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Circular Economy & Industry in 2035

Industrial policies

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1. Definitions

1.1. Defining the report topic

The macrovariable “Industrial policies” focuses on France’s industrial strategy within the European context and includes industrial and territorial ecology.

Industrial strategy

A review of the literature reveals that there is no universally accepted definition of industrial policy. For this report, we adopt Cohen and Lorenzi’s (2000) broad, inclusive definition: “Industrial policy in the strict sense is sectoral policy: It aims to promote sectors that warrant intervention for reasons of national independence, technological autonomy, the failure of private initiative, the decline of traditional activities, or regional or political balance.”

Two main conceptions of industrial policy stand in opposition:

- A vertical approach consisting of direct support measures—subsidies, tariffs, public equity stakes in companies, and so forth—targeting companies or sectors identified as priorities by public authorities.
- A horizontal approach intended to create an environment conducive to the development of all companies through support for R&D, training, taxation and regulation, improved financing conditions, infrastructure development, intellectual property protection, and so on: The government creates an economic environment and regulatory framework favorable to industry.

These two approaches tend to be regarded as complementary rather than substitutes. European and French policies therefore combine them.

Industrial and territorial ecology (ITE)

ITE focuses on optimizing resource flows within a relevant, clearly defined geographic area. It has a dual purpose: environmental, by reducing the environmental impacts of industrial activities, and economic, by improving regions’ competitiveness and attractiveness (Abitbol, 2012).

These approaches to pooling resources and closing material and energy loops typically comprise four main processes:

1. Resource substitution: One actor in the ecosystem uses another actor’s resources, such as waste heat or waste, in its operations
2. Resource pooling: Sharing equipment, space, skills, and so forth—for example, shared stormwater management
3. Service pooling: Joint electricity purchasing, for example.
4. Developing innovative sectors of activity to fill identified gaps in economic value chains.

1.2. Relevance to the study and key questions for the future

Industrial policies play a crucial role in industry’s transition to the circular economy by creating a favorable environment and providing incentives, including innovation funding, environmental regulation, subsidies, training policies, and access to sustainable financing. Industrial policies also influence industry’s overall development trajectory.

ITE is one of the seven pillars of the industrial economy as institutionalized in France. In some of the broadest interpretations, ITE and the CE are even synonymous, since both refer to a new approach to producing goods and services that seeks to “close” the management of material and energy flows within a geographic area. In the narrower sense of developing a policy that promotes industrial ecosystems, ITE helps the circular

economy take off: It provides access to financial resources, coordination support, and knowledge that can enable regions to develop their circular economy projects. The more numerous and diverse the beneficiaries reached by ITE policy, the more ground the CE will gain.

2. Retrospective analysis

2.1. Past developments

A general trend toward deindustrialization, particularly pronounced in France

Deindustrialization affects most advanced economies. It results from the combined effects of productivity gains in industry, which lower the relative prices of industrial products; the development of services; increased subcontracting and outsourcing; and the fragmentation of value chains. In France, industrial employment peaked in 1974 before declining at varying rates until the period preceding the health crisis.

Among the major industrialized countries, France has experienced the greatest deindustrialization in recent decades. Since 1980, industrial sectors have lost nearly half their workforce—2.2 million jobs—and industry now accounts for only 10.3% of total employment. Industry's share of GDP fell by ten percentage points over the same period, standing at 13.4% in 2018, compared with 25.5% in Germany, 19.7% in Italy, and 16.1% in Spain.

Deteriorating cost competitiveness: French industry has suffered from declining cost competitiveness associated with particularly high taxation of factors of production, which continued to rise until recently. It faces a higher rate of compulsory levies than other sectors, even though it is more exposed to international competition: Total compulsory levies on manufacturing represented 28% of gross value added, compared with 24% in other sectors excluding finance.

Large French groups' choice of offshoring over moving upmarket: Faced with rising production costs, industry chose to preserve price competitiveness by squeezing margins at the expense of moving upmarket and thus of nonprice competitiveness (Gallois report, 2012). Deteriorating cost competitiveness instead translated into widespread offshoring, resulting in faster deindustrialization than elsewhere. Because France's industrial base is made up of large companies to a greater extent than elsewhere, these companies took greater advantage of their ability to produce in low-cost countries to offset the rise in French costs relative to competitors. Employment in French groups' industrial subsidiaries abroad is equivalent to 62% of employment in France's industrial sector, compared with 52% in the United Kingdom, 38% in Germany, 26% in Italy, and 10% in Spain.

By offering generally midrange products with limited differentiation, French manufacturers exposed themselves more heavily to price competition from emerging countries and parts of the European Union.

1980–2000: Industrial policies lose momentum

Until the early 2000s, many countries dispensed with explicitly formulated industrial policies. The view that the growth of service jobs could replace industrial employment prevailed in many advanced economies, including France, the United Kingdom, and the United States.

The strengthened European competition policy framework and the proliferation of free-trade agreements through the WTO reduced the room for traditional industrial policies. However, industrial policy never really ceased in advanced economies: It continued implicitly through instruments such as support for private and public R&D and innovation, support for clusters and industrial cooperation, technical standards, and public procurement.

France chose to support demand, whereas Germany and other countries sharing the single currency chose to strengthen their competitiveness through supply-side policy. European countries generally suffered from incomplete integration of the European internal market and insufficient coordination of aid supporting the

development of innovative industrial solutions. The only notable exceptions were aerospace and space, and telecommunications until the 2000s, alongside a clear failure regarding the internet. Europe thus missed the digital technological revolution.

Industrial policies return to favor over the past decade: A very significant shift has taken place over approximately the past ten years. Awareness of the disadvantages facing French industry, particularly following the Gallois report, led to a series of decisions intended to address them.

In the early 2000s, French industrial policy primarily sought to develop the knowledge economy through the creation of competitiveness clusters and Oséo. Following the severe impact of the 2008 financial crisis on industrial employment, France then strengthened public support for innovation by launching the Programmes d'Investissements d'Avenir (PIA) and creating Bpifrance, while seeking to narrow cost-competitiveness gaps between its companies and those in other countries through the CICE and taxation.

A focus on cost competitiveness and innovation: Cost-competitiveness gaps narrowed partly during 2010–2020, particularly through reductions in employment-related charges under the CICE. However, labor costs remain among the highest in the European Union. Alongside efforts to control labor costs, public authorities took measures over the past decade to rebalance corporate taxation and narrow gaps with the European average and comparable countries. The corporate income tax rate fell from 33.3% in 2017 to 25% in 2022, bringing it into line with the average for OECD and euro area countries. Nevertheless, France's overall level of business taxation remains high compared with its main partners: 15% of GDP, compared with 12% in Spain and Italy and 10% in Germany.

Before the COVID crisis, public support for industry amounted to €17 billion to €20 billion annually, according to France Stratégie. More than 80% came from the national government through reductions in social security contributions, tax credits, lower energy bills, and support for R&D and innovation, with the remainder provided by regions and European funds. Overall, for every €100 in assistance to industrial companies, €40 supports employment and training, primarily through reductions in charges and the CICE; €25 supports R&D and innovation; €10 consists of reductions or exemptions from TICPE (electricity); and €6 consists of equity stakes and subsidized loans. The remainder comprises various forms of assistance, particularly from local and regional authorities or the European Union.

The PIA's mixed record (2010–2020): Problems of capture by certain actors

Over the past decade, innovation policy and its financing instrument, the Programme d'Investissements d'Avenir (PIA), have been the main tools of industrial policy. During 2010–2020, half the PIA's resources—€28.5 billion out of €57 billion—went to business modernization and the commercialization of research, and €15.7 billion went to structural measures to disseminate innovation. In 2019, the PIA supervisory committee gave a mixed assessment of its impact on industry. The PIA supported innovation and modernization in France's traditional industrial sectors—aerospace, automotive, nuclear, and space—and addressed market failures in start-up financing. However, public authorities did not always succeed in preventing the capture of assistance by certain actors or the continuation of choices favoring industrial sectors originating in major historical programs, a phenomenon known as "path dependence," at the risk of neglecting other actors or sectors and failing to anticipate technological disruptions. The PIA's effects on the economy's productive specialization, industrialization, and competitiveness thus appear limited.

ITE: Progress in theory and methodology rather than operations

Over the past thirty years, ITE has returned to prominence in scientific and public discourse, particularly since the success of Frosch and Gallopoulos's (1989) article. Before that, ecologists studying biochemical flows had already explored the concept, producing international studies that were sometimes highly detailed—see, for example, Billen et al. (1983)—but generally did not lead to concrete measures. Japan is a notable exception (Brullot et al., 2017; Erkman, 1997). ITE found its most direct and evident application in "eco-industrial parks": business zones where companies are selected so that one company's waste or by-products serve as

inputs for another (Erkman, 1997). Industrial and territorial ecology is then viewed through the lens of industrial metabolism.

In France, a chair in industrial ecology was established at the Université de Technologie de Troyes (UTT) in 2005. From 2007 to 2009, foresight work on industrial ecology resulted in a report presenting a definition of ITE and research perspectives. Between 2009 and 2014, major ITE research projects led to frameworks such as that developed under COMETHE, laying the foundations for a French approach to ITE. During the same period, the Comité d'Animation Territoire Durable et Écologie Industrielle provided a forum for the ITE community, eventually producing a methodological guide (see Commissariat général au développement durable, 2014).

2.2. Current developments

Expanding policies focused on decarbonization, resilience, and digitalization (PIA 4 and the France 2030 plan): Implementation of PIA 4—€20 billion for innovation during 2021–2025—is providing financing for digitalization, decarbonization, and targeted reshoring to strengthen economic resilience and France's strategic autonomy. These actions will be complemented by the France 2030 plan.

The France 2030 plan, with €54 billion deployed over five years, aims to develop industrial competitiveness and future technologies. Half its financing is intended for emerging actors and half for decarbonization measures. It pursues ten objectives to understand better, live better, and produce better by 2030. In particular, it aims to establish leadership in green hydrogen and renewable energy by 2030 and decarbonize industry to meet the commitment to reduce greenhouse gas emissions in the sector by 35% between 2015 and 2030. The plan relies on various means to achieve these objectives: securing access to raw materials and strategic components; supporting emerging talent by developing tomorrow's training; mastering sovereign, secure digital technologies; drawing on the excellence of our higher education, research, and innovation ecosystems; and accelerating industrialization by start-ups crucial to deploying innovation. France 2030 places its hopes in innovative, high-potential emerging actors—start-ups and tomorrow's unicorns—and situates its actions within the European momentum established since the health crisis and the adoption of the European recovery plan.

Supporting the digital transition of SMEs and intermediate-sized enterprises: Under France Relance, a decree was introduced to enable SMEs and intermediate-sized enterprises to receive government financial support for investment in technologies for the industry of the future. This assistance provides cash flow support at the time of investment to improve the competitiveness of companies' production processes. A budget of €40 million is being deployed to support investment in areas such as robotic equipment, augmented reality software and equipment, and physical sensors that collect data. Alongside the recovery plan, several initiatives have sought to organize the sector, particularly the creation in 2021 of the sector's digital platform, www.solutionsindustriedufutur.org, which facilitates exchanges between demand for and supply of Solutions Industrie du Futur. The overall goal is to develop tomorrow's leading companies in technologies and solutions crucial to France's economic and industrial sovereignty: industrial applications of robotics, AI, 5G, cloud computing, human-machine interfaces, 3D manufacturing, and so forth.

French industrial policy aligned with European policy focused on the digital and ecological transitions (Horizon Europe): Europe's industrial strategy for 2030 aims to retain an industrial base by successfully completing the digital and ecological transitions while developing breakthrough innovations to increase high-technology industries' share of European specialization. It draws on public-private partnerships, value chains or "industrial ecosystems," and financing for R&D and breakthrough innovation.

For 2021–2027, the European Union's Horizon Europe research and innovation framework program has a budget of €95.5 billion. It allows support for the innovation chain through the development and market deployment stages of industrial products, via the European Innovation Council (EIC), whose remit is to finance start-ups and SMEs with European and international growth potential. The launch of Horizon Europe

marks a significant increase in EU resources devoted to innovation and its industrial benefits.

Growing emphasis on regional and local delivery: The Territoires d'industrie program: Public interventions supporting industry have also increasingly considered issues at the regional and local levels. Regions' economic powers have been affirmed, and they have undertaken numerous initiatives, such as competitiveness clusters and Territoires d'industrie. Since 2018, Territoires d'industrie has promoted a place-based approach to stimulating industrial development through tripartite governance involving local authorities, regions, and the national government. Its goals are reindustrialization, the ecological transition, and innovation at the local level. In response to the Green Industry Law, the government will allocate €100 million from the Green Fund in 2024 to support manufacturers' ecological transition and rebuild historically rooted sectors throughout the country. Currently, 183 selected areas are committed through 2027, demonstrating local actors' determination to rebuild industry. Aid applications are managed by regional prefectures with ADEME's support, in consultation with regional councils.

Stronger policies supporting cost competitiveness: The health crisis led the government to expand its efforts to support companies' cost competitiveness. A €10 billion annual reduction in production taxes from 2021, including €3.7 billion for industry, is intended to contribute to this effort.

Carbon tax (CBAM): The European Union's "carbon tax" is becoming a reality. More precisely termed the Carbon Border Adjustment Mechanism (CBAM), this instrument begins to apply on October 1, 2023. Sometimes called a "carbon tax," it will impose an additional cost on importers of iron and steel, cement, fertilizer, aluminum, electricity, and hydrogen when those products cross European borders. It is to be introduced progressively through 2034. The mechanism aims to prevent Europe from, on the one hand, subjecting its domestic industry to demanding standards and, on the other, importing goods whose production accelerates global warming. Goods imported into the Union whose production is not subject to a carbon price, or is subject only to a low price, will face an additional cost when entering the European market. CBAM's additional costs are modeled on prices in the Emissions Trading System (ETS), which currently covers only companies established in Europe—approximately €85 per metric ton of CO2 at the end of September. Initially, the following sectors will be covered: iron and steel, aluminum, cement, fertilizer, electricity, and hydrogen. Certain goods, such as screws and bolts, are also covered.

The institutionalization of ITE initiatives

Institutionalization. The term ITE became institutionalized in France from 2013 through the Institut de l'Économie Circulaire and ADEME, with a focus on a technical approach to closing material loops, close to the idea of industrial metabolism and sometimes described as reductive (Brullot et al., 2017).

During 2015–2017, various nationwide experiments emerged. In particular, the Programme National de Synergies Inter-entreprises (PNSI), led by the Institut National de l'Économie Circulaire and piloted in Auvergne-Rhône-Alpes, Brittany, Normandy, and Nouvelle-Aquitaine, helped develop ELIPSE, a framework for evaluating ITE initiatives supported by OREE. Institutionalization continued during 2018–2020 with a change of scale and ADEME's creation of the national ITE network SYNAPSE, which brings together 308 initiatives across France, 186 of which remain active. This network provides resources—studies, reports, monitoring briefs, tools, and methodological guides—and organizes national ITE meetings. In 2020, OREE/ADEME (2020) conducted an initial assessment whose first recommendation was to continue financing Synapse and develop a form of subsidiarity with regional structures: Synapse should provide coordination complementary to, rather than duplicating, regional network coordination.

Proliferating ITE frameworks in France, but problems sustaining initiatives: Various methodological approaches—ACTIF, INEX, NISP, and others—are being implemented to encourage intercompany activity at the local level. They identify stakeholders, needs, objectives, and potential synergies. They are applied by actors such as chambers of commerce and industry, intermunicipal authorities, metropolitan authorities, and sometimes private consultants (Jambou et al., 2022), who act as facilitators to maintain lasting

engagement. However, the synergies created through these frameworks do not necessarily persist over time (Jambou et al., 2022). Assessments of initiatives' maturity highlight difficulties in ensuring continuity. In 2020, of 103 active initiatives, only fifteen had reached the consolidation stage and only two had reached "long-term sustainability." The seventeen ITE initiatives that agreed to provide this information generated €784,351 in annual economic benefits (OREE/ADEME, 2020). However, this aggregate figure conceals substantial disparities: Half the result came from one particularly mature network, approximately seven years old at the time of the analysis. Other initiatives contributed less, with benefits as low as €400 annually.

A "proliferation" of ITE ecosystems in Grand Est. Grand Est is among the regions with the most initiatives: twenty-eight, approximately 10% of the total, including twenty active initiatives, approximately 11% of all active initiatives. These initiatives generally have a high maturity level, with eight at maturity level 2 and seven at maturity level 3. They are led by diverse actors—sometimes public bodies, sometimes ad hoc associations—and address varied themes, such as wooden crates and the recovery of certain materials, including cork stoppers and epoxy waste powder.

3. Foresight exploration

3.1. Structural trends

Industrial policies directed toward the ecological and digital transitions: The public policies with by far the greatest impact on industry will be those associated with the ecological transition, foremost among them decarbonization. Electricity generation equipment, automotive, aerospace, and rail sectors will be directly affected. The digital transition, particularly but not exclusively the growing use of artificial intelligence, will also be central to productivity and industrial challenges in the coming years.

Structural trends: The institutionalization of ITE in France. Continuing to finance SYNAPSE, the national network of ITE actors, and mobilizing it to define France's future broad ITE priorities is OREE/ADEME's (2020) first recommendation. This national network is therefore intended to strengthen its coordinating role by conveying needs expressed by regional networks, organizing complementary activities, and presenting national initiatives. The institutionalization of ITE will probably continue in the coming years, particularly because it reflects an increasingly important principle of subsidiarity: The national level primarily complements and supports locally driven activity.

3.2. Uncertainties

CBAM's effects: Extension to processed products and the risk of distorted competition. Companies fear price distortions relative to non-European competitors. External markets lack a comparable mechanism, and many countries impose little or no domestic carbon tax. The imbalance between European and non-European product prices could therefore widen. This is particularly true for processed products not covered by CBAM, such as cars: Producers outside Europe will be able to continue exporting them to us at competitive prices, whereas European companies will have to raise prices to offset the adjustment mechanism. Eventually, however, CBAM is to extend to other processed goods to prevent this unintended effect. Furthermore, how will importers' carbon declarations be checked at the product level? This will be highly complex and require unprecedented global alignment.

The ability of industrial policies to support breakthrough innovation in pursuit of decarbonization and digitalization objectives.

The current pace of industrial decarbonization, approximately 1.4% annually between 2013 and 2019, is insufficient to achieve the emission-reduction targets in the National Low-Carbon Strategy (SNBC): Meeting the 2030 target requires an increase to 4% annually. Part of the target can be achieved by investing in existing technologies—electrification of processes, improved energy efficiency, and recovery of decarbonized heat—through recovery plan financing of €1.2 billion. However, maintaining industry's decarbonization trajectory

requires technological breakthroughs. The France 2030 plan provides for increased resources for this purpose, but will they be sufficient?

Questions also arise about whether industrial policies can help French industry catch up in the digital transition. Despite the policies introduced so far, such as Industrie du futur, France remains significantly behind comparable countries. Despite a high rate of investment in manufacturing, French industry's digital transition, based on exploiting data from digitalized and optimized industrial processes, has yet to begin on a large scale. Public programs for industrial digitalization have also suffered from a degree of instability.

Simplifying assistance for SMEs and intermediate-sized enterprises: The industrial base suffers from difficulties in the growth of SMEs and intermediate-sized enterprises. This weakness is linked particularly to low margins and unbalanced business relationships with most large groups. Initiatives were launched in early 2020 to develop intermediate-sized enterprises through the Nation ETI strategy. Their growth is nevertheless constrained by the persistent complexity of the assistance landscape. France Stratégie identified more than 600 business support measures, excluding those of local and regional authorities, including 468 tax measures, twenty-nine reduced rates or exemptions from TICPE, thirty-four earmarked taxes, and twenty-four reclassified tax expenditures. Simplifying these support mechanisms is a prerequisite for improving the effectiveness of public action for SMEs and intermediate-sized enterprises and is therefore a priority.

The ability to define a stable strategy and have an independent body measure its results: Public investment strategy for industry should be defined consistently and accompanied by outcome indicators. So far, it has been associated only with input indicators. The strategy's different tools also need better coordination. The multitude of aid providers and programs, together with their lack of continuity, disperses resources, exacerbates these effects, and limits the ability of support to generate lasting competitive advantages. It therefore seems necessary to reduce the number of programs and entities providing access to them and to orient the programs consistently in the right direction. To prevent certain actors from capturing public support for the technological solutions they offer, support must be overseen by collective governance that is as independent as possible and draws on diverse expertise.

Strengthening national–regional government links. A national–regional government committee was established in 2019, and a framework agreement for regional and partnership-based implementation of PIA 4 was signed in January 2021. This cooperation between the national government and local and regional authorities should be deepened. One objective could be to specialize the respective interventions of national and regional governments, making them clearer and more effective. Accordingly, the 2021–2027 European Regional Development Fund (ERDF) programming could aim to strengthen regional actions supporting competitiveness clusters, productive investment such as digitalization, and financial instruments such as regional funds.

Restoring a fully empowered Ministry of Industry. The fragmentation of responsibilities among ministries—defense, transportation, health, agriculture, energy, the environment, research, and the economy—can undermine policy coherence. Some have the resources to play an important industrial policy role successfully, for example in defense or aerospace. Others, however, are not equipped to conduct industrial policy, particularly in health. The alternative would be an administrative reorganization following the principle used in other countries: a ministry of the economy independent of the ministries responsible for finance and public accounts and also responsible, depending on the case, for energy policy, foreign trade, or research and innovation policy. In any event, the priority must be to develop essential synergies with energy and innovation policies, given their impact on industry.

Uncertainty: The ability to sustain ITE initiatives. The vast majority of initiatives receive political support from local actors, and public financing is critically important. Moreover, the most advanced initiatives generate economic benefits, but less mature initiatives do not necessarily do so. Continuity is therefore an issue: What proportion of ITE initiatives could continue if public financing disappeared? How sensitive are these initiatives to fluctuations in financing?

3.3. Seeds of change

The end of the European paradigm of complete openness to competition in favor of a more pragmatic, proactive approach: The dominant belief was that the liberal democratic model would prevail, interstate conflicts would disappear, and all states would accept limits on their economic sovereignty along European lines. The war in Ukraine marks an "industrial policy turning point" in Europe, with a return to proactive industrial policy that must rest on strong political choices taking account of renewed geopolitical competition, primarily between China and the United States. This means introducing, if not barriers, at least a principle of reciprocity: If China taxes our cars, we tax theirs (Louis Gallois, Thinkerview 2023). Today, 85% of public procurement markets are open to external competition, compared with less than 30% in the United States.

3.4. Disruptions

Toward an ambitious European industrial policy? Can the EU pursue industrial policy when its financial capacity in this area is extremely limited—1% of GDP? How can it respond to Chinese and US industrial policies? Building cutting-edge industrial capabilities is very costly. A single semiconductor plant, for example, is estimated to cost €15 billion to €20 billion. Few European states can make such investments, and deregulating competition could lead to competition among them that fragments the single market. In her 2022 State of the Union address, Commission President Ursula von der Leyen proposed a "European Sovereignty Fund" to address this problem. However, debates over the fund simply exposed the familiar divisions between northern creditor states and southern debtor states, and between France and Germany.

ITE's sustainability principles called into question. ITE's appeal lies in its ability to combine economic development and environmental concerns. The idea is to maintain a degree of economic growth while reducing the production system's consumption of materials and energy. However, closing all material flows is impossible. Developing an industrial system, even one largely based on ITE, therefore necessarily leads to the degradation of environmental resources (Brullot et al., 2017). Worsening consequences of climate change could lead to a reassessment of sustainability as promoted by ITE initiatives, which may no longer be considered relevant in the future. Given these initiatives' dependence on public support, the repercussions could be significant.

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