Industrial Policy and Development: Time for Disciplined Action*

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This essay seeks to answer one of the key paradoxes of the fourth industrial revolution (Industry 4.0) that has been unfolding since 2011: Despite the multitude of dedicated industrial policy strategies and policy interventions put in place since then, why have we not seen spectacular success? Using the US and EU industrial policy landscape, I argue that, although it will take time for the effects of Industry 4.0 to materialise, the strategy of "patience is a virtue" (respice finem) cannot be sustained indefinitely, i.e. until certain systematic industrial policy paradoxes are resolved, because only a systemic and primarily resilience-driven industrial policy can be expected to yield results.

Journal of Economic Literature (JEL) codes: O10, O25, O38, L16, L52

Keywords: Industry 4.0, industrial policy, USA, Europe

1. Introduction

In developed countries, economic history in the last 30–40 years has led economists to believe that industrial policy no longer features on the map of countries' and the world's economic governance. Nevertheless, industrial policy has long been part of the life of advanced economies, as a sort of invariable policy aspect – one way or another, even if unnamed as such – insofar as its narrative has permeated the ideological battles of the political playing field over time. The imposition of tariffs is usually seen as protectionism, i.e. an industrial policy act to boost the international competitiveness of domestically-owned companies; and when there are negative feedbacks from a competitor, it is referred to as none other than a trade war centred on industrial policy. Those who advocate the primacy of the free market, on the other hand, would have none of either.

* The papers in this issue contain the views of the authors which are not necessarily the same as the official views of the Magyar Nemzeti Bank.

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The first version of the Hungarian manuscript was received on 21 August 2023.

DOI: https://doi.org/10.33893/FER.22.4.5

The reality is that the competitive situations induced by hyper-globalisation, intensifying with each cycle, have organically generated the application of industrial policy in various forms. From a European perspective, for example, the current rise of China is very similar to what was seen in the 1970s and 1980s when the strengthening competitive position of the United States and Japan was the driving force behind a number of industrial policy interventions. After this, industrial policy was relegated to the margins of economic governance and lost its former lustre. Today, however, owing to the growing range of crisis phenomena (e.g. Covid-19, surging inflation, deteriorating productivity dynamics, gaping inequalities, demographic problems, natural disasters and climate change, shrinking fiscal space due to sovereign debt crisis, migration crisis, war, etc.), economists and economic policymakers have had to realise that harnessing the potential benefits of digitalisation and Industry 4.0[1] (*Kovács 2018*) requires strong, refocused industrial policy.

In addition to the detailed literature review, this essay is innovative in that it can help the profession to clarify the paradox of why, over more than a decade, the many dedicated industrial policy strategies and policy interventions adopted since the emergence of Industry 4.0 have not led to spectacular success. In *Section 2*, I briefly take stock of industrial policies. In *Section 3,* I then proceed to outline the industrial policy trajectories of the two major competitors, the United States and the European Union, which may help resolve the paradox. Building on their experience, *Section 4* delves deeper into industrial policy paradoxes – going beyond the available literature – without addressing them the success of any Industry 4.0-focused industrial policy is fairly doubtful. Finally, the key conclusions are discussed in *Section 5*.

2. The Balance of Industrial Policies

Two issues need to be clarified very briefly when talking about industrial policy. First, what do we know about the effectiveness of industrial policy in the light of historical economic experience? And second, in what way should a new industrial policy differ from the old one? Regarding the first question, the sobering fact is that the message of past empirical analyses is very mixed (*Criscuolo et al. 2019*). It seems that almost everyone can find their own narrative, i.e. there are many studies arguing for the success of industrial policy, but there are just as many papers claiming that such policy can actually distort competition policy which is aimed to promote consumer welfare (*Aiginger – Rodrik 2020*). In a nutshell, given the

[1] Industry 4.0 is a new manufacturing philosophy and way of functioning based on the Internet of Things (IoT) where smart factories are set up by connecting and integrating resources, machines and even logistics systems into a cyber-physical system, creating independent and self-optimising local production processes.

imperfect functioning of the market, various economic administrations in various eras have made use of interventions to further structural change (e.g. from an agrarian economy to a more advanced industrial economy, such as South Korea, Taiwan, Ghana, Nigeria, or Finland, for example, which is dominated by modern services and characterised by a transition to a knowledge-based economy that produces higher added value). There are many documented success stories, but also plenty stories of failure. Since structural change is a qualitative transformation and therefore involves change in many processes, it should come as no surprise that there is no and cannot be a universal definition of industrial policy for all ages, as is also suggested by *Éva Voszka* (*2019*) in her article.

Undoubtedly, even today, there are publications with the premeditated intent of pointing out the uselessness of industrial policy. However, for professionals who are more aware of the nuances and the socio-economic realities, the question is not "*Is it necessary?"* but rather "*How should we implement it?"* (*Juhász et al. 2023*). As for the how, it is a matter of what can (and should) be done differently from the old industrial policy approach. Earlier industrial policy approach was essentially top-down, focused on selected sectors, sought to protect the domestic market with a touch of nationalism, and was deeply imbued with an assumption of honesty, competence, the feasibility of quality implementation, and that solutions had in fact been already recognised elsewhere (typical of Taiwan or South Korea).

By contrast, the new approach to industrial policy dismisses these naive assumptions, abandons the belief in the omnipotence of the state, and, focusing on general-purpose technologies, upholds the principle of neutrality with regard to interventions, and, as such, is embedded in the modern development policy approach, accompanied, of course, by hidden market protection mechanisms[2] (*Szalavetz 2015*). However, it believes in the power of institutional planning, i.e. it does not seek to pick up the winners or pursue classical objectives (technology, innovation, R&D, export promotion, etc.), but focuses on the retention and creation of "good and productive jobs", also citing the paradigm of quality growth. In other words, the new industrial policy focuses on one aspect of subjective well-being, i.e. job satisfaction, the real creation of jobs that enable us to tap our potential through work while being beneficial for productivity dynamics. *Vasvári et al.* (*2019*) point out that industrial policy should also focus on enhancing learning ability, that is, it should prioritise industries where domestic actors can learn more and better things.[3] In what follows, I will look at the United States and Europe to see whether their industrial policy gradients point in this direction.

[2] E.g. environmental regulations, standards.
[3] For more on this in the European dimension, see *Mazzucato et al.* (*2015*).

