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JANUARY 2020

Policy Notes and Reports 36

The European Union's Industrial Policy:

What are the Main Challenges?

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Abstract

This policy report stakes a stance on industrial policy in the European Union in the light of the revived interest in the subject and the most pressing challenges ahead. In the current global context these challenges are: (i) to keep pace at the technology frontier with the technologically most advanced economies; (ii) to meet the challenge of fast catching-up emerging economies; (iii) to contribute to the convergence and cohesion processes within the EU; and (iv) to deal with climate change and environmental sustainability issues more generally. A quantitative exercise that makes use of the EU's budget data, including the structural funds, and member states state aid expenditures is used to identify the EU's current industrial policy priorities. The results are the basis for an assessment of the extent to which the key challenges are addressed at the supranational level and which aspects are primarily dealt with by national governments.

Keywords: Industrial policy; EU's industrial policy, smart specialisation, mission-oriented industrial policy, EU structural funds, EU cohesion policy, EU competitiveness, EU Green Deal

JEL classification: L5, L16, O25, O38, O52; Q59, F68

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The European Union's Industrial Policy: What are the main challenges?

1. INTRODUCTION: RESURGENCE AND MAIN CHALLENGES OF EU INDUSTRIAL POLICY

Industrial policy is back on the agenda around the globe. The United Nations Conference on Trade and Development (UNCTAD) reports that since 2013, no fewer than 84 countries have adopted formal industrial policy strategies (UNCTAD, 2018). The return of industrial policy (Wade, 2012) followed a period of industrial policy fatigue in the 1980s and 1990s. One of the reasons for the renewed interest in industrial policy is dissatisfaction with the growth and structural outcomes of the non-interventionist period of the 1990s and early 2000s. In the European Union (EU), concerns about de-industrialisation in several member states, a changing global context, the experiences of persistent regional disparities and the uneven impact of the financial and economic crisis after 2008 have all played a part in altering the way in which industrial policies are perceived.

Industrial policy in the EU has traditionally been a mixed approach, incorporating both horizontal and sector-specific measures – with significant variation in focus over the decades. More recently, policy frameworks have multiplied, with new approaches emerging from various fields – ranging from Schumpeterian growth theories (Aghion et al., 2015) to empirically driven patterns of industrial development across product spaces (Hidalgo et al., 2007) to new conceptual frameworks that guide policy initiatives at the EU level, such as 'mission-oriented' policies (Mazzucato, 2018) or 'smart specialisation' (Foray et al., 2009).[1] One unifying theme, though, seems to be the rather general insight that purely horizontal industrial policy is either inadequate or simply impossible.[2]

Identifying the industrial policy stance of the EU is complicated by at least three factors. First, the great importance attached to competition policy within the single market means that subsidies are ruled out by default. More precisely, the European state aid rules prohibit any subsidies that distort or threaten to distort competition between member states, although there are several exceptions to the general ban (e.g. projects of common European interest, such as the Airbus endeavour). Thus the strict competition rules of the single market, itself part and parcel of the EU's industrial policy (and arguably one of its greatest successes), have to be considered along with continued state aid support from EU member states, all of which must have been cleared by the European Commission and deemed compatible with the rules of the single market.

Second, and related to the point above, industrial policy action takes place at both the member-state and the EU level. Furthermore, member states, to varying degrees, delegate the formulation and

[1] For an overview, see for example Radosevic (2017).

[2] This is because any form of industrial policy – even one designed as a horizontal measure, such as R&D support or even a slightly undervalued exchange rate – will affect sectors differently; or, as Rodrik puts it: 'In practice most interventions, even those that are meant to be horizontal, necessarily favor some activities over others' (Rodrik, 2009, p. 6).

implementation of industrial policy to the regional level. The same is true of the EU's cohesion policy, realised via the numerous European structural and investment funds (ESIF), a cornerstone of EU industrial policy.

Third, at the EU level, making sense of industrial policy action is difficult, given the numerous strategies, programmes, actions and initiatives that are announced at – so it seems – ever shorter intervals. Of late, the EU has developed the habit of publishing a new or adapted industrial policy strategy every other year or so (see European Commission, 2010; 2012; 2014; 2017a). The latest of these calls for investment in a smart, innovative and sustainable industry. Triggered by the European Commission's blocking of the planned Siemens-Alstom merger,[3] intense negotiations are currently under way about yet another reformed industrial policy (EPSC, 2019; European Commission, 2019). The rise of China, with its geopolitically motivated One Belt, One Road (Obor) initiative and its comprehensive and ambitious industrial policy strategy entitled 'Made in China 2025', is another major trigger for the new European industrial policy drive.

China's successful catching-up process and ambitious industrial strategy show that EU industrial policy (whether at the supranational, the national or the regional level) is not conducted in a vacuum, but is necessarily context specific. Changing global and socio-economic circumstances are shaping policy efforts and priorities. The contextual nature implies that all discussions on European industrial policy are embedded in the overarching economic challenges that the EU is facing and in the objectives that it set itself under the Lisbon Agenda and subsequent strategies. The most pressing economic challenges may be summarised as follows:

(i) *Technological/innovation challenge.* Keeping pace with the technologically most advanced economies in future-oriented technological areas – including the digital transformation – has been one of the long-standing aspirations of EU industrial policy. In order to defend the EU's position at the technology frontier in many technology-driven industries, it is imperative to build on inherited strengths of industrial, technological and human capital structures.

(ii) *Emerging markets challenge.* Meeting the challenge of emerging economies that are catching up rapidly, adopting a strategy that includes both competition and collaboration. Here, China merits special attention on account of its dynamic growth, as well as both its geopolitical ambitions (realised via Obor) and its technological ambitions (as laid down in 'Made in China 2025', the country's ambitious industrial policy strategy).

(iii) *Cohesion challenge.* To foster progress in the field of convergence and cohesion policy within the EU. Here, a major issue in the industrial context is the fact that, as they strive to make progress in their industrial development or structural upgrading process, peripheral regions and countries are faced with the strong agglomeration tendencies inherent in tradable activities in the core areas of Europe's economy.

[3] The motivation behind the deal was to create a European player in the rail sector with sufficient weight to compete with the rapidly expanding (state-owned) Chinese rivals. The European Commission's decision has intensified the perception that the tough European competition rules in the areas of merger control, state aid and public procurement place European firms at a disadvantage vis-à-vis foreign competitors, who do not always play by the same rules.

