for public debt was chosen arbitrarily, according to the former ECB Vice President, [Vitor Constâncio](#), at a time when climate and digitalisation investments were

considered less pressing. Progressive activists, scholars and policymakers should therefore continue to mobilise for long-term alternatives to the existing contractionary fiscal framework.

A STRONG EUROPEAN STATE, NOT JUST SUBSIDIES

European policymakers have perceived public investment guarantees as a cheap alternative to guide private investment towards socially important but otherwise unprofitable destinations. This has been exemplified by the EFSI and InvestEU programmes. The [Letta report](#) similarly proposed the launch of a "European Green Guarantee".

As these measures [have fallen short](#) of closing Europe's green investment gap, it is clear that corporate subsidies cannot substitute for supranational public investment and lending. An expanded fiscal capacity is imperative to accelerate Europe's decarbonisation, whether through permanent EU bonds, taxation, a permanent EU investment fund, the further leveraging of public development banks, or a combination of these approaches.

CHAPTER 10

EU'S NEW FISCAL RULES: BALANCING BUDGETS WITH GREEN AND DIGITAL AMBITIONS

By Philipp Heimberger

The recently enacted EU fiscal framework aims for fiscal prudence but poses challenges for funding the green and digital transition.

The European Union's revamped fiscal rules, which took effect on 30 April 2024, mark a significant shift in how member states manage their public finances. This comprehensive reform, the most substantial since the post-financial crisis tightening, seeks to rein in national deficits and debt. However, this renewed emphasis on fiscal consolidation raises crucial questions about the future of public spending, particularly concerning the ambitious green and digital transitions the EU is championing.

While a recent decision to [exempt additional defence spending](#) will lead to a more expansionary overall fiscal policy stance, this deficit-financed military expenditure is projected to increase the proportion of government interest payments relative to total tax revenue. Consequently, the anticipated political reluctance towards higher fiscal deficits is likely to exert downward pressure on crucial public investment in the green and digital agendas. This analysis will critically assess the new EU fiscal framework, focusing on its implications for public spending in these vital areas, and discuss potential avenues to enhance fiscal space for the "twin transition" within the constraints of these new regulations.

KEY ELEMENTS OF THE NEW EU FISCAL RULES

The core objective of the [new EU fiscal rules](#) is to ensure that member states bring their fiscal deficits below 3 percent of Gross Domestic Product (GDP) and their public-debt-to-GDP ratios below 60 percent of GDP. The revised framework prioritises a medium-term perspective on public finances, shifting away from a purely annual assessment and concentrating on limiting the growth of government expenditures.

Under the new regulations, should a member state breach either the 60 percent debt or 3 percent deficit threshold, the European Commission will propose a "reference trajectory". This trajectory is designed to guarantee that the public debt ratio follows a "plausibly downward path" by the end of a fiscal adjustment period lasting at least four years. Essentially, the reference trajectory serves as preliminary guidance on the extent of fiscal adjustment each member

state must undertake over a multi-year period to ensure the public debt ratio is on a sustainable downward trajectory within 10 years following the adjustment.

Multi-year budget plans, spanning a minimum of four years, will be negotiated between the European Commission and national governments, informed by the reference trajectory and underpinned by a [Debt Sustainability Analysis](#) (DSA). The country-specific nature of the fiscal adjustment requirements, based on technical DSA assumptions, represents a significant departure from the previous framework. Safeguard mechanisms will be in place to ensure minimum fiscal adjustment efforts for countries grappling with high deficits and debt levels.

Crucially, member states can commit to a package of investment and reform measures, potentially extending the fiscal adjustment period from 4 to a maximum of 7 years. To qualify for this extension, the package must be growth-enhancing, consistent with debt sustainability, address shared EU priorities (such as the Green Deal, digitalisation, and security), align with country-specific recommendations within the European Semester, and maintain at least the existing national investment level. It is important to note that the reformed framework does not include broad exemptions for public investment at the national level.

The incentives for national governments to submit these investment and reform packages to the European Commission are clear: by doing so, they can lengthen the fiscal adjustment period and reduce the required annual adjustment efforts. These packages should incorporate government spending on shared priorities related to the twin transition. However, member states must convincingly demonstrate that the planned measures are conducive to growth and compatible with maintaining sustainable debt levels. For instance, climate-related spending that is deemed necessary to meet environmental targets but does not demonstrably boost economic growth may not be supported as part of a package aimed at extending the adjustment period. Given the absence of widespread exemptions, if member states wish to increase spending on green and digital initiatives while adhering to the new rules, they will likely need to offset this by reducing expenditure in other areas.

A CRITICAL ASSESSMENT OF THE NEW FRAMEWORK

As the EU fiscal framework prioritises the medium-term reduction of public liabilities relative to economic output, it may inadvertently hinder the build-up of public assets through crucial public (infrastructure) investment necessary for the twin transition. An article [published by the International Monetary Fund](#) (IMF) suggests that nations with stronger government net worth – calculated by subtracting total public liabilities from total public assets – tend to experience greater economic stability and more robust macroeconomic development. From this perspective, public assets are also vital for ensuring sustainable public finances in the long run. However, the new EU fiscal framework does not explicitly consider government net worth, focusing instead on public liabilities. The green transition, in particular, will necessitate significant investment in [replacing and expanding the capital stock](#) over the coming decades.

While the new framework incentivises governments to propose investment and reform plans to the European Commission, the acceptance of such a package does not translate into broad-based exemptions for financing these investments. Instead, it merely extends the fiscal adjustment timeline to a maximum of 7 years, which, while [easing annual adjustment pressures](#), does not fundamentally alter the overall fiscal consolidation requirements.

Maintaining the current level of public investment will likely prove insufficient to achieve ambitious climate targets within the next decade or two. The EU's overarching goal of achieving climate neutrality by 2050, and thus net-zero greenhouse gas emissions, will demand [substantial additional investment](#) in areas such as transport and energy infrastructure, as well as more energy-efficient housing. Worryingly, the multi-year budget plans submitted by EU member states to the European Commission indicate that the nationally financed public investment rate is projected to [decline in more than a third of countries](#). The initial round of plans submitted to the Commission does not adequately reflect the need for increased public investment. Consequently, the Commission's conclusion that EU countries will maintain or increase investment over the plan horizon appears overstated. Actual reductions in public investment could be even more pronounced as difficult budget choices arise.

The combination of increased defence spending and the pressure for fiscal consolidation on other spending categories from 2025 onwards will likely impede national governments' ability to sufficiently boost public investment in the twin transition, despite this being essential for meeting climate and digitalisation targets. The following section will explore [three potential strategies](#) to expand the fiscal space available for public spending on the twin transition within the constraints of the new EU fiscal rules.

OPTIONS TO INCREASE FISCAL SPACE FOR THE TWIN TRANSITION

Given the restrictive nature of the new EU fiscal rules, policymakers must explore innovative solutions to ensure adequate funding for the green and digital transitions. Three potential options warrant consideration:

- 1. Changing Technical Assumptions in the Substructure of New EU Fiscal Rules:** While debt sustainability forms the cornerstone of the new regulatory framework, studies of the European Commission's Debt Sustainability Analysis reveal that relatively [minor adjustments to a few technical assumptions](#) can significantly alter fiscal consolidation requirements. Therefore, modifying the DSA assumptions could lead to a reduction in the DSA-based fiscal adjustment demands. The European Commission's current DSA framework does not account for the potential positive economic growth effects stemming from public investment and reforms. A potential way forward could involve revising the technical assumptions to explicitly incorporate the anticipated benefits of increased investment and structural reforms. Higher projected growth rates would result in more favourable simulations of public debt ratio trajectories over time, thereby lessening the need for stringent fiscal adjustments. Importantly, this could be achieved without necessitating further legislative reform, as the relevant technical assumptions are not explicitly regulated by the legislative texts.
- 2. Increasing National Co-financing of EU Funded Programmes:** When assessing member states' compliance with their fiscal plans under the new framework, the European Commission will exclude national spending on the co-financing of EU-funded programmes from government expenditure calculations. Consequently, an increase in the fiscal deficit resulting from higher-than-planned co-financing of EU programmes will not be considered a breach of the rules' expenditure ceilings. In the short term, this may not have a substantial impact, as the majority of national co-financing is linked to spending on EU regional funds. However, in the future, a greater reliance on national

co-financing could enable governments to meet fiscal targets more readily and to better align their spending with EU policy objectives, including efforts related to the green and digital transitions. The potential for co-financing will depend on the nature and scope of future EU programmes and the level of national co-financing they require or permit. Therefore, the next Multiannual Financial Framework (MFF, 2028-2034) will be of critical importance in this regard. The European Commission [has proposed](#) making the MFF significantly more flexible, moving away from fixed programmes towards a general budget pool designed to address broadly defined EU objectives. This would allow individual member states to set their own priorities within these overarching EU goals. Consequently, EU funds could be leveraged more easily than before and could also be combined more effectively with the ex-post exemption of national co-financing from EU fiscal rules.

- 3. Introducing an EU Investment Fund for Climate and Digitalisation:** Another option to facilitate a substantial increase in public investment is the establishment of a dedicated investment fund for climate and digitalisation at the EU level. Key features of such a fund could draw upon the [experience of the Recovery and Resilience Facility](#) (RRF). The RRF was established during the Covid-19 crisis to support the economic recovery of EU member states while simultaneously promoting investments and reforms aimed at achieving climate and digital objectives. However, the RRF's current size is insufficient to fully address the investment demands, and its grant component is scheduled to conclude in 2026. Following the RRF model, the European Commission could issue bonds on behalf of the EU to raise capital in financial markets for a new EU investment fund specifically targeted at fostering the green and digital transition. Investments financed by such a fund could prioritise [genuinely European public goods](#) projects in areas such as the transformation of energy and transport systems, as well as digital infrastructure, thereby generating clear EU added value. For example, investments could be channelled into a European high-speed train network, which would contribute to long-term reductions in carbon dioxide emissions within the transport sector. Furthermore, in the energy and decarbonisation domain, policymakers could support the development of an integrated electricity grid for the transmission of renewable energy and promote complementary battery and green hydrogen projects. In the realm of digital infrastructure, truly EU-wide projects could focus on delivering significant cross-border benefits for multiple member states, aligning with the EU's overarching digital strategy and promoting EU integration in the digital sphere. Examples include a high-speed, ultra-broadband network connecting all EU regions, an EU-wide 5G network, EU cloud infrastructure, cross-border digital identification systems, or a European digital health infrastructure.

CONCLUSIONS

Major fiscal consolidation will be necessary in several large EU countries in the coming years to comply with the reformed EU fiscal rules. However, the temporary exemptions granted for additional defence spending will result in a more expansionary overall fiscal stance across the EU than would otherwise have been the case. There is currently a political emphasis within the EU on industrialisation through re-armament. Nevertheless, the pressure to finance additional defence spending through deficits will eventually increase the proportion of government inter-

est payments relative to total tax revenue, and the anticipated political aversion to higher fiscal deficits is likely to exert downward pressure on public spending dedicated to the green and digital transitions.

To meet ambitious policy goals, policymakers must identify new long-term financing solutions for the green and digital transition. As argued above, options to expand the fiscal space for additional public expenditure in these crucial areas, within the context of the new EU fiscal rules, [include](#):

1. Modifications to key technical assumptions underpinning the new rules, which could lead to an overall reduction in fiscal adjustment requirements.
2. An expansion of national co-financing for EU programmes, as this spending is not counted when assessing compliance with the reformed fiscal rules.
3. The establishment of a permanent EU investment fund for climate and digitalisation to provide funding at the European level, focusing on genuinely European projects that deliver clear EU added value, such as investments in an integrated electricity grid, high-speed rail networks across the EU, an EU-wide 5G network, or a European cloud infrastructure.

CHAPTER 11

THE ECB MUST EMBRACE EUROPE'S GREEN FINANCE RULES TO SECURE BOTH CLIMATE GOALS AND FINANCIAL STABILITY

By Gaston Bronstering, Agnieszka Smoleńska, David Barmes

Integrating sustainable finance standards into central bank operations would align market incentives and strengthen the eurozone's climate resilience.

The EU has set ambitious sustainability objectives over the past few years. In the field of financial market policies, one important element is the EU sustainable finance framework, which currently comprises over 20 pieces of legislation. These span foundational definitions relating to sustainable business activities (Green Taxonomy), corporate governance rules (disclosures), product and service standards (EU Green Bond, ESG ratings), as well as prudential reforms. As an increasing number of legislative interventions shape the emergence of the EU's "[green macrofinancial regime](#)", especially through EU sustainable finance policy, there is a strong need for increased policy coherence.

This essay therefore argues in favour of further integration of EU sustainable finance policies into the ECB's operational framework, without undermining the ECB's mandate and independence. This would support alignment of the financial actors' expectations and incentives, thus contributing to goals of financial stability and aligning capital flows with the Paris Agreement.

To a certain extent, the ECB has already been recognising the relevance of the sustainable finance instruments for its policies. For example, the ECB has followed the Taskforce for Climate-Related Financial Disclosures (TCFD) in its reporting. It has likewise considered whether banks within the EU should disclose in accordance with the Corporate Sustainability Reporting Directive (CSRD). However, as the above-mentioned pieces of the EU sustainable finance package come into force, a more holistic approach is required to ensure coherence between EU legislators' intervention in market regulation and the ECB's policies.

This need for further policy coherence — and a commensurate level of ambition among policies — is partly articulated by the ECB in its [Opinion on the Omnibus](#), which aims to reduce the scope of EU sustainable corporate governance rules. However, whilst streamlining sustainable finance rules might mitigate the inconsistencies, overlaps, and complexities of the current framework, [the Omnibus package is unlikely to significantly ease administrative burden and risks undermining green investment and the management of climate-related risks](#).

Since the Sustainable Finance Framework and especially the CSRD and Corporate Sustainability Due Diligence Directive (CSDDD) constitute crucial inputs for the ECB's activities in terms of monetary policy implementation, prudential supervision of credit institutions,

financial stability, and statistical data collection, the burden alleviation should not come at the expense of the scope or ambition of the Sustainable Finance Framework. In other words, there are crucial interconnections between the Union's Sustainable Finance Framework and the ECB's activities that require coordination.

Even as the ECB recognises how the adequacy of its policies relies on the availability and quality of sustainability data, further action may enhance the coherence of EU policy implementation in this respect. For example, interest rates could be differentiated via a [Green Targeted Longer-Term Refinancing Operation \(Green TLTRO\) based on the Taxonomy](#). Furthermore, the use of sustainability definitions included in the Sustainable Finance Framework by the ECB would not only contribute to the general coherence of the EU's economic policy but also represent a necessary and important signal to market participants, who — even with acts such as the EU Taxonomy or EU Green Bond Standard in force — decry absence of adequate standards or market definitions.

Where the EU sustainable finance framework is oriented towards increasing transparency around climate change-related risk exposures, the integration of this approach into the ECB's monetary policies would support adequate risk management and financial sector resilience. Such an approach would further enhance the effectiveness of policy intervention, whereas the absence of coherence between EU sustainable finance policies and the ECB's monetary policy operations risks undermining the objectives of both.

ON THE RIGHT TRACK TO INTEGRATING EU SUSTAINABILITY GOALS INTO THE ECB'S POLICIES?

Over the past few years, the ECB has already taken several steps to integrate climate and environmental considerations into its different activities. It has acknowledged that "market neutrality" approaches in monetary policy and financial frameworks negatively interact with sustainability targets. For instance, [Executive Board Member Isabel Schnabel](#) has recognised that the ECB's monetary policy had a carbon bias.

Similarly, one of the conclusions from the ECB's [2021 monetary policy strategy review](#) was that climate change and transition policies are likely to affect the conduct of monetary policy and the ECB's ability to deliver on its price stability mandate. For instance, [climate change directly causes supply shocks through extreme weather events](#), and [disorderly transition policies could have inflationary effects in the short to medium term](#).

In its [2025 monetary policy strategy review](#), the ECB reiterated its commitment to taking into account the implications of climate change for monetary policy and expanded this focus to include nature degradation. The Governing Council also noted that it may extend its policy horizon when supply shocks are present, signalling intent to [adapt its approach to a period of supply-side volatility](#) driven by climate change and other structural factors.

In July 2022, the [Governing Council of the ECB](#) decided to take further steps to include climate change into its monetary policy operations, leveraging various elements of the EU sustainable finance framework. First, the tilting of the ECB's corporate bond holdings — that is, its alignment with the Paris Climate Agreement — would be based on an internal climate scoring that is strongly guided by the requirements for the EU Climate Transition Benchmarks and EU Paris-aligned Benchmarks. The ECB also announced that it would [limit shares of assets issued by high-carbon footprint entities](#) that can be pledged as collateral by individual counterparties

when borrowing from the Eurosystem and consider climate risk when reviewing haircuts applied to corporate bonds used as collateral. Moreover, the [ECB announced](#) it would make the eligibility of companies' marketable assets and credit claims as collateral in Eurosystem credit operations dependent on whether the latter comply with the CSRD.

In March 2024, the [ECB announced](#) that the design of its operational framework will aim to incorporate climate-related considerations into structural monetary policy operations. The intent is that the operational framework ensures the effective implementation of the monetary policy stance and does not cause prejudice to the ECB's primary objective of price stability.

Whilst these were steps in the right direction, the practical implementation of such policies remains at an early stage. The operationalisation of the 2025 monetary policy strategy offers an opportunity to further support EU policy coherence. There are several additional ways in which the expanded sustainable finance framework can and should be applied to the ECB's activities in a manner that aligns with the central bank's primary mandate and secondary objectives.

IMPROVING CONSISTENCY BETWEEN THE ECB'S POLICY OPERATIONS AND EU SUSTAINABLE FINANCE POLICIES

First, the ECB pursues the primary objective of maintaining price stability as set out in the first sentence of Article 127(1) of the Treaty on the Functioning of the European Union (TFEU). Following the Court of Justice, and more specifically its decision in the [Case C-62/14 Gauweiler](#), climate change could also be deemed relevant for the ECB's primary objective when it threatens to undermine price stability.

A legal basis to further integrate the Sustainable Finance Framework into the ECB's activities can also be found in its secondary objectives. According to the second sentence of Article 127(1) TFEU, the ECB is to support the general economic policies of the Union without undermining the objective of price stability. The latter are laid down in Article 3 of the Treaty on the European Union (TEU) and include, amongst other elements, "full employment and social progress" and "the quality of the environment".

Considering climate action among the secondary objectives, Frank Elderson stated that "it is irrefutable that the EU's climate policy constitutes part of the general economic policies in the EU". More concretely, Elderson describes how the sustainable finance framework creates an "ecosystem" of EU legislation that links nature degradation, the economy and the financial sector — and thus central banks and supervisors — and leaves no doubt that central bankers have the duty and tools at their disposal to take nature-related risks into account when exercising their mandate. The prioritisation of climate policy in the Union's economic policy is also reflected in the Paris Climate Agreement and the European Climate Law (Regulation 2021/1119), which are both part of the Sustainable Finance Framework and translate the former into concrete obligations.

Furthermore, financial stability can be considered a precondition for price stability, [transcending the delimitation between secondary and primary objectives](#), as per the Court of Justice of the European Union. Moreover, Article 11 TFEU states that "environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development". Article 7 of the TFEU represents another transversal treaty provision stating that the activities and policies of

the ECB must be consistent with EU law, including, for instance, the EU law on nature and biodiversity as well as other environmental legislation.

Whilst the ECB's interference with the principles of an open market economy with free competition (third sentence of Article 127(1) TFEU), for instance via the differentiation between green and brown assets, must meet proportionality standards, [such differentiation could be justified by EU standards such as the EU Taxonomy or the EU Green Bond Standard](#). As previously mentioned, [the ECB seems to have "turned away from considering market neutrality as a binding legal instrument"](#).

Consequently, both the ECB's primary mandate and secondary objectives provide ample justification for further integrating the EU's sustainable finance policies, particularly those related to risk management, sustainability definitions, and corporate governance requirements, with the ECB's activities. But what could such integration look like, and what elements must be considered?

PATHWAYS FOR FURTHER INTEGRATING EU SUSTAINABILITY GOALS IN THE ECB'S POLICIES

To ensure that integration of EU sustainable finance policies with the ECB's monetary policy activities enhances long-term policy effectiveness and supports EU sustainability goals and transition risk management, several considerations should be taken into account.

Beyond sustainability data, the ECB should also consider the appropriateness of consistently using the sustainability definitions under the EU Taxonomy Regulation and the Sustainable Finance Disclosure Regulation (SFDR). The mainstreaming of sustainability definitions, rather than their multiplication, would lead to an easier and more coherent implementation of the transition among market participants and EU institutions. In addition to increased coherence, endorsing the definitions of sustainability set out in the EU sustainable finance policy would also represent a crucial and necessary signal to market participants, supporting the credibility of the latter.

Taking the example of the tilting of the ECB's bond holdings, the latter could be better aligned with the evolving EU sustainable finance framework. In the past, the ECB's bond holdings were assessed using an internal climate score, which drew partly on sustainability disclosures associated with the EU Climate Transition Benchmark and the EU Paris-aligned Benchmarks. In addition, with the EU Green Bond Standard coming into force, the ECB should ensure that such instruments are adequately represented in its policies (for example, collateral policies), also in the context of transition risk management.

Furthermore, the ECB could rely on the EU sustainable finance policies to develop an approach to differentiating interest rates according to the climate change risk profile of the underlying asset. Among other factors, interest rate differentiation responds to the observation that contractionary monetary policy undermines long-term price and financial stability by scarring the economy's productive capacity. For instance, the ECB's contractionary monetary policy in response to the war in Ukraine and repercussions on the global economy was found to [significantly impact the financing conditions of renewable energies](#).

Comparable effects were also found in the case of the [United States](#), [several Asian countries](#), and [Iran](#). A differentiated rate shielding renewable energy investments, as in [Japan](#) and [China](#),

could be implemented via a [Taxonomy-based Green TLTRO](#). Whether it is the EU Taxonomy or another element of the Sustainable Finance Framework, such as the EU Green Bond Standard, the ECB should explicitly consider the appropriateness of using existing regulatory definitions when assessing and integrating sustainability into its various activities.

CONCLUSION

The ECB's opinion on the Omnibus package and the 2025 monetary policy strategy review confirmed the importance of the EU's sustainable finance agenda for the ECB's various activities. Further, the relevant policies introduced to accelerate financial sector climate change risk management and transition should inform the broader macrofinancial regime.

Ensuring integration of EU monetary policies with key pieces of the EU sustainable finance agenda, such as a Taxonomy- or EU Green Bond-aligned Green TLTRO, can be aligned with both the ECB's primary mandate and secondary objectives. Such integration of the ECB's activities with the Union's sustainability goals is a critical step toward greater policy coherence, thus enhancing financial stability and aligning capital flows with the Paris Agreement.

**PART FIVE
OUTLOOK**

CHAPTER 12

A PROGRESSIVE INDUSTRIAL POLICY FOR THE GLOBAL SOUTH: A LATIN AMERICAN PERSPECTIVE

By José Miguel Ahumada and Fernando Sosso

The Global South must redefine industrial policy to build new productive capabilities and address escalating global challenges.

The global economy is undergoing a [profound transformation](#), moving away from the neoliberal globalisation that defined international economic relations from the 1980s until the 2008 financial crisis. This shift is driven by the climate emergency, the digital revolution, rising military tensions, and an escalating trade war involving the United States, the European Union, and China. This conflict extends beyond tariffs, encompassing the race for critical minerals, control of digital platforms, the restructuring of global value chains, and the appropriation of intellectual property.

This structural conflict has had two major consequences. First, the neoliberal multilateral trade order has been effectively surpassed. Unilateral measures, such as tariffs, investment restrictions, and selective subsidies, have displaced foundational [World Trade Organisation \(WTO\) principles](#) like "Most-favoured-nation" (MFN) and "National Treatment". New logics, based on national security, strategic autonomy, and geopolitical competition, have taken precedence. Second, the use of industrial policy (IP) instruments, including tariffs, investment regulations, subsidies, and public spending, has become normalised as a legitimate means to strengthen domestic strategic sectors and reconfigure national comparative advantages.

Given the transformation of the international economic order and the renewed emphasis on industrial policy in the Global North, crucial questions arise: How is the Global South positioned within this new context? And what kind of (IP) can be designed from the Global South, considering its structural challenges and peripheral position in the global economy?

THE RETURN OF INDUSTRIAL POLICY: A SHIFTING FOCUS

The current industrial policy orientation of developed economies is primarily shaped by national security concerns and the goal of strategic autonomy. In the United States, successive administrations have promoted the reshoring or nearshoring of production, particularly away from China, by offering subsidies and incentives to large corporations. Notable examples include the CHIPS Act and the Inflation Reduction Act (IRA). Under the Trump administration,

this strategy was largely reduced to a [unilateral tariff policy](#) focused on confronting global competitors, especially China.

The European Union, by contrast, has adopted a more fluctuating approach. Initially grounded in environmental sustainability and decarbonisation, European IP has increasingly shifted towards strengthening its military-industrial complex, supported by targeted fiscal spending, credit programmes, and strategic subsidies. In this context, IP in the Global North has taken the form of [corporate de-risking](#), providing regulatory and financial guarantees largely decoupled from labour or environmental requirements to large firms investing in sectors deemed strategic.

The outcomes of this renewed industrial policy remain uncertain. [Protectionist strategies without obligations](#) — "carrots without sticks" — combined with weak labour protections and a lack of institutional capacity to steer complex reindustrialisation processes, are unlikely to reverse the long-term erosion of productive capabilities that has occurred over decades of neoliberal deregulation. Furthermore, these policies generate significant collateral effects on the international economic order, particularly for Global South countries and global commons such as the environment.

As [Raúl Prebisch warned](#) decades ago, tariffs imposed by advanced economies function, in practice, as indirect taxes on peripheral countries, curtailing their developmental policy space. Today, escalating tariffs and new barriers to investment are undermining global trade, increasing financial market volatility, and feeding a cycle of global economic slowdown, whose impacts are most acutely felt in [developing economies](#).

Moreover, the shift towards national security has overshadowed structural global challenges, including environmental protection, public health, and equity. During the pandemic, both the US and the EU opposed waiving intellectual property rights to allow universal access to vaccines, rejecting proposals put forward by India and South Africa. In the area of investment, while the EU has introduced limited reforms to its investor–state dispute settlement (ISDS) system, the US has retained traditional ISDS clauses in most of its treaties with countries in the Global South. Likewise, both powers have defended the WTO moratorium on tariffs for digital services, thereby enabling the free appropriation of digital data from the Global South by large Northern-based platforms.

In summary, the climate emergency, the trade war, and inequalities constitute critical challenges to the long-term sustainability of economic growth. Yet, the current resurgence of industrial policy in the Global North appears blind to these transformations. By focusing narrowly on rescuing declining national industries and militarising their economies, these strategies risk deepening international fragmentation and reinforcing a zero-sum logic, thereby squandering a pivotal opportunity to collectively rethink the foundations of the global economic order.

A PROGRESSIVE INDUSTRIAL POLICY AGENDA FOR THE GLOBAL SOUTH

In the context of growing international instability and intensifying geopolitical competition, Latin America risks deepening its subordinate position within global value chains. The region faces a dual trap: a specialisation in low-productivity sectors with high carbon emissions. This situation is exacerbated by its exposure to global disruptions, such as trade wars and technological fragmentation, as well as the escalating climate crisis.

The new global race for control over critical minerals could lock countries rich in copper, lithium, and rare earths into rigid trade agreements, extractive investments with weak local linkages, and development models disconnected from domestic ecosystems. Meanwhile, economies like Mexico and those in Central America are losing ground in light manufacturing to Chinese competition, further entrenching a specialisation in low-value-added activities and low-skilled labour.

This peripheral insertion persists within a region already marked by [longstanding structural weaknesses](#): premature deindustrialisation, low productive complexity, and deep internal gaps in productivity and income, all of which have contributed to volatile and stagnant long-term growth. The fragility of national industrial strategies compounds this. Over the past two decades, [industrial policy in Latin America](#) has been inconsistent, subject to political cycles, poorly financed, and limited in its ability to foster technological learning and spillovers. Even during favourable periods, such as the commodity boom between 2003 and 2013, windfall profits were largely spent on [redistributive measures](#) decoupled from structural change.

Against this backdrop, a progressive industrial policy agenda for the region must simultaneously build new productive capabilities and address the global challenges currently unfolding. To this end, we propose five strategic dimensions that articulate action across multiple scales.

First, establishing a new deal with respect to foreign direct investment (FDI). While FDI remains a key source of capital, it has primarily targeted extractive sectors or domestic oligopolistic markets in Latin America. Given the region's market power in critical minerals and renewable energy, it is feasible to leverage this position to negotiate investment frameworks that include technology transfer requirements, local content provisions, high environmental standards, and public-private partnerships. To prevent a regulatory "race to the bottom", such frameworks should be regional in scope and coordinated among the leading resource-intensive economies.

Second, strengthening regional production networks. In a world of increasing fragmentation and uncertainty, Latin America must deepen its intra-regional trade and investment ties to foster productive autonomy and reduce carbon footprints. Strategic sectors such as electromobility — dependent on minerals such as copper and lithium — could serve as a platform for promoting productive diversification and upgrading within global value chains.

Third, aligning productive regionalism with financial regionalism. Coordinating national development banks (such as BNDES) with multilateral ones (such as CAF) could enable joint investments in key sectors, improving access to capital on favourable terms and enhancing financial autonomy from global financial centres. One idea worth exploring is the creation of inter-governmental public enterprises that act as catalysts of innovation and pioneers in the development of dense and technologically sophisticated production networks (the cases of Airbus and Eurostar in Europe can serve as important examples).

Fourth, ensuring digital sovereignty. Today, digital data flows from the Global South to the North are extracted as raw material by major tech platforms, which then process and repack-age them into high-value-added digital services sold back to peripheral markets. These flows constitute a form of public good the use of which must be regulated. Latin American governments — and those in the Global South more broadly — must push for national, regional, and multilateral legal frameworks that [secure sovereign control](#) over these strategic digital assets.

Fifth, redefining the institutional architecture of industrial policy. A progressive IP agenda must go beyond correcting market failures or granting subsidies with no strings attached. It should be conceived as a comprehensive institutional architecture that sets the "rules of the game", redefines market boundaries, and directs accumulation towards collective objectives. This architecture must be socially embedded, with mechanisms for transparency, public deliberation, and participation of labour and civil society. Today, industrial policy in the Global North appears dominated by a centralised military-industrial complex focused on national security, with limited concern for deep decarbonisation or regional employment upgrading. Latin America can provide an alternative: a participatory, sustainability-oriented industrial policy committed to protecting the global commons.

CHAPTER 13

INDUSTRIAL POLICY FOR THE TWIN TRANSFORMATION – TOWARDS A PROGRESSIVE AGENDA

By Werner Raza, Christa Schlager, Viktor Skyrman, Michael Soder

Industrial policy is making a comeback, yet it remains tentative. The EU's twin transformation requires a careful balance between climate action, digitalisation, and social fairness.

The tentative return of industrial policy marks a pivotal moment for Europe. After decades of marginalisation, industrial strategy has reappeared on the political agenda, yet fundamental questions persist. What objectives should it pursue? How can the ensuing change be managed equitably? What are the respective roles of the state and private sector? The contributors to this eBook explore these issues and offer some initial insights and preliminary answers.

Whilst the primary motivations for renewed EU industrial policy — combating the climate crisis and navigating digital transformation — are evident, rampant protectionism propagated by the Trump administration and perceived security threats from geopolitical conflict have shifted focus towards economic security and competitiveness. Recent initiatives such as the EU's Competition Compass and Clean Industrial Deal exemplify this trend.

However, the pronounced emphasis on competitiveness and deregulation threatens to undermine progress achieved under the Green Deal during the past five years, particularly concerning climate protection and human rights due diligence. Financing remains uncertain, and prevailing austerity policies could dampen necessary economic stimulus. Europe faces the prospect of five lost years for the green transition, accompanied by welfare cuts and further democratic erosion — factors that could fuel the populist right and trigger a full-scale backlash against not only the green transformation but European integration itself.

A PROGRESSIVE AGENDA FOR TWIN TRANSFORMATION

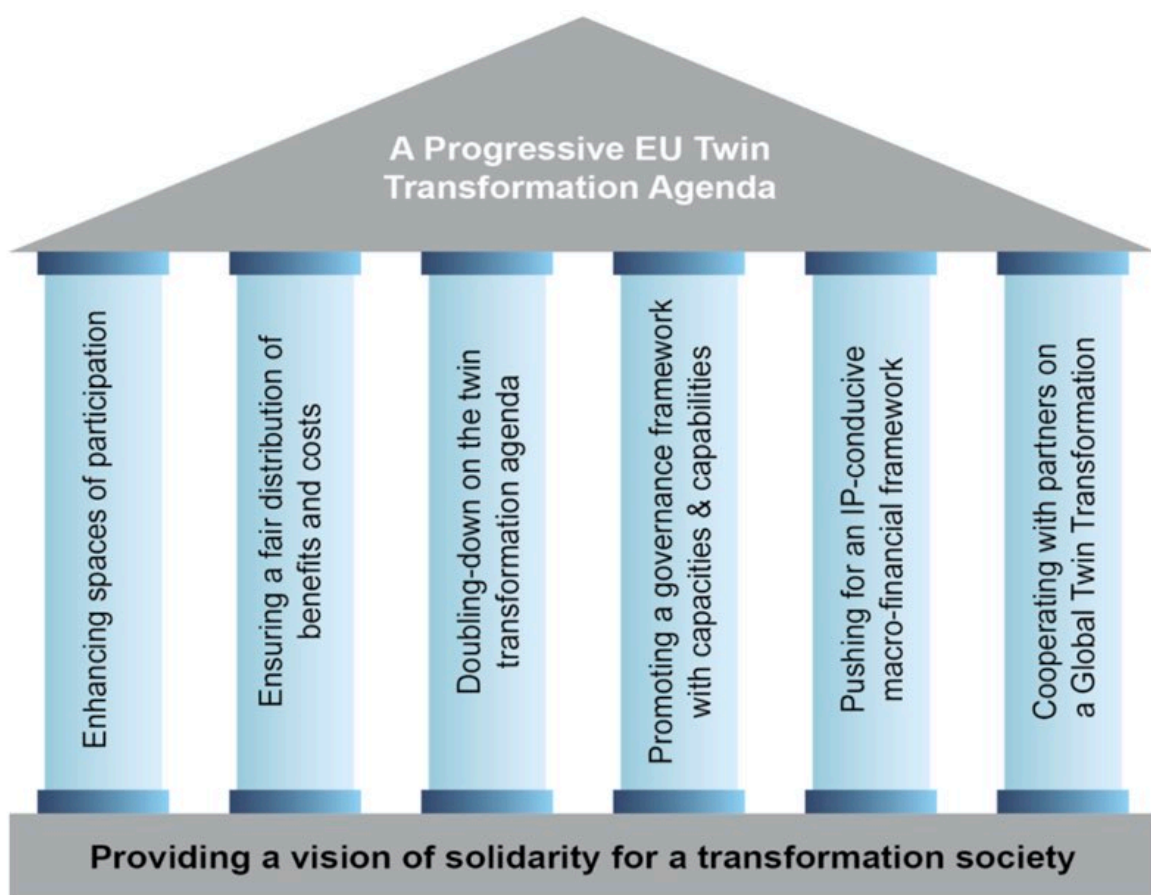
Successfully implementing the twin transformation — encompassing both green and digital dimensions — is fundamentally a political undertaking. Although technological solutions such as solar power, wind energy, batteries, and heat pumps exist, their deployment faces economic, social, and political risks. Some risks, like geopolitical conflicts, lie beyond the EU's direct control. Others, including social resistance or funding shortfalls, demand decisive political intervention.

The long-term success of this transformation hinges on maintaining legitimacy and social support over the next quarter-century. In today's crisis-marked environment, rebuilding public

confidence is paramount. The immediate challenge for the next five years is demonstrating to businesses, workers, and citizens alike that the European Green Deal must not only persist but accelerate whilst becoming more inclusive.

This places significant demands on EU institutions and national governments, requiring them to balance long-term strategic planning with immediate crisis management. Enhanced institutional capacities are essential, yet no government can manage this transition in isolation; broad societal cooperation, if not co-creation, is crucial.

Legitimacy thus rests upon three foundations: greater political participation, equitable sharing of burdens and benefits, and effective implementation. A transformation vision grounded in solidarity must guarantee a stable social safety net through to 2050, reinforced by a pan-European public services agenda. The contributors to this eBook explore these issues and offer some initial insights and preliminary answers.



Six Pillars for a progressive EU Twin Transformation agenda

Pillar 1: Enhancing Spaces of Participation

Deliberative democracy must be strengthened, granting civil society and citizens an active role in shaping transformation. European Citizens' Councils should be empowered to develop proposals on key issues, which would then inform newly established Twin Transformation Councils (TTCs) at both national and EU levels.

Comprising representatives from EU institutions, national governments, businesses, trade unions, NGOs, and academia, these councils would improve policy coordination, establish priorities and adjust policies, and assess progress whilst addressing implementation deficits. At micro- and in particular company level, workers should be given a voice in co-designing and implementing transformation strategies.

Pillar 2: Ensuring Fair Distribution of Benefits and Costs

Structural transformation inevitably creates winners and losers amongst workers, companies, and regions. The existing EU Just Transition Mechanism (JTM) is insufficient to mitigate adverse regional impacts and is scheduled to phase out by 2026. To prevent exacerbating rural discontent, sustained long-term support is necessary.

Furthermore, stronger public implementation capacities are required at national and regional levels. Proposals include establishing the JTM on a permanent footing, expanding cohesion and social climate funds, and strengthening public implementation capacities nationally and regionally. At the micro-level, social conditionalities should impose obligations on companies receiving public financial support to share benefits and costs equitably.

Pillar 3: Accelerating the Twin Transformation Agenda

With the EU at risk of missing numerous climate and environmental targets, urgent action is required across six critical areas:

- A stronger focus on reducing energy and material consumption through promoting energy efficiency and accelerating the transition to a circular economy.
- A significantly increased EU investment programme for renewable energies, prioritising solar, wind, geothermal energy, and green hydrogen.
- An EU mobility strategy centred on massive investment in rail infrastructure, support for electrified public transport across all regions, and measures to reduce private vehicle use, such as promoting car sharing.
- A strategic EU industrial strategy identifying productive activities requiring special attention regarding (a) security of supply, including disaster preparedness, and (b) closing innovation gaps in high-technology sectors.
- An EU strategy for digital sovereignty that ensures democratic control over the digital sphere via stringent regulation and proactively promotes public digital infrastructure.
- A transformation agenda for the European food industry focusing on (a) stricter regulation of unfair competitive practices, including pricing and contractual conditions, and (b) intensified promotion of organic farming.

Pillar 4: Promoting a Governance Framework with Capacities and Capabilities

Public institutions often lack the capacity to steer the transformation process effectively. EU innovation agencies grapple with administrative overload, risk aversion that hinders radical innovation, and an excessive focus on technology at the expense of broader transformative innovation.

To enhance governance, the EU should ensure diverse stakeholder representation in decision-making processes, improve coordination amongst its innovation agencies, and demonstrate greater tolerance for risk and experimental approaches.

Pillar 5: Closing the Funding Gap

The twin transformation necessitates additional public investment estimated at €180–400 billion per annum. Rather than solely prioritising the de-risking of private investment through a European Capital Markets Union and public financial support, a more effective approach involves three key elements.

These include establishing an EU Transformation Fund equivalent to one percent of GDP over 10 years, financed via common borrowing; expanding the EU budget from 2028 onwards, funded by e.g. Emissions Trading System revenues and new EU taxes; and leveraging European Central Bank monetary financing mechanisms, such as green bond purchases.

Pillar 6: Cooperating with Partners on the Global Twin Transformation

Given the EU's significant external dependencies, a new approach to cooperation with partner countries, particularly in the Global South, is essential for a global twin transformation. Shifting global political power dynamics and a relatively weakened EU position necessitate basing external relations on principles of equal partnership and mutual benefit-sharing.

This includes promoting high Environmental, Social, and Governance (ESG) standards in mining and infrastructure projects in cooperation with partners; facilitating EU-backed technology transfer and local industry development; and ensuring fair benefit-sharing in resource contracts and pricing policies.

As a general principle, strategic autonomy means that the EU should maintain an independent stance in international politics and avoid coercion into a subaltern position by world powers, whether the US or China. Regarding relations with China, a realistic assessment of the importance of Chinese green technology for timely implementation of the green transition underlines that maintaining cooperative bilateral relations with China will be pivotal.

CHANGE BY DESIGN OR CHANGE BY DISASTER

The European Union stands at a critical juncture, challenged by internal authoritarian populism and external geopolitical pressures. Industrial policy offers a means to enhance economic sovereignty whilst respecting ecological limits. In contrast to prevailing policy discourse, the fundamental issue is not a lack of financial resources or competitiveness — Europe possesses both. Rather, what is missing is the political courage to address the twin transformation decisively through a socially inclusive and proactive entrepreneurial state as pioneered by Mariana Mazzucato.

Progressive political forces, including trade unions, civil society organisations, and academia, must advocate forcefully for such an approach. The choice is stark: change by design or change by disaster.

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