3. Industrial Policy Panorama: The USA and Europe

What industrial policy in the United States and the European Union have in common is that in recent decades they have both become increasingly sharp, coordinated and holistic in the sense that they are designed to serve socio-economic development and competitiveness in general, embedded, if you like, in a more macro-conscious innovation strategy.[4]

3.1. The USA: The Practice of a Furtive and Increasingly Direct Industrial Policy

Previous US industrial policies were not particularly in the limelight, since their primary focus was on the defence sector (e.g. supporting technological development of interest to the Pentagon), while the dimension of civilian life and everyday industrial activities was long treated as taboo. The Cold War period and the fear of competitors eventually led to industrial policy playing a growing role in US economic governance with some creeping normality, and the USA has now become the home of the largest industrial policy programmes in the world.

The US professional discourse of the 1980s began to be dominated by the articulation of the need for a more strategic and coordinated industrial policy (*McKay 1983*). All this was due to declining (industrial) productivity (relative to major competitors such as France and Japan) and, through this, fading growth dynamics. In fact, it was nothing more than a forced acknowledgement of the cyclical nature of technological progress and policy considerations to facilitate the shift to a new stage of technological development, since by the 1980s it had become clear that technological modernisation and the change of direction called for state intervention (*Solo 1984*). One of the side effects of the restructuring power of the information and communications technology (ICT) revolution at the beginning of the installation phase in the 1980s was the inherent deindustrialisation of the service sector as the ICT revolution brought it up to speed.[5] To counteract this, industrial policy considerations had to be taken into account to bring about a renaissance of industry. Also, it was good to be aware of the impact that the development policies in competitor countries had on trade, and to shape industrial policy accordingly.[6] One of the central elements of US industrial policy – beyond the fact that military-based industrial policy has been the main factor determining the development trajectory of US capitalism for at least a century – was, and continues to be, the support of small and medium-sized, often young enterprises (e.g. the *Advanced*

[4] By the end of the 1990s, US and European industrial policy, which was more of an innovation policy considering its real content, had begun to converge. See: *Gulbrandsen and Etzkowitz* (*1999*).
[5] *Nagy et al.* (*2019*) or *Boda et al.* (*2023*) contrast the trend of deindustrialisation in Western Europe with the reindustrialisation observed in some countries of Central and Eastern Europe.
[6] Developments in Japan's industrial policy and science and technology policy have affected US global trade opportunities in many ways. See: *Audretsch and Yamawaki* (*1988*).

Technology Program and the *Manufacturing Extension Partnership* programme), as they innovate and create jobs much faster and more often than large firms (*Hayden et al. 1985:387*). It did so primarily through selective enterprise policies to strengthen economic resilience (e.g. selecting and subsidising certain companies to mitigate global energy challenges – which have gone down in the history of US industrial policy as failures rather than success[7]), and through technology support programmes aimed at commercialisation (e.g. the ARPANET programme, which later became the basis for the Internet, etc.). It undertook all of this while still having a significant share of policy objectives that did not encourage the spirit of competition in innovation but, rather, had the effect of restraining it, e.g. through forced job creation, the forging of domestic business coalitions, and the promotion of global industrial alliances (*Fong 2000*). Meanwhile, the nature of the innovation ecosystem in a hyper-globalised world economy had obviously changed – in a service-dominated, ICT-based knowledge economy, innovations[8] were harder to protect than before – and it proved easier to enter the market as a follower, finding a way to improve efficiency and profitability through incremental improvements. Moreover, with the advance of ICT and the rise of network industries, the spatial decentralisation of production intensified, undermining the number one argument against industrial policy that as a consequence of the US federal institutional architecture, industrial policy would lead to inhospitable relations (*Schrank – Whitford 2009*). Many initiatives were taken in the decentralised system (e.g. export incentives independent of industry and company size; the individual states, nonetheless, competed with each other to attract a wide variety of innovative and, in terms of technology, promising businesses and the highly skilled, young and agile workforce they needed), but the stranglehold of high-tech industries and the US military industry never fully weakened.[9] Therefore, by the 1990s, US industrial policy had changed its "instrumentation". The previous mission of supporting innovators with innovations that bring global and national productivity and create jobs was replaced by a philosophy and policy of promoting diffusion, shifting the focus from innovators to developing the ability to adopt and adapt and other capacities needed to do so.

From the 2000s onwards, energy technology initiatives were also put on the agenda, with the organisational background undergoing significant changes (the Department of Energy became an innovation and technology organisation into which the Advanced Research Projects Agency – ARPA-E – and several other energy

[7] See: *Hufbauer and Jung* (*2021*).
[8] See *Kovács* (*2011*) on the characteristics of service innovations, or *Tengely* (*2020*) on the additional expansion of services in the manufacturing industry.
[9] Fiscal incentives were used by many to attract foreign manufacturers (KIA, Volkswagen, Honda, Toyota), building on the continued dominance of the car industry, while Silicon Valley also developed, the labour drain effect of which is now well known.

efficiency agencies have been incorporated). Work was helped by a group of Tech-to-Market Advisors to support promising projects even in times of crisis (this is how Tesla, for example, avoided bankruptcy and became today's leading electric car manufacturer). The 2010s were marked by a firm move towards advanced manufacturing technology. This was also spurred by China's relentless advance as a dangerous competitor, and that after decades of double-digit growth, it wished to remain a dominant economic force in the world through its industrial policy.[10] In addition, the concept of Industry 4.0 popped up in more and more places. Major industrial policy programmes were launched focusing on semiconductor manufacturing, critical technology development, energy demonstration projects, the reinforcement of domestic supply chains in critical areas, and stepping up domestic vaccine development and production. These programmes required new support infrastructures, including the establishment of 16 manufacturing innovation institutes, which were more or less structured around the various subtechnologies of Industry 4.0 (e.g. additive manufacturing, robotics, etc.). A multidisciplinary and essentially organic approach involving a wide range of stakeholders (small and large manufacturers, universities, government players) came to be dominant, with industry, state, regional and federal government funding (e.g. the 2022 Inflation Reduction Act,[11] or the unprecedented USD 53 billion incentive programme for the semiconductor industry – CHIPS). The driving force behind this was the industrial policy panacea that many believe ensured the success of Covid-19 vaccine development, Operation Warp Speed (OWS). The OWS was a public-private partnership initiated by the US government to facilitate and accelerate the development, production and marketing of vaccines, therapies and diagnostics against Covid-19. Indeed, the literature indicates that it supported the development of many successful vaccines, but the reality is that it did not help and *even hindered* the development of the most effective one (Pfizer) (*Lincicome – Zhu 2021*). That said, the industrial policy horizon also changed, with more emphasis put on creating a new talent base,[12] facilitating the integration of research relations, developing solid manufacturing bases and supply chains, modernising technology certifications, enabling more flexible conditions for contracting, expanding funding sources and further exploiting the potential of government purchases. What we see, then, is that in addition to pursuing the principles of strategic autonomy (e.g. energy independence) and economic efficiency (e.g. boosting industrial productivity), US industrial policy today also embraces the global decarbonisation mission. There

[10] On the advance of China, see *Balogh* (*2017*), and for an overview of Chinese industrial policy, see *Szunomár* (*2020*).
[11] The Inflation Reduction Act of August 2022 is an industrial policy tool in disguise, as it seeks to boost industrial productivity by tackling climate change.
[12] The *IMD World Talent Report* rankings since 2019 show that the US slipped from 12th place in 2019 to 16th in 2022 (it is no longer as outstanding at developing, retaining and attracting talent, and the available skills and competencies are not up to the level required by the challenges of the times).

is still plenty of work to be done, and more and more targets need to be set, as, according to authoritative surveys, from the early 2020s, the US started to lose ground to China on the technology front.[13]

3.2. The European Union: Towards an Industrial Policy Driven by Resilience

In a certain sense, industrial policy in Europe is also characterised by a kind of "stealth mode", but unlike in the United States, there is no sign of a serious, coordinated industrial policy, not even in the defence sector.[14] The Treaty of Rome made no reference to industrial policy at the Community level, and by no accident: it proclaimed the principle of neutrality and the non-distortion of competition. However, under Article 92, it is possible if it is targeted, specific, has a temporary effect and facilitates a more successful adaptation to a changed environment. Taking into account the most general definition of industrial policy, i.e. the facilitation of structural change, this immediately provides the basis for the evolution of industrial policy which, in the EU today, is primarily aimed at strengthening systemic *resilience* through structural change.

By the 1970s, the unprecedented competitiveness gains of Japan – also mentioned in the context of the United States – were a regular feature of Western European policy discourse, and many attributed this to the closer relationship between state and industry. This is why industrial policy became a focus of attention. Japan was already explicitly mentioned in the Memorandum of 1967, and the aim of Community industrial policy was stated as being to enable industry to contribute as much as possible to improving overall productivity, maintaining a high level of employment and strengthening the international competitiveness of enterprises by means of measures which, on the one hand, facilitate adaptation to changing economic and technical conditions and, on the other, do not distort competition within the common market.[15] It is no coincidence that the issue of joining the techno-economic paradigmatic shift (ICT-based knowledge economy dominated by the service sector) that started in the early 1970s was also put on the agenda (*Perez 2010*).[16] Nevertheless, until the Maastricht Treaty, the policy landscape was dominated by Member States' "maverick" policies, which furthered the differentiation of integration rather than improved competitiveness at the Community level. In 1985, Karl-Heinz Narjes, Commissioner for the Internal Market,

[13] For example, in terms of the so-called Hamilton Index, which measures international competitiveness in advanced manufacturing, we see that the overall global market share of the United States in advanced industries has fallen to 6 per cent under the global average since 1995, while China's share in advanced industries is 34 per cent higher than the global average (*Atkinson 2022*).

[14] All the more so because we have only been able to talk about a common security and defence policy since 2009.

[15] See: *Mémorandum sur la politique industrielle de la Communauté = Memorandum on Community industrial policy*. SEC (67) 1201 final, 4 July 1967.

[16] On the relationship between the transition to a knowledge economy and intellectual property, see *Csath* (*2023*).

the Customs Union, Industrial Innovation, the Environment, Consumer Protection and Nuclear Safety, specifically pointed out that – despite the aid schemes of unprecedented magnitude which dedicated millions of euros to stimulating industrial projects and business development – only an ever-longer agony of uncompetitive zombie firms was achieved, as these could survive on the market thanks to the aid provided. Therefore, no innovation dynamism and productivity explosion induced by organic development occurred. Even the Single European Act of 1986 has no industrial policy mentioned. The "point of inflection" came with the Maastricht Treaty in the early 1990s, after which the restoration and cultivation of industrial competitiveness at EU level became an explicit Community objective. According to Article 173 of the Treaty, the EU's industrial policy is aimed at encouraging an environment that enables the adjustment of industry to structural changes and is favourable to SMEs by looking more closely at the aspects of general policies of innovation, research and development that are relevant to industry. Contrary to the USA, Europe could then start to converge on all common policies affecting industrial activities.[17]

Since the dawn of the new millennium, both Member States and the EU have become increasingly active in developing industrial policy. Sectoral (vertical) interventions were replaced by more targeted horizontal measures. This was mainly due to globalisation, EU enlargements, deindustrialisation, and unfavourable and sometimes anaemic growth and productivity rates which fell short of those of major competitors, such as the United States (e.g. one of the most important core integration countries, Germany, had negative real GDP growth in 2002 and 2003, and France also recorded virtually stagnant growth of only 0.8 per cent in 2003). In fact, by the mid-2000s the European Commission had come up with an integrated industrial policy at the EU level.[18] This 2005 strategy reflected on horizontal issues, accepting and building on sectoral specificities with the already well-known aim of improving the framework conditions for industrial development and policy coherence in a proactive manner.[19] The coordination exercise was

[17] This was a task set out in the 1993 White Paper *Growth, Competitiveness, Employment: The Challenges and the Ways Forward into the 21st Century. {COM(93) 700}*. https://op.europa.eu/en/publication-detail/-/publication/4e6ecfb6-471e-4108-9c7d-90cb1c3096af/language-en

[18] "*Industrial policy in an enlarged Europe*" *{COM(2002) 714}*. https://eur-lex.europa.eu/EN/legal-content/summary/industrial-policy-in-an-enlarged-europe.html; "*Some Key Issues for Europe's Competitiveness – Towards an Integrated Approach*" *{COM(2003) 704}*. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2003:0704:FIN:en:PDF; "*Fostering structural change: an industrial policy for an enlarged Europe*" *{COM(2004) 274}*. https://eur-lex.europa.eu/EN/legal-content/summary/fostering-structural-change-an-industrial-policy-for-an-enlarged-europe.html; "*Implementing the Community Lisbon Programme: A policy framework to strengthen EU manufacturing – towards a more integrated approach for industrial policy*" *{COM(2005) 474}*. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2005:0474:FIN:en:PDF

[19] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions – "*i2010 – A European Information Society for growth and employment*" *{SEC(2005) 717}*. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52005DC0229. Downloaded: 7 September 2023.

necessary, but by no means sufficient.[20] The global financial and economic crisis of 2008 and its aftermath played a key role in governments allocating financial resources to support industry. Seeing that after the 2008 crisis the USA (*America First*), China (*Made in China 2025*) or India (*Make in India*) became determined to modernise industry through more direct state intervention, the EU also took increasingly decisive steps towards a more dedicated industrial policy. In order to maximise the impact of industrial policy, since 2008 the policy agenda has shifted to a more favourable entrepreneurial environment. A comprehensive *Small Business Act* (SBA) was launched, which drew heavily on good practice from abroad (e.g. the subobjective of giving failed businesses the chance to try again as soon as possible followed the Israeli model). To put the principles of the SBA into practice, the *Entrepreneurship 2020 Action Plan*[21] was drawn up in 2013 to reignite the entrepreneurial spirit in Europe, building on three pillars – entrepreneurial education and training; creating an environment where entrepreneurs can flourish and grow; and role models and reaching out to special groups – to act as a blueprint for improving the potential of industrial policy. All of this indicated that the EU was ready to join the reindustrialisation frenzy to tap the potential of Industry 4.0 that started in 2011. One of the flagship industrial policy programmes was *Smart Specialisation* launched in 2011 to close the innovation gap by integrating Industry 4.0 technologies into manufacturing. The European Commission spoke of the real advent of the European industrial renaissance.[22] Although the programme was a step forward, it failed to address the structural asymmetries that dominated the continent: rather, it was only able to catalyse the industrial development of the more developed regions where the conditions for specialisation were already in place, while the less developed regions continued to lag behind.[23] And all along the EU stressed in several of its communications that industry had to be strengthened to boost competitiveness, and it required intervention in a number of areas (e.g. better market conditions, improved human capital, completion of the single market, etc.).[24] This type of industrial policy, even if it benefited from significant budgetary resources (e.g. the *Competitiveness and Innovation Framework Programme 2007–2013* or the framework programme to support SMEs between

[20] See: *Korres (2007*). For example, the lack of a techno-economic paradigmatic shift is sometimes explained by the feebleness of industrial policy (for the Italian example, see *Lucchese et al. 2016*), sometimes by its absence (for the Portuguese case, see *Godinho and Mamede 2016*).

[21] https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/entrepreneurship-2020-action-plan. Downloaded: 7 September 2023

[22] *For a European Industrial Renaissance*. COM/2014/014. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52014DC0014

[23] See: *Wigger (2023*). Moreover, the results of the various convergence studies also tend to point in the direction of an opening gap between the developed world and the other regions. For a discussion of the latter, see *Gergics* (*2023*).

[24] *Industrial policy: Reinforcing competitiveness*. COM(2011) 642. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0642&from=EN; *A Stronger European Industry for Growth and Recovery*. COM(2012) 582. https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0582:FIN:EN:PDF

2014 and 2020), tended to reinforce a pattern of differentiated integration, despite the best intentions. This is depressing also because the reason for the persistently worsening productivity growth trend in both the USA and the EU is not the nature of the industrial structure, which was roughly similar (*Sayed – Gordon 2019*), but rather a difference in the pace of technological change (contrary to the USA, the EU lacks the greater capacity for the diffusion of new technologies across sectors and company sizes). This implies that European industrial policy had not for a long time sought to create real interactions between the different spheres; instead, it had pursued more specific and measurable (economic) objectives one by one. Especially in the era of Industry 4.0, such an approach is needed, which is not merely focused on the return on investment.

Industrial policy ideas and strategies organised around Industry 4.0 at the supranational level have thus been largely in place in Europe since the early 2010s, while at the Member State level, only the period 2016–2019 was fruitful in this respect.[25] Strategies and programmes at the EU level, such as the 2015 *Digital Single Market Strategy,*[26] can help boost industrial competitiveness by increasing investment in ICT infrastructure and Industry 4.0 subtechnologies (e.g. cloud services, Big Data technologies) and R&D. Launched in 2016, the *Digitising European Industry Initiative*[27] has brought a sector-neutral edge to industrial policy with the objective of overall digitalisation. This is no longer just about the nearly 2 million companies in the industrial sector – which employ nearly 33 million people – but about the roughly 26 million active enterprises across the EU which employ more than 144 million people. The Communication "*Investing in a smart, innovative and sustainable Industry: A renewed EU Industrial Policy Strategy"*[28] published in 2017 was one of the first to go beyond the need to reindustrialise and to address the changes that the EU will have to face in the context of increased digitalisation and the transition to a low-carbon and circular economy. These are additional dimensions that can be addressed through Industry 4.0, and not simply a matter of progressing towards improved productivity.[29] In addition, the *Smart Specialisation Strategy* (S3) is expected to have a beneficial impact in the period 2021–2027 in that it may boost innovation-led growth in EU regions affected by

[25] Most of the programmes started between 2016 and 2019: Belgium *(Made Different*); Denmark *(Manufacturing Academy of Denmark*); France *(Industrie du Futur*); Germany *(Deutschland: Industrie 4.0*); Italy *(Impresa 4.0*); the Netherlands *(Smart Industry*); Portugal *(Indústria 4.0*); Spain *(Industria Conectada 4.0*); Czechia (*Průmysl 4.0*); Hungary *(Ipar 4.0 – National Technology Platform*); Poland *(Morawiecki Plan – Future Industry Platform*); Slovakia *(Smart Industry Platform*), etc.

[26] *Digital Single Market Strategy for Europe*. COM(2015) 192. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52015DC0192. Downloaded: 7 September 2023.

[27] https://digital-strategy.ec.europa.eu/en/library/digitising-european-industry-initiative-nutshell. Downloaded: 7 September 2023

[28] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52017DC0479&from=EN

[29] It is not simply a matter of considering the cost-price coordinate system of competitiveness *(Wigger – Horn 2018*). *Pianta et al. (2020*) also argued for the inevitability of a broader European industrial policy. For the circular economy, see *Baral et al. (2023*), and for the green economy transition, see *Javaid et al.* (*2022*).

industrial transformation, integrate regional economies into European value chains, and promote green innovation processes that respond to global environmental challenges in line with the UN Sustainable Development Goals, and should include the whole spectrum of European industry. To this end, in early February 2023, the Commission presented the *Green Deal Industrial Plan,*[30] a programme for the development of a net-zero industry (capable of producing clean technologies and environmentally friendly products). Such technologies used by industry will improve the EU's industrial competitiveness, the continent's strategic energy autonomy and the resilience of its entire energy system, while enabling the transition to clean energy (a compelling necessity brought about by the Russia-Ukraine war). The 2022 *REPowerEU*[31] plan also supports the achievement of these goals. In an effort to speed up access to finance, the *InvestEU*[32] programme also runs in the background, aiming to generate a EUR 372 billion investment wave by 2027.[33] The EU has therefore, albeit slowly, reached a point where more than a decade after the emergence of Industry 4.0, it surpassed itself in the sense that it no longer takes different, inconsistent industrial policy actions, but seeks to pursue a broader industrial policy in a more comprehensive and consistent policy framework, adapted to the challenges of our time.

4. Industrial Policy Paradoxes

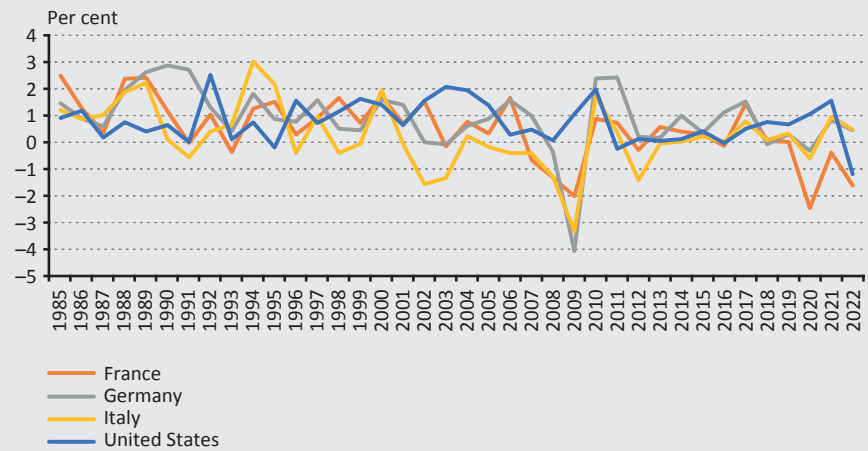
The above shows that both the USA and the European Union have been directing their industrial policies towards Industry 4.0 (and beyond) for almost a decade now. Yet at least three major industrial policy and Industry 4.0 development paradoxes can be detected, along the following lines: (i) the nature of Industry 4.0 and economic growth; (ii) industrial policy and institutional constellation; and (iii) industrial policy and fiscal policy. These paradoxes should not be ignored, if only because their existence sends a message that serious problems can arise if the state is not vigilant. Let us note that this is in fact no different from what Károly Polányi long ago explored in his pioneering work (*Polányi 1944*|*2001*), namely that technological development can be accompanied by serious socio-economic upheaval, and that countervailing mechanisms need to be worked out, and paradoxes need to be dealt with in a disciplined way. Obviously, this implicitly

[30] *A Green Deal Industrial Plan for the Net-Zero Age*. COM(2023) 62. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0062. Downloaded: 7 September 2023.
[31] https://investeu.europa.eu/investeu-and-repowereu_en. Downloaded: 7 September 2023.
[32] See: https://investeu.europa.eu/investeu-programme_en. Downloaded: 7 September 2023.
[33] However, for example, the second pillar of Horizon Europe *(Global Challenges and European Industrial Competitiveness*) will account for three quarters of SMEs' total share and two thirds of all EU contributions to SMEs between 2021 and 2022, representing around EUR 1.9 billion in support for SMEs. *Horizon Europe implementation – Key data for 2021–2022*. https://www.horizontevropa.cz/files_public/elfinder/4182/Horizon%20Europe%20Implementation%202021-2022%20-%20Key%20figures%20v2.pdf

means that the state also needs to improve its own innovativeness, as *Kovács* (*2023*) argues.

First, since 2011, we all expected[34] that the industrial revolution would ultimately lead to higher, greener and more inclusive economic growth, but none of these things have happened. The secularly deteriorating trend in productivity growth rates has not been reversed since 2011 and set on an upward path, neither in the EU core countries nor in the USA. The total factor productivity of even the most productive manufacturing firms is also on a downward path (*Figure 1*).[35]

Figure 1
Evolution of multifactor productivity for the USA and some selected EU core countries between 1985–2022



Source: OECD.Stat

According to a very important finding of *Tibor Erdős* (*2006*), an internationally renowned researcher of the nature of economic growth, (qualitative) change in the structure of production is continuous: it is sometimes faster, sometimes slower, and sometimes really spectacular. The latter is an era of techno-economic paradigmatic shift, including the ongoing Industry 4.0 and digitalisation. Erdős concludes that new industries can expect a rapidly expanding market because labour demand is rising at a quick pace and wages can be relatively high, which in turn requires accelerated

[34] The term Industry 4.0 was first used at the 2011 Hannover Industrial Technology Fair.
[35] See: https://www.hcamag.com/us/specialization/employee-engagement/worker-productivity-now-at-lowest-in-75-years-report/445147. Downloaded: 7 September 2023. Whether we look at manufacturing or the broader industrial sector, in the European Union we see that the periodic percentage change in hourly real labour productivity shows a downward trend over the period 1995–2022. See: *Eurostat (NAMA_10_LP_A21*).

technical development. By contrast, the reality reflected in productivity statistics is that the use and diffusion of Industry 4.0 has not yet reached a level that would allow the rehabilitation of productivity dynamics. In their analysis of 300,000 US firms, *Acemoglu et al.* (*2023*) found that about half of the US firms in the sample did not use any Industry 4.0-related technology between 2016 and 2018, but the FDI and Covid-19-focused analysis by *Kalotay and Sass* (*2021*), for example, also points to a slowdown in Europe, including the Visegrad countries.

In the context of green growth, it is important to recognise that since Industry 4.0 set out to conquer the world in 2011, greenhouse gas emissions have stagnated, with a moderate decline in EU core countries starting in 2019, in sync with the economic slowdown caused by Covid-19 (*Campos – Macchiarelli 2021*). The illusory nature of greening expectations is confirmed by the fact that primary energy consumption (in million tonnes of oil equivalent) is stagnating in both the USA and the EU core countries. Moreover, greenhouse gas emissions from industrial processes also fail to show any significant reduction.[36] Nor has there been any notable progress on the dimension of inclusiveness. If we only take the OECD definition of inclusive growth as economic growth that is evenly distributed across society and offers opportunities for all to make a value-creating and valuable contribution, we see that inequality in most OECD countries is at its highest in 30 years and has been exacerbated by the Covid-19 crisis. Wealth inequality is systematically increasing. Based on the last data for the 2010 decade (see *Table 1*), approximately 80 per cent of the total wealth held by US households was owned by the richest 10 per cent of households. The European figures are lower, but in many cases they are still above the OECD average (52 per cent) (Germany: 55 per cent, Denmark: 62 per cent, Austria: 56 per cent, the Netherlands: 63 per cent, etc.).

[36] *European Union emission inventory report 1990–2021*. EEA Report No 4/2023. https://www.eea.europa.eu/publications/european-union-emissions-inventory-report-1990-2021/download

Table 1
The share of certain groups in the total net wealth of households (2017 or last data for the 2010 decade, OECD countries)

	Bottom 20% (%)	Bottom 40% (%)	Top 10% (%)	Top 5% (%)	Top 1% (%)
Australia**	0	4	49	35	16
Austria	0	1	56	43	23
Belgium	0	4	47	35	16
Canada***	0	3	51	37	18
Denmark***	–7	–7	62	46	23
Estonia	0	3	58	45	25
Finland*	–1	2	47	33	14
France	0	2	49	36	17
Germany	–1	1	55	41	19
Greece**	–1	4	41	27	9
Hungary	1	5	51	39	20
Ireland**	0	3	50	36	15
Italy*	0	5	43	30	12
Japan***	–2	1	47	33	13
Latvia	0	3	52	39	19
Lithuania*	2	9	48	36	15
Luxembourg**	0	4	50	38	20
The Netherlands***	–3	–2	63	49	27
Norway**	–4	–3	54	41	23
Poland*	1	8	41	30	14
Portugal**	0	4	54	42	23
Slovak Republic	2	9	41	29	12
Slovenia	0	6	44	32	15
Spain**	0	4	53	40	20
United Kingdom	0	4	52	40	23
United States***	–1	0	79	68	40
OECD**	–1	3	52	38	19

*Note: Net wealth refers to financial and non-financial assets minus liabilities held by private households. * 2016, ** 2018 and *** 2019.*

Source: OECD Wealth Distribution Database (WDD) (https://www.oecd.org/els/soc/WDD-Key-Indicators.xlsx)

The widening gap further erodes trust in that it restrains and prevents social mobility. Currently, it takes roughly 5 generations until a child born into a low-income family in the USA can ascend to the middle class, but EU countries are not doing any better.[37] Those in the lowest income quintile or the highest income quintile of the working-age population were unable to change their position for four years. If we add to this that the advances in Industry 4.0 technologies, especially automation, are accompanied by a reduction in the employed workforce (*Acemoglu et al. 2023*), we can say that deteriorating inclusiveness is a concomitant of the socio-economic innovation ecosystem of our time, which can inflict severe wounds on political stability, aiding the rise of populism (*Gozgor 2022*).

Second, the experience of the USA and the EU highlights that it does matter what institutional architecture industrial policy is embedded in. Our thesis on the paradoxical situation of the United States can be summarised as follows: despite the apparent obstacles posed by the US institutional structure (federalism), it is a hotbed of industrial policy learning and thus a foundation for innovation dynamism; on the other hand, it is also a background mechanism causing social inequalities in the longer term. It is true that the formal institutional architecture of the United States, one of the most decentralised economies, in principle makes any form of national industrial policy fragmented and therefore difficult to coordinate, so a high degree of decentralisation and industrial policy are therefore, theoretically, on quite unfriendly terms. A high degree of decentralisation, on the other hand, enables more experimentation in tackling certain challenges at the local level, the lessons of which can be shared (parallel learning) for faster and more efficient knowledge diffusion, which in turn is beneficial for innovation dynamics and the common good. The innovation dynamics generated by such an institutional constellation may lead to the reinforcement of one of the specific features of capitalism, namely income and wealth inequalities which could undermine social confidence in economic governance, including the effectiveness of industrial policy, and thus give rise to political instability. Compared to Europe, which tends to stagnate or improve in terms of income inequality, US statistics show an almost continuous deterioration (e.g. the Gini coefficient was 35.2 in 1980, 40.2 during the 2008 crisis, and 41.5 in 2019 at the onset of the Covid-19 crisis compared to an average of 31.6 in 1990, 30.4 in 2008, and 29.9 in 2019 for the European core countries of Austria, Belgium, the Netherlands and Germany).[38] Thus, the EU pays the price for its socio-economic and institutional configuration in which its welfare system ensures lower income and wealth inequality relative to the USA with falling behind in the technology competition, innovation dynamics that are worse

[37] E.g. Austria (5), Germany (6), France (6), etc. (*OECD 2018*).
[38] World Bank data, or *Milanovic* (*2018*).

than its competitors' and its diverging productivity.[39] It is therefore not surprising that the experience of comprehensive or regional EU projects related to Industry 4.0 is that the level of adoption of Industry 4.0 technologies is still modest.[40] Nonetheless, the EU also shows a high degree of heterogeneity in industrial policy, and it is not possible, nor even necessary, to think in terms of a single industrial policy concept.[41] The institutional architectures of the EU Member States show a heterogeneous picture: the highest degree of (federal) decentralisation is found in Belgium, Germany and Spain; they are followed by Finland, Italy and Austria, where the institutional setup is more unitary or quasi-federal, even though the degree of decentralisation is also remarkable; then come Denmark and Sweden with a medium degree of decentralisation; and then the countries with an increasingly centralised institutional architecture: Czechia, Poland, Croatia, Portugal, France, the Netherlands, Hungary, Greece, Slovakia and Romania.[42] Despite a series of national but rather uncoordinated industrial policy programmes in the Member States, there is a very telling divide with regard to Industry 4.0. *Castelo-Branco et al.* (*2023*) showed that when looking at only three aspects (Industry 4.0 infrastructure; Industry 4.0 applications; Big Data analytics), Denmark, Finland, the Netherlands and Sweden stand out from the EU average in the first two areas, while in Big Data analytics, France and Luxembourg also perform above the EU average, while the rest of the EU is well below the EU average, despite their more centralised institutional systems (e.g. Bulgaria, Hungary and Greece). This suggests that *progress in Industry 4.0 is greater where industrial policy is run in an institutional constellation that is more supportive of learning capacity, and where the focus of industrial policy is not only on increasing productivity but also on achieving more inclusive and greener quality growth*.[43] A conclusion similar to that of *Johnson and Acemoglu* (*2023*) can be drawn, namely that progress is most dramatic where there has been a conscious effort to distribute the gains from technological progress more equitably. This leads us to the area of good governance, the possibility of which is influenced by the question of how well the formal institutions (reviewed above) are in harmony with the informal institutions (culture, norms, etc.). Undoubtedly, this harmony takes

[39] For example, the combination of social transfers and income taxes reduces the Gini coefficient by just over 20 per cent. See: *Fischer – Strauss (2021*).

[40] See the experience of the 4STEPS project that run from 2019 to 2022: https://programme2014-20.interreg-central.eu/Content.Node/4STEPS.html. Downloaded: 7 September 2023.

[41] *Domonkos and Kovács (forthcoming*) use economic history to point out that the FDI-dependent and labour-constrained growth model for the Visegrad countries offers the prospect of uncertain reindustrialisation, as decisions on Industry 4.0 development projects in these countries are more likely to be made abroad. But even after German reunification, there was still a significant degree of path dependency (*Kovács – Orosz 2011*) in the EU's growth engine economy where it is also not possible to pursue a homogeneous industrial policy, as most of the so-called hidden champions (mostly medium-sized family businesses which are front-runners in their respective segments in Europe) are concentrated in West German regions (*Simon 2022*).

[42] European Commission, *Division of Powers* database: https://portal.cor.europa.eu/divisionpowers/Pages/Decentralization-Index.aspx#. Downloaded: 7 September 2023.

[43] *Tagliapietra and Veugelers* (*2020*) show, through the case of Denmark, the Netherlands or Sweden, that an industrial policy with a green focus requires the involvement of a wide range of actors of society, and thus catalyses more inclusive development.

a long time to develop, and any major change that disrupts it (e.g. technological progress through Industry 4.0) can only hint at slower progress.[44]

Thirdly, the case of the USA and the EU highlights another contradiction, namely that industrial policy efforts have not been able to deliver breakthrough results, not even in an era of abundant liquidity and cheap capital. But it also suggests that, as Industry 4.0 development projects require significant initial investment – which only large companies can afford – the fiscal policy of the state must also line up behind industrial policy in order to promote the spread of Industry 4.0.[45] The OECD trend is for the cost of capital to fall (lower corporate tax burden, lower interest rate trend), yet the business investment rate followed an almost stagnant trend between 2000 and 2020 (*Hanappi et al. 2023*). The state therefore has (or has had) to compensate for the capital projects and the aid granted for them which has (or has had) the effect of overburdening public finances. The average debt ratio of OECD countries rose from 69.2 per cent in the early 2010s to 89.2 per cent in 2021, while the average debt ratio of the United States doubled between 2000 and 2022 (from 72 per cent in 2000 to 144 per cent in 2022), while the average debt ratio of the European Union climbed from 66.4 per cent in 2000 to 84 per cent at the end of 2022. One could say that in the developed part of the world economy, it is not necessarily public debt that is to be feared today (but rather political ambitions that use debt for one purpose or another, as such decisions may worsen the fiscal stress tolerance of foreign investors); nevertheless, reasonable steps should be taken to alleviate the excessive burden carried by the state for it to be able to support the transition to Industry 4.0 in a sustainable way.[46] The latter, however, suggests a systemic problem, namely that the financial system has more or less ceased to play its role as an effective intermediary for the real economy (for example, in the context of the Industry 4.0 mission). Therefore, in order to develop an industrial policy, the state must also do something about the financial system because what we thought was the immune system of the economy through the work of Nobel Prize winners *Ben S. Bernanke, Douglas W. Diamond* and *Philip H. Dybvig* (see

[44] Informal institutions also have a role to play in the roll-out of Industry 4.0. As *William F. Ogburn* (*1922|1964*) warned in his classic work, culture resists change.

[45] The durability of the current bloated inflation induced by the post-Covid era and war is doubtful, so a period of low interest rates could re-emerge (*Blanchard 2023*); moreover, the relative room for manoeuvre for fiscal policy could retain its focus on climate change, on moving towards the sustainable development of economies, also because, for example, in developed economies, debt growth has so far had no impact on inflation expectations. On the latter, see: *Brandao-Marques et al.* (*2023*). The various debt trajectory studies also tend to predict manageable or even declining trends (*Baksay – P. Kiss 2023*).

[46] Between 2019 and 2021, OECD countries still did not spend much (around 3 per cent of total industrial policy support and tax incentives) on promoting the digital transition (a corollary of Industry 4.0). See: *OECD* (*2023*).

Világi 2023), turns out to be more of an autoimmune system today.[47] This essay can only superficially suggest that the harmony between the financial system and the real economy has been broken to the extent that investors have increasingly turned away from riskier and longer-term real economic investment projects; and therefore the old ordoliberal view that industrial policy can only work as long as its application can improve the conditions of competition; as long as it can adjust the price mechanism so that prices better reflect scarcity; and as long as the system is willing to make investments for the longer term, is no longer fully valid.[48] In other words, if industrial policy wants to make a future-oriented and sustainable medium and longer-term Industry 4.0 feasible in a self-organising structure that is also supported by an efficient financial system, then the expanding financial universe must be re-regulated. Curbing the overexpansion of the transnational financial system brings us back to the need for an institutional constellation that allows for centralisation in this respect, but provides a more decentralised framework for industrial policy.

5. Conclusion

This paper provides, perhaps, sufficient ammunition to conclude that *industrial policy is a set of multidimensional instruments and regulations that promote (or inhibit, for that matter) structural change when a qualitatively new configuration of the socio-economic system emerges*. Today's industrial policy must take a very complex approach: it must use and manage various (supply-side, demand-side, regulatory, etc.) instruments – at times top-down, at times bottom-up – while balancing different approaches and building on the smart involvement of a changing and diverse range of actors for it to be able to take part in the coordination of diverging objectives such as boosting economic efficiency, global decarbonisation

[47] A financial system freed from the shackles of strict rules and unleashed has long been thought to be the foundation of long-term economic growth. But as it expanded, it left its traditional role behind. This is what OECD statistics tell. The added value of the financial sector within GDP was 5 per cent and 4.5 per cent in the 1980s in the USA and the euro area countries, respectively, but by 2010 it had risen to 8 per cent and 6 per cent, respectively; since the 1970s, the share of loans granted by banks and other financial intermediaries within GDP has grown significantly (from 90 per cent in the USA in 1980 to around 200 per cent in 2010, and from 60 per cent to close to 150 per cent in the euro area), and the sector became primarily self-sustaining, supporting the real economy to an ever lessening degree as it began to favour investments that promised high returns in the short term. This is confirmed by the substantial increase in the buyback of shares, i.e. companies are forced to raise their share prices gradually because real economy processes are no longer sufficient; or by the global frenzy to save (decline in real economy orientation, proliferation of non-production areas). The impact of this is reflected in weaker average real GDP growth between 2005 and 2020 compared to the 1985–2000 period; a deteriorating trend in market entry rates across OECD countries (see *OECD DynEmp3*); and a widening gap between the productivity of leading companies and companies lagging behind (see *Andrews et al. 2016*).

[48] Unfortunately, the latter is no longer the case (as indicated, for example, by the EU KLEMS database or *Ranaldi and Milanovic* (*2022*): labour income share is declining secularly, while capital income share is increasing). It is therefore appropriate, for example, to force banks to write down losses, to reduce leverage – as suggested by *Mérő* (*2023*) – or to launch a reform of insolvency/bankruptcy regimes. In short, restoring the symmetry between the financial universe and the real economy also demands the introduction of governance to the financial sphere to better serve a sustainable Industry 4.0 transformation.

or strategic autonomy. For this reason, industrial policy is a particularly important cog in the economic policy machine that works to build resilience.

In addition to demonstrating the mutual catalysis of industrial policies between the two continents, this industrial policy overview of the United States and Europe offers three lessons that can help both the domestic and international community of economists and politicians responsible for the economy to better understand the magnitude of the Industry 4.0 challenge.

First, we are living in an age of epochal challenges (geopolitical competition, supply shocks brought about by Covid-19, surging inflation, overburdened states, etc.) that have suspended the validity of old-fashioned evidence on industrial policy (for example, that governments rarely know better than the market which technologies will be successful, and often make efforts to reach goals that have nothing to do with the development of the given industry). Governments everywhere are therefore keeping a watchful eye on the pace of industrial development. Both US and European industrial policy is driven by the dual technological-economic transition (green and digital economy). There is a degree of alignment between the USA and the EU in terms of industrial policy missions, but there is also divergence of implementation and particularities. More importantly, this divergence will remain institutionally wired in the future, affecting the time needed for Industry 4.0 to show more spectacular success.

Second, the techno-economic paradigmatic shifts mean that the observation of *Károly Polányi*, quoted above, that the pattern of capitalism's dynamics is essentially determined by different political cycles, one representing *laissez-faire*, and the other more strongly focused on reinforcing the social welfare safety net, remains valid. Two things follow from this concerning the nature of industrial policy: (i) economic governance is on a more secure footing if industrial policy is seen as a policy matrix with moving targets (missions), whose direction and instruments change dynamically over time; and (ii) industrial policy must have a long-term framework, but keep the horizon of its actions predominantly on the short term, i.e. impulsiveness is key to avoiding cultural capture of subsidies and preventing counter-incentives for companies.

Third, the existence of industrial policy paradoxes leads to at least four insights: (i) industrial policy should not be applied for the sake of industry, to rehabilitate the dominant position of the classical conception of competitiveness, but should also actively serve to prioritise areas beyond the pure economic dimension; (ii) paradoxically, industrial policy seems to be more successful when the institutional system of the economy is relatively more decentralised so that the more centralised aspects of industrial policy can open the way to quicker learning about and thus the diffusion of Industry 4.0 by weakening and possibly eliminating systemic counter-

incentives. Excessive decentralisation leaves the underlying distortions of the system (e.g. a financial universe that extends beyond the real economy) intact, and thus reinforces the *status quo*, which is dead-end development in terms of the evolution of the socio-economic system; with full centralisation, local autonomy, initiative, more innovative learning, the possibility of interactions disappear, which will lead to slowing or stagnating innovation dynamics; (iii) industrial policy must also take into account the configuration of the complex ecosystem of socio-economic innovation (e.g. industrial policy without restoring the broken symmetry between the financial system and the real economy can only lead to the overburdening of the state); and (iv) the modernisation of industrial policy requires that the public sector also becomes more innovative, as there needs to be more room for creative, adaptive and exploratory (experimentation) capabilities to flourish also within the public sector in order to talk about a public sector that catalyses industrial policy. Obviously, an inventory of aid policy instruments that enhances transparency must be produced.

Overall, neither greening nor digitalisation can succeed if they fuel social tensions that undermine social trust and thus political stability, and, ultimately, the state's ability to act. The complexity of the socio-economic system should be respected, i.e. an industrial policy that seeks to meet the requirements of political stability, economic feasibility and social acceptability should be preferred over one that shaped by constantly optimising and therefore interventionist economic governance. This is more likely to happen if industrial policy is carefully and slowly developed responding to the global megatrends that permeate daily life in our modern global economy and whose effective management calls for a complex public policy approach, in which industrial policy must play a significant role on several fronts (increasing energy efficiency as required by climate change; new employment challenges brought about by migration; mitigating inequality and strengthening social cohesion, etc.). Only this kind of disciplined approach to industrial policy can be resilience-driven, the outcome of which is really worth waiting for. As the Latin proverb says: *respice finem*!

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