(iv) *Environmental challenge.* Dealing with the challenges of the Paris Agreement on climate change and sustainability issues more generally. Given the comparatively strong regulatory framework for environmental protection, European industry is bound to adjust and incorporate resource efficiency, emission reduction and sustainability in a cost-efficient manner (see the recent European Commission Communication on the 'European Green Deal'; European Commission, 2019). The implications for the competitiveness of European industry of such a shift to the desired circular economy are as yet unclear, but they differ across industries. On the one hand, regulations that force firms to rely increasingly on sustainable or reusable goods (including packaging) may promote first-mover advantages in a series of new materials and technologies. On the other hand, several of these regulations will initially impose additional costs on firms producing within the EU.

2. QUANTIFYING EU INDUSTRIAL POLICY AT THE NATIONAL AND THE SUPRANATIONAL LEVEL

There is no lack of documents outlining the EU's industrial policy strategies. Typically, these documents put forward a large number of objectives and initiatives. Since 2010, the Commission has launched five industrial policy strategies, each supplementing and fine-tuning the previous ones. The industrial policy strategies are complemented by countless communications, strategies and initiatives that are, in one way or another, related to the EU's industrial policy strategy. The updated industrial policy strategy of 2017 (European Commission, 2017a) lists no fewer than 48 such communications, strategies and initiatives, including the strategy on Digitising European Industry, the new Circular Economy Package, the extension of the European Fund for Strategic Investments (EFSI) or the free-trade agreement with Japan.

While the strategy documents are a valuable source for learning about the EU's general approach to industrial policy and its main objectives, to some extent the sheer number of strategy documents and the varying priorities obscure – albeit unintentionally – the true priorities of the EU's industrial policy. This Policy Report therefore supplements the information on industrial policy priorities available in official documents with data on actual spending on policy objectives that are related to industrial policy. The two main sources of data used for this quantitative exercise are the Multiannual Financial Framework (MFF) –the EU's budget plan – for the period 2014-2017 and the EU State Aid Scoreboard (SAS), which records the value of the aid elements involved in the subsidies granted by member states.[4] SAS data for the period 2014-2017 are combined with the MFF data.

Above all, this analysis reveals the relative importance of spending on industrial policy at the EU level, on the one hand, and at the level of member states or regions within member states, on the other (*level dimension*). At both levels, the data are further dissected to identify the priorities of industrial policy (*thematic dimension*), and differences in these thematic priorities across member states or groups of states are discussed (*country dimension*).[5]

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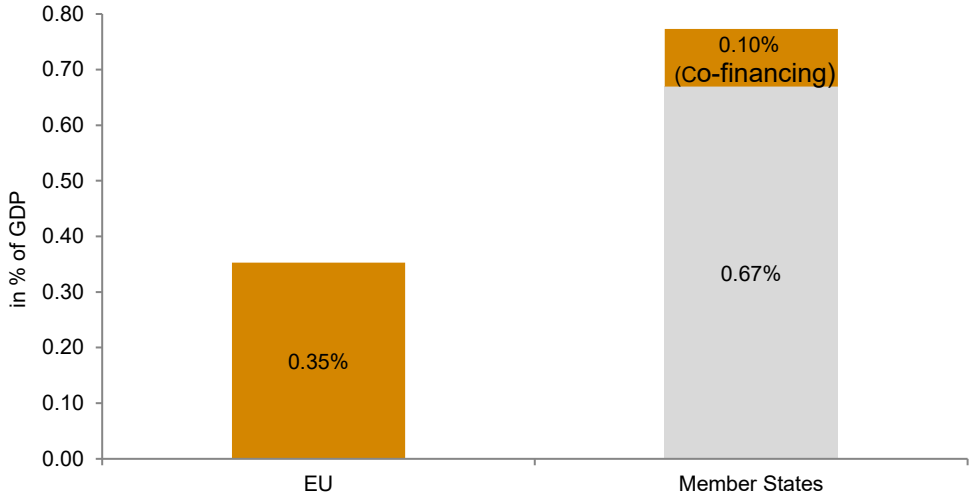
[4] For details, see Appendix A.1.

[5] Note that this approach captures only policy actions that have budgetary implications, and therefore other potentially important measures (such as regulations or the conclusion of a free trade agreement) are left out.

On the whole, expenditure on industrial policy by member states far exceeds the amounts spent at the supranational level (Figure 1). The financial resources from the EU budget flowing to industrial policy-related measures amounted to 0.35% of the EU's GDP annually during the period 2014-2017.[6] By contrast, industrial policy spending by member states was in the order of 0.75% of GDP during the same period. Apart from the state aid provided, the latter figure includes member states' contributions to EU programmes financed by the ESIF (known as co-financing by member states).

Figure 1 / Spending on industrial policy in the European Union, average 2014-2017



Note: EU funding is the sum of expenditure items related to industrial policy in the MFF over the years 2014-2017. Co-financing amounts by member states are estimates, calculated as the ratio of planned allocations of EU spending to spending by member states in the MFF 2014-2017. All expenditures are expressed as nominal values, as a percentage of GDP. National state aid by member states indicates the subsidy element contained in national state aid, and is also expressed as a percentage of GDP.
Source: European Commission; authors' calculations. For details see Appendix A.1.

While the subsidy spending by member states obviously forms part of their national industrial policy activities, the co-financing part should in principle also to some extent reflect European industrial policy objectives, although specific projects financed by the ESIF are selected and designed by national or regional governments.

The finding that the funding of industrial policy by member states is more than double the level of funding at the EU level also reflects the fact that industrial policy is a shared competence, with only subsidiary powers at the supranational level and with member states assuming the role of main actors in this domain (see also Wyns, 2017).[7]

[6] This share of industrial policy-related spending is lower than that in Pellegrin et al. (2015), who subsume 87% of the EU MFF 2014-2020 under 'Relevant programmes from an industrial policy perspective' (see Table 2, pp. 31-32). This would result in EU industrial policy spending of about 0.8% of EU GDP. The main difference between the numbers in this paper and those in Pellegrin et al. (2015) is that Pellegrin and co-authors include in their analysis all spending on the common agricultural policy (CAP) and the maritime and fisheries policies (together amounting to about 40% of the EU budget).

[7] While not surprising, this is still a remarkable result, given the rather generous allocation of funds from the EU budget to the realm of industrial policy in the calculations, which include public infrastructure expenditure and parts of active labour market policies.

The combined spending on industrial policy by member states and the EU amounts to about 1.1% of EU GDP. This is certainly a non-negligible amount of public support, but is low by historical standards: it is estimated that during the 1970s subsidy spending in the EU amounted to 3% of GDP, and it was still around 2% during the 1980s (European Commission, 2011b). This can be interpreted in two different ways: either the proclaimed 'renaissance' of industrial policy in Europe has not materialised, or else the new industrial policies of the twenty-first century are not just 'old wine in new bottles', but do indeed have some new features. In this narrative, the comparatively low amounts spent at the aggregate level reflect the fact that the new industrial policies involve fewer of the old-fashioned 'hard' support policies and more 'soft' policies (better aligned with market forces), resulting in less government expenditure.

The thematic dimension: priorities in industrial policy

The categorisation of industrial policy in this exercise is mandated by the structure of the MFF and reflects various drivers of competitiveness. More precisely, the following broad support categories are distinguished: (i) research, development, innovation and technology; (ii) support for small and medium-sized enterprises (SMEs); (iii) employment, education and training; (iv) ecological transformation ('green' industrial policy); and (v) investment in infrastructure. Two further categories are added – sectoral industrial policy and regional policy – although the latter can also be further allocated to the other thematic fields in the case of industrial policy spending at the EU level.

Table 1 / EU and member states' spending on industrial policy, by policy field, 2014-2017 (annual averages)

	EU industrial policy	State aid by member states	EU industrial policy	State aid by member states	EU industrial policy	State aid by member states
	Absolute amounts				% of total industrial policy	
Industrial policy field	(in EUR bn)		% in GDP		spending/state aid	
Ecological transformation	0.29	51.90	0.00	0.35	0.01	0.52
Employment, education training	0.44	3.13	0.00	0.02	0.01	0.03
Infrastructure	1.44	0.00	0.01	0.00	0.03	0.00
RDI and technology	7.47	9.07	0.05	0.06	0.14	0.09
Regional policy	40.96	11.13	0.28	0.08	0.79	0.11
SME support	0.09	4.68	0.00	0.03	0.00	0.05
Sectoral industrial policy	1.32	7.02	0.01	0.05	0.03	0.07
Other	0.00	12.33	0.00	0.08	0.00	0.12
TOTAL	52.01	99.25	0.35	0.67	1.00	1.00

Note: See Figure 1. Co-financing amounts by member states are excluded from the table.
Source: European Commission; authors' calculations. For details, see Appendix A.2.

Table 1 shows the absolute amounts spent on these industrial policy fields, along with their shares in GDP and their share in overall industrial policy spending.

At the supranational level, the data reveal two main policy priorities: regional policy and support for RDI and technology. Taken by itself, the EU's regional policy (that is, the activities of the ESIF)[8] accounts for the lion's share of EU industrial policy spending: €40 billion or almost 80% of the total industrial policy-

[8] Note that this quantitative exercise does not include all spending under the ESIF, but only that of the European Social Funds (ESF) and the European Regional Development Fund (ERDF), as well as the Cohesion Fund.

related expenditure at the EU level is disbursed via the ESIF. The fact that industrial policy spending at the EU level is dominated by regional policy has important implications for policy formulation. This is because, in contrast to industrial policy measures financed via the central EU budget (e.g. the Trans-European Networks), the projects financed by the ESIF are designed and selected by the member states or their regions.[9] Hence, with regard to the design of policies, it is useful to distinguish between EU industrial policy in the narrow sense – which is financed and predominantly designed by the EU institutions – and the EU's regional industrial policy.

The second key policy at the EU level, support for RDI and technology policy, accounts for another 14% of the EU's industrial policy budget. As will be discussed in detail, the main policy vehicle in this domain is Horizon 2020, a grant-based programme for research institutions, enterprises and universities that finances collaborative research activities of all kinds.

Moving on to the state aid activities of the member states, Table 1 suggests that the industrial policy priorities at the national level are quite different from those at the supranational level. While member states also spend considerable amounts on RDI and technology policies (€9 billion) and regional policy (€11 billion), the most prominent state aid category is green industrial policy[10] – that is, state aid granted for ecological transformation. The importance attached to 'green' industrial policy measures is attributable above all to Germany's massive expenditure on the *Energiewende* (energy transition), parts of which constitute state aid.[11]

Also noteworthy is the fact that during the period 2014-2017, only marginal sums were spent on sector-specific industrial policy. At the EU level, €1.3 billion (3%) were spent on specific industries (essentially space, aircraft and electronics); meanwhile €7 billion (7%) were spent by member states. In the latter case, this includes restructuring and bail-out aid, e.g. for airlines (former national carriers).

Returning to the EU level and the ESIF, Figure 2 presents the same data, but this time with the ESIF funds split into corresponding categories of industrial policy.[12]

At the EU level, this presentation of the expenditure on industrial policy confirms the point made above that EU industrial policy predominantly coincides with R&D and innovation policy. Approximately 70% of 'central' EU industrial policy spending is destined for RDI and technology. The other two categories of industrial policy that are of high relevance in financial terms are infrastructure investments and sector-specific policies: these accounted for 13% and 12%, respectively, of industrial policy spending from the 'central' EU budget.

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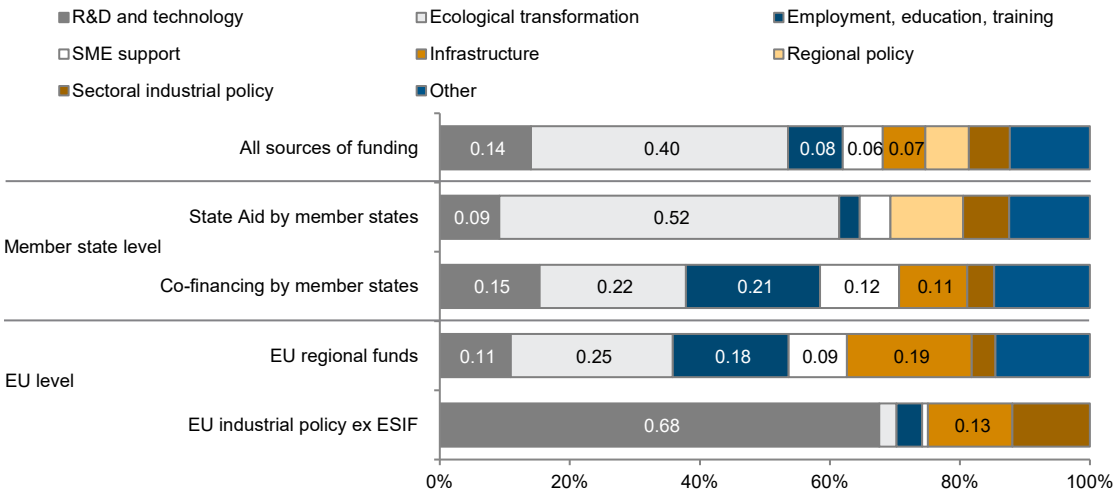
9 However, EU institutions do monitor the projects and the disbursement of funds, which is also an important function.

10 This finding is influenced by the fact that we defined industrial policy spending by member states rather narrowly, limiting it to state aid; this therefore excludes most of the investment expenditure on public infrastructure.

11 Germany's expenditure on 'green' state aid amounts to €33 billion, or about two thirds of total EU spending on this item. The €33 billion also make up 86% of Germany's total state aid expenditure and amount to 1.06% of German GDP.

12 The disaggregation of ESIF funds into categories of industrial policies is possible because ESIF funds are structured into 'thematic objectives'. See Appendix A.2 for details.

Figure 2 / Funding of industrial policy in the European Union by themes, average 2014-2017



Note: See Figure 1. For the EU regional funds, the total actual financing flows by the ESIF are assigned to individual funds using the shares of these funds in the planned budget allocations in the MFF 2014-2020. ex ESIF= excluding spending under the ESIF.
Source: European Commission; authors' calculations. For details, see Appendix A.1.

The EU's infrastructure-related industrial policy is embedded in its Trans-European Networks (TEN) policy. This comprises several instruments, including the Connecting Europe Facility (CEF), which provides financial support for strategic investment in transport, energy and (increasingly) digital infrastructure.[13] A key objective of the CEF is to create pan-European energy networks and European transport corridors, in order to overcome Europe's nationally fragmented energy and transport systems. While this objective is laudable, the effectiveness of the CEF is circumscribed by persistent financing gaps in relation to member states' declared needs (European Commission, 2017d), and arguably also by their nationally oriented priorities.

One particularly glaring aspect of the EU's infrastructure-related industrial policy is that policy efforts are scattered across too many programmes. Although – given the different policy objectives – it is understandable that infrastructure (including the TEN) should be financed via the ESIF as well as the CEF, it is less clear why there is any need for the additional infrastructure-driven investment programme set up under the EFSI[14] (see Box 1).

[13] See: https://ec.europa.eu/transport/themes/infrastructure_en

[14] The European Fund for Strategic Investments (EFSI) is the central pillar of the Investment Plan for Europe. See EU regulation 2015/1017 on the European Fund for Strategic Investments, the European Investment Advisory Hub and the European Investment Project Portal.

BOX 1 / EUROPEAN FUND FOR STRATEGIC INVESTMENTS (EFSI)

The EFSI, better known as the 'Juncker Plan' after its main promoter, former European Commission President Jean-Claude Juncker, was set up as a response to the financial crisis. The investment plan was initially intended as a temporary fiscal stimulus measure,[15] but was extended until 2020. In the meantime, it has become clear that the EFSI will become a permanent EU programme in the MFF 2021-2027, under the name InvestEU. Unfortunately, the design of the EFSI leaves much to be desired, with its old-fashioned industrial policy approach. To start with, its actual budget is far too small to make any great impact: far from the €315 billion announced, the actual funds provided by the EU amounted to only about €3.5 billion for the original three-year period, with some additional funds coming from the European Investment Bank (EIB). The difference stems from the fact that official EU documents include the private investments that would supposedly be mobilised by the EFSI. While the figures published by the European Commission for the investments actually triggered suggest that the target of €315 billion has even been exceeded, auditors have cast doubt on them, arguing that the claims made by the EIB, which is managing the EFSI, have been overstated.[16]

Given the current experiences with the EFSI, it also remains unclear what is 'strategic' about the fund: the areas eligible for financing under the EFSI are so broad and diverse that hardly any priorities are discernible. The fields of operation include energy and transport projects, but also support for SMEs, R&D and the digital economy.[17] Agriculture and social matters are also covered. Hence, to some extent the EFSI and the future InvestEU programme are likely to duplicate existing programmes. The EFSI is already linked to the Connecting Europe Facility (CEF) – the EU's main infrastructure investment programme – with part of its budget simply redirected from the CEF.

The greatest problem with the EFSI, however, is that is does not seem to live up to its proclaimed principle of additionality. The EFSI was only supposed to support programmes that otherwise could not be realised (which, incidentally, was one of the explanations given for the high leverage effects). A look at the project list, however, casts doubt on the additionality of projects and on the desperate need of the beneficiaries for public support from EU funds. A prime example would be the purchase by Austrian Federal Railways of new rolling stock (CityJets) for regional passenger transport, at a total cost of €1.7 billion. The project is supported by a €500 million loan from the EIB, backed by an EFSI guarantee. In all likelihood, the Austrian railway company would have bought this new rolling stock anyway, as the upgrade was long overdue. This is just one example demonstrating that, in all likelihood, the support provided by EFSI is plagued by the rent-seeking behaviour of firms that hope to benefit from improved financing conditions thanks to EFSI.

In summary, the EFSI (and the InvestEU programme) is an example of a poorly targeted, old-style industrial policy programme, and a rather unfortunate attempt to revive EU industrial policy. As will be shown, though, the EU is also following more promising industrial policy avenues.

Staying in the domain of infrastructure-related industrial policy, but moving to the European structural funds, an interesting finding regarding the spending profile of the European structural and investment funds is that infrastructure is no longer the primary thematic objective. Though it is still important,

[15] The initiative was initially scheduled for three years (2015-2017).

[16] See: 'EIB and Commission defend Juncker plan following auditors' criticism', EuroActiv, 30 January 2019. https://www.euractiv.com/section/economy-jobs/news/eib-and-commission-defend-juncker-plan-following-auditors-criticism/

[17] For a distribution of the projects financed by the EFSI by country and topic see: https://ec.europa.eu/commission/priorities/jobs-growth-and-investment/investment-plan-europe-juncker-plan/investment-plan-results_en

accounting for roughly a fifth of total ESIF spending, the number one priority within the ESIF, according to the categorisation employed, is funding for ecological transformation, i.e. regional green industrial policy.

While it is reassuring to see that the EU is providing funds for the ecological transformation of industry and infrastructure, it should be borne in mind that the projects are selected by member states. And until very recently, there was in the EU the surprising and rather unfortunate situation whereby 'green industrial policy' enjoyed much greater prominence (as measured by budgetary outlays) in national industrial policy budgets than at the EU level.[18] The situation was surprising, insofar as the mitigation of climate change and protection of the environment more generally constitute an archetypal global public good (see, for example, Rodrik, 2014). As such, one would expect the design and funding of green industrial policies to be ideally placed at the supranational level. Obviously, this has changed dramatically with the announcement of the *European Green Deal* by the incoming Commission president, Ursula von der Leyen, and the accompanying policy document (European Commission, 2019).

According to the official rhetoric, some €1 trillion are to be spent on various initiatives of this Green Deal over a period of 10 years. Laudable as the objectives of the Green Deal are (and they include making the EU climate neutral by 2050), it remains to be seen how much *additional* investment in green technologies, energies and products the initiative will actually trigger. This scepticism stems from the fact that very little new money is expected to be mobilised, beyond that already foreseen in the current budgetary plans for the next MFF period (2021-2027) (which have yet to be agreed upon by member states). In fact, the only fresh money is the €7.5 billion (again over a 10-year period) for the newly created *Just Transition Fund*, which is to provide financial assistance to regions with a strong specialisation in coal mining and other industries that are likely to be eroded in the course of the ecological transition. Unfortunately, the entire investment plans envisaged for the European Green Deal are modelled on the InvestEU initiative or are even integrated into it. Having spelt out our objections to both the overall design and the implementation of the InvestEU fund, we are naturally also doubtful that the European Green Deal and its accompanying financial instruments will greatly speed up the – clearly necessary – ecological transformation.

Given the quantitative importance of national governments' state aid expenditure in EU industrial policy spending, the thematic priorities set by member states strongly determine the overall industrial policy spending patterns. Overall, 40% of industrial policy spending in the EU is 'green industrial policy' of some sort, an issue to be discussed in more detail in Section 3.

The country dimension: substantial differences in industrial policy expenditure

Going beyond EU averages across member states and zooming in on the activities of individual member states (or groups of member states), Figure 3 reveals considerable heterogeneity in spending priorities at both governance levels.

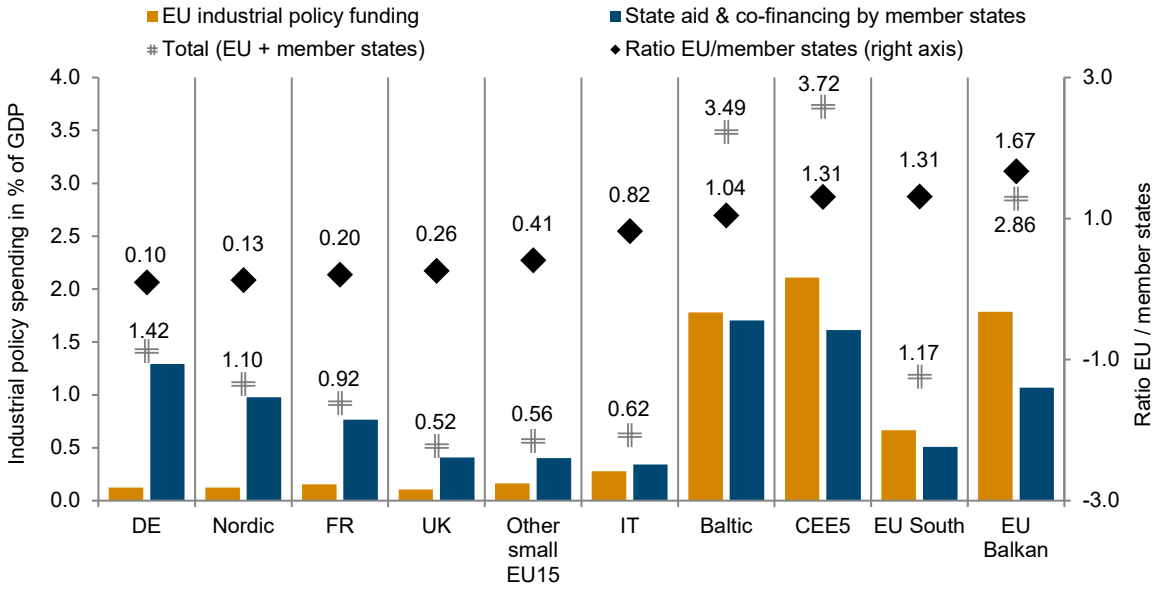
[18] Of course, the priorities of the central EU budget are also ultimately decided by member states.

A first key insight is that the dominance of industrial policy funding from member states' own resources that emerged in the aggregate is not present in all country groups. In particular, for the Central and Eastern European (CEE) member states and the Southern cohesion countries, the industrial policy funding received from the EU budget exceeds national expenditure. The ratio of the industrial policy funding received from the EU to national sources is 1.3 in the case of the CEE5 (i.e. Hungary, Czech Republic, Poland, Slovakia and Slovenia) and as high as 1.7 for the EU Balkan countries (Croatia, Bulgaria and Romania).

At the lower end of the spectrum is Germany, which, due to its high expenditure on energy transition, has a funding ratio of only 0.1 (or 10:1 in favour of national industrial policy spending). For this reason, Germany is also the country with the highest state aid expenditure in the EU15, not only in absolute terms but also in relation to GDP. Including the funding for industrial policy obtained from the EU budget, German expenditure on industrial policy amounted to 1.4% of GDP in the period 2014-2017, slightly higher than the EU average of 1.1%.

The reason for the patterns of industrial policy spending observed is that the CEE and the Southern cohesion countries are the main beneficiaries of the ESIF, as they have more regions eligible for funding from the European Regional Development Fund (ERDF) and the Cohesion Fund. Therefore, the pronounced differences in industrial policy spending across member states are largely explained by the big differences in income levels within the bloc.

Figure 3 / Spending on industrial policy by the EU and by member states, by country group, average 2014-2017



Note: EU Balkan = HR, BG, RO; Other small EU15 = AT, BE, NL, LU, IE; CEE5 = HU, CZ, SK, PL, SI; Baltic = EE, LT, LV; EU South = CY, EL, ES, MT, PT. For the EU regional funds, the total actual financing flows are assigned to individual funds by the ESIF using the shares of these funds in the planned budget allocations in the MFF 2014-2020. Co-financing amounts by member states are calculated using the ratio of planned allocation of EU spending to actual spending by member states in the MFF 2014-2020. National state aid by member states is the subsidy element contained in national state aid, also expressed as a percentage of GDP.
Source: European Commission; authors' calculations. For details, see Appendix A.1.

The combination of comparatively high levels of state aid and generous receipts from the ESIF resulted in expenditure on industrial policy amounting to 3.7% of GDP for the CEE5 (with 2% of GDP coming from the EU budget); 3.5% for the Baltic countries; and 2.9% for the EU Balkan countries. These figures are high even by historical standards, given that the amount of state aid is estimated to have been around 3% of GDP during the 1970s, in the heyday of industrial policy. This has to be borne in mind when discussing possible industrial policy initiatives, especially because the effectiveness of various ESIF programmes has been shown to decline with the amount of funding received (e.g. Becker et al., 2012). Hence, in some regions, there may be a risk of overspending. In these cases, new initiatives should not be added to existing support programmes, but should replace some of the less successful support mechanisms.

The next section shows that industrial policy spending across member states not only varies with regard to the amounts spent, but also targets different thematic fields.

The country dimension: different countries, different priorities

Differences in industrial policy priorities across member states are discernible in the funds received from the central budget (Figure 4, panel a) and those channelled via the ESIF (Figure 4, panel b).

The most striking feature in the central EU budget is undoubtedly the dominance of industrial policy spending on RDI and technology. For the Nordic countries, the UK and the Other small EU15 member states, RDI and technology accounts for more than three quarters of the total funding of industrial policy. The shares are similarly high for Germany and Italy. The most notable exceptions here are the Central and Eastern European member states. For the CEE5, the Baltic countries and the EU Balkan countries, the corresponding share is about 40% or less. This comparatively small role of RDI and technology support is compensated for by larger spending on infrastructure financed by the EU budget, mainly through the TEN projects.

While the distribution of funds is more even across the different industrial policy fields in the case of the ESIF, the pattern of infrastructure-related industrial policy being more important in the CEE member states is also discernible in the ESIF budget. The same is true for the more limited role of RDI and technology policies in those countries, compared to the EU15.[19]

It is worth mentioning that the stronger focus on infrastructure-related industrial policy detectable for the CEE member states and the greater emphasis on RDI and technology policies in the EU15 signal the different needs of member states. These different needs are, in turn, again largely explained by the still prominent differences in development levels across member states.

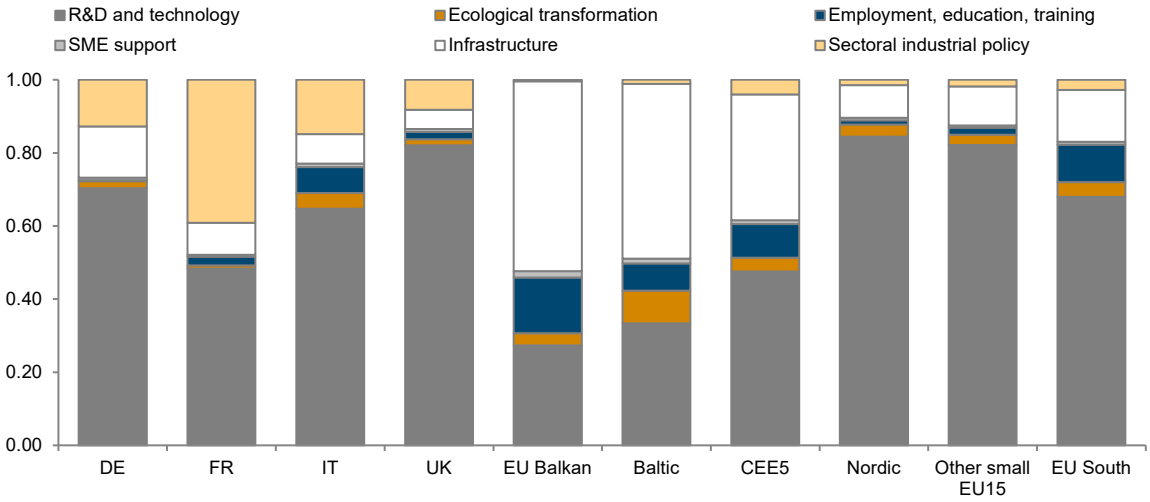
It also seems that the share of funds destined for ecological transformation account for the relatively large share of the overall industrial policy spending financed via the ESIF in the CEE5, the Baltic countries and the EU Balkan countries, compared to other member states. This might reflect the legacy in Central and Eastern European countries still dealing with the communist-era priority given to heavy

[19] It should be mentioned that France's high share of sector-specific industrial policies in the total funds it receives from the EU budget does not reflect the country's supposedly interventionist stance on industrial policy, but is linked to France's leading role in the European earth observation programme, now called Copernicus, which the EU is operating jointly with the European Space Agency (ESA).

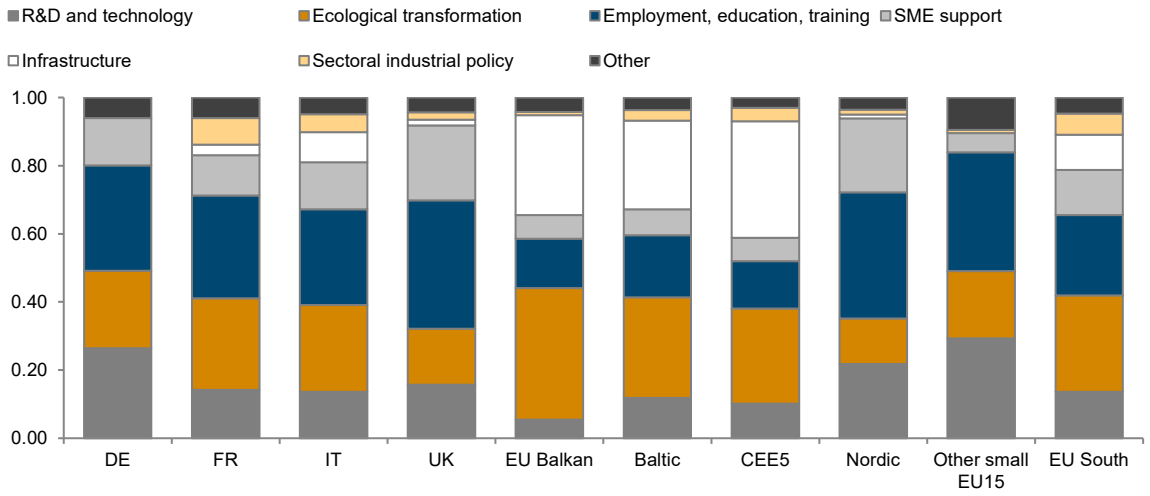
and energy-intensive industries. Given member states' state aid spending profile, however, this seems to indicate compensation for a lack of domestic spending, rather than policy priorities.

Figure 4 / Spending on industrial policy from the EU budget, by country group and theme, average 2014-2017

a) Funding of industrial policy from central EU budget



b) Funding of industrial policy from European structural and investment funds (ESIF)



Note: EU Balkan = HR, BG, RO; Other small EU15 = AT, BE, NL, LU, IE; CEE5 = HU, CZ, SK, PL, SI; Baltic = EE, LT, LV; EU South = CY, EL, ES, MT, PT. The numbers are the share of the respective industrial policy theme in a country or country group's total EU policy spending, funded by either the central budget or the ESIF.
Source: European Commission; authors' calculations. For details see Appendices A.1 and A.2.

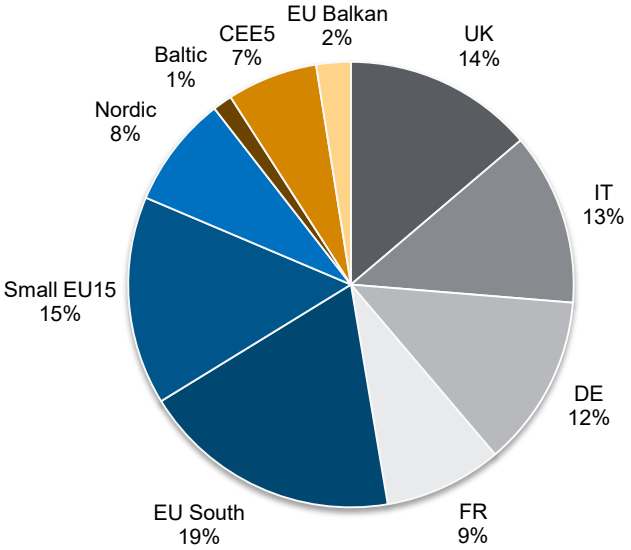
The key policy question in this respect is the extent to which both the EU's industrial policy spending and the possibilities for member states in terms of state aid spending should accommodate developmental and structural differences. This is a delicate issue, as it touches directly upon competition rules – i.e. the disciplining layer of EU industrial policy and one of the building blocks of the single market. An alternative (or complementary) approach would be to ensure that the national innovation systems in the

CEE member states are significantly strengthened, in order to allow those countries to benefit to a greater extent from the EU's R&D and innovation grants and programmes.

In this context, the Horizon 2020 programme, the EU's main R&D flagship programme, is of key importance, as is the thematic objective RDI and technology within the ERDF. Both are highly relevant, not only because of the significant amounts of support involved, but also because they incorporate new industrial policy approaches. As can be seen from Figure 5, in terms of participation in the Horizon 2020 programme, there is a clear bias in favour of the most advanced EU member states, visible in the applications for Horizon 2020 grants.

The Horizon 2020 programme supports collaborative R&D and innovation projects to the tune of €7.5 billion in the form of grants, allocated via competitive funding. Its main objectives are to stimulate excellent science, build industrial leadership and provide solutions to the grand societal challenges. The programme is structured into three pillars: excellent science (targeting 'frontier research');[20] industrial leadership (targeting closer-to-the-market research focused on 'key enabling technologies');[21] and societal challenges (European Commission, 2018).

Figure 5 / Share of Horizon 2020 applications per EU member state, average 2014-2016



Note: EU Balkan = HR, BG, RO; Other small EU15 = AT, BE, NL, LU, IE; CEE5 = HU, CZ, SK, PL, SI; Baltic = EE, LT, LV; EU South = CY, EL, ES, MT, PT.
Source: European Commission (2018); authors' calculations.

The most interesting pillar of the Horizon 2020 programme – and of its successor in the coming MFF, the Horizon Europe programme – is the *grand societal challenges pillar*. Here the European Commission

[20] See ERC website at: https://erc.europa.eu/about-erc/mission

[21] The key enabling technologies (KETs) include, but are not limited to: advanced materials, nanotechnology, micro- and nano-electronics, biotechnology and photonics (European Commission, 2009a; European Commission, 2009b). The KETs are regarded as the basis for innovation in a range of products across all industrial sectors. In particular, they should support the modernisation of Europe's industrial base and the shift to a greener economy.

has discovered the *mission-oriented approach* (see Box 2) to industrial and innovation policy, and seems determined to fully embrace it in the Horizon Europe programme.[22]

BOX 2 / MISSION-ORIENTED APPROACH

The *mission-oriented approach* to industrial and innovation policy is rooted in a systemic perspective of innovation, and is based on a number of assumptions and characteristics. The first assumption is that successful innovation necessarily involves a large number of actors, both private and public – hence the notion of an 'entrepreneurial state' (Mazzucato, 2013). Second, the impact of public funds is strongly enhanced if the money is not spent on narrowly defined and often isolated projects, but is channelled to related research endeavours that all serve a common purpose. Ultimately, research projects will serve a grand societal challenge such as health, secure societies and climate change. Missions are one level down in the granularity (compared to societal challenges), with the key feature that they are clearly specified and above all measurable. Unfortunately, for the time being it is not quite clear how these missions will be defined in an EU context, although some concrete proposals do exist (see Mazzucato, 2018). An implementation-related issue of the EU's main research programmes continues to be the uneven distribution of funds. So naturally, the question of who defines these missions and who will participate in such missions will arise.

The EU's regional funds have also incorporated elements of new industrial policy thinking. In particular, since 2016 support from the ERDF in the field of research, technological development and innovation (thematic objective 1)[23] requires a region to have a *Research and Innovation Strategy for Smart Specialisation* (S3) in place. This 'ex-ante conditionality' for accessing money from the ESIF confirms the view that smart specialisation has gained a strategic and central function within the new Cohesion Policy of the EU (Foray et al., 2009). In quantitative terms, the actual expenditures during the period 2014-2017 amounted to approximately €9 billion annually, including co-financing by member states.

The *Strategy for Smart Specialisation* (see Box 3) is a regional and innovation-oriented form of industrial policy developed within Europe. Despite the huge potential of the place-based S3, there is also scepticism about the appropriateness of this policy for less developed regions (e.g. Capello and Kroll, 2016). Based on case studies, Trippl et al. (2018), for example, found that while there is policy learning in less developed regions, they are struggling with the issue of stakeholder involvement – due either to a lack of capable stakeholders (e.g. universities) or to the unfamiliarity of actors with this type of co-operation. Radosevic (2017) argues that for less developed regions, the switch from an individual entrepreneurial discovery process to a collective one is difficult to achieve. Also, in order to avoid conflict over the alternative entrepreneurial opportunities of a region, stakeholders agree on the lowest common denominator, which often leads to the selection of very broad technological areas. In such environments, the value added of S3 is likely to be rather limited.

[22] See https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en

[23] The same is true for thematic objective 2, information and communication technologies (ICT). In the quantitative exercise, these two objectives are subsumed under the themes 'RDI and technology' and 'sector-specific industrial policies', respectively. Note that the S3 conditionality also applies to TO1 of the European Agricultural Fund for Rural Development (EAFRD) (Fostering knowledge transfer and innovation in agriculture, forestry and rural areas). However, we have excluded the EAFRD from the analysis in this paper.

BOX 3 / STRATEGY FOR SMART SPECIALISATION (S3)

The central idea underlying the *Strategy for Smart Specialisation* (S3) is the 'entrepreneurial discovery process' (Hausmann and Rodrik, 2003). Entrepreneurial discovery is central, because it is the process by which regions can find out about promising niches in which to specialise. Public support – i.e. S3 – is therefore necessary to encourage entrepreneurial discovery processes. It is assumed here that countries and regions possess latent comparative advantages that can be turned into effective comparative advantages with the appropriate policy interventions.

While the economic model of Hausmann and Rodrik (2003) would apply to both innovation and (physical) investment for the production of products new to the region, the concept of smart specialisation has been developed in the context of R&D and innovation policies (see Foray et al., 2009). S3 has been designed as a place-based (i.e. regional) innovation-oriented industrial policy.

3. EU INDUSTRIAL POLICY EFFORTS IN THE LIGHT OF THE MAJOR CHALLENGES AHEAD

The wide spectrum of industrial policy and the large set of measures make the overall assessment of EU industrial policy an elusive task. This is all the more the case, as EU programmes and initiatives set different, potentially conflicting objectives and have different underlying intervention logics (see also Pellegrin et al., 2019). The potential conflict in objectives becomes evident when considering the four major challenges of industrial policy that were discussed in the introduction. It is against these challenges that the strengths and achievements of current EU industrial policy (as well as its weaknesses and omissions) are discussed in this section. The discussion pays due attention to the fact that industrial policy, to be effective, needs to be not only well formulated, but also appropriately implemented and continuously evaluated.

The technological/innovation challenge

As regards the long-standing challenge of defending or attaining technological leadership, many excellent studies have assessed the record, scope and current ambitions of EU innovation policy (e.g. Veugelers et al., 2018; Veugelers and Baltensperger, 2019, evaluating the EU's policy initiatives in the areas of electric vehicles, digitalisation, the 'battery alliance' and others). In fact, the initiatives and measures taken by the EU in the area of innovation policy can be considered one of the success stories of EU co-operation. This is no small achievement, and reflects the fact that, as was confirmed by the quantitative exercise, 'innovation policy' lies at the core of what the EU sees as 'industrial policy'.

As described above, European R&D and innovation policy could be further sharpened by fully embracing the mission-oriented approach within the upcoming Horizon Europe framework programme.[24] The missions will be defined within the realm of five clusters that have already been determined.[25] Certainly, the effectiveness of the mission-oriented approach depends heavily on the type of missions that are

[24] Horizon Europe is the R&D and innovation framework programme of the MFF 2021-2028, and will replace the current Horizon 2020 programme.

[25] The five clusters are Health; Culture, Creativity and Inclusive Society; Civil Security for Society; Digital, Industry and Space; Climate, Energy and Mobility; and Food, Bioeconomy, Natural Resources, Agriculture and Environment.

defined. Of the five clusters, climate, renewable energy and the environment figure prominently, and this offers an excellent opportunity to link the technological challenge to the environmental challenge. The commitment of the new EU Commission to the *European Green Deal* as a core element in its policy agenda (European Commission, 2019) makes it likely that the mission-oriented approach will indeed be implemented in this area and will receive a high degree of visibility.

At this stage, it is noteworthy that the Horizon Europe programmes may also tackle the *digital transformation*, which for many is the key technological challenge facing EU economies, and which has potentially transformative power for the EU's entire production system. While most EU countries seem, with their innovation and industrial capabilities, to be well positioned to master the digital challenge (e.g. WEF, 2018), there is some concern that EU industry does not possess any major global players in the internet business.[26] This may indeed turn out to be a disadvantage for the transition towards Industry 4.0, in which cyber-physical systems combining the physical and virtual worlds are created. While it is far too early to judge whether the EU could fall behind, it is clear that the EU economy will need heavy investment in digital technologies and the required infrastructure. Efforts in this respect vary significantly across member states,[27] which is why a strong impetus is required at the EU level (as envisaged by the Digital Single Market). This could certainly support EU-wide technology dissemination, collaboration in innovation efforts and exchange of best practices across the EU. In this context, it is also important to emphasise the EU's role in supporting national governments to deal with the structural adjustment processes and social implications of digitalisation.

As in the past with mechanisation, and more recently with IT, embracing technological change will mean rapid change in the composition of the workforce and the demand for different types of skills: some occupations will disappear and others will emerge. This requires strong adaptation processes from the labour force, and in education and training programmes. European industrial policy thus requires a two-pronged approach: on the one hand, to be at the forefront of technology developments, tapping into the full potential of such new technologies and production processes in order to achieve productivity advances and improve living standards; on the other hand, to make a major effort also to deal with the human capital, distributive and adjustment challenges arising from the impact of rapid technological and structural change. EU support schemes to deal with these challenges and to facilitate EU-wide training programmes for new types of jobs, the harmonisation and recognition of qualifications, and the exchange of information regarding best practice in structural adjustment programmes and policies would be an important component of the EU's digitalisation agenda.

As covered in the quantitative assessment presented above, innovation support plays an ever-greater role in EU industrial policy. And while European innovation policy has improved immensely since its shaky beginnings in the early 1980s, there is one important shortcoming that needs to be addressed. At the moment European innovation-oriented industrial policy is targeted largely at the most advanced economies, companies and regions that are at the forefront of technological developments. Ideally, however, the EU's industrial policy should be conceived in a way that gives equal prominence to the developmental needs of those regions, countries and (industrial and company) segments that are not on (or close to) the global technology frontier: in other words, Europe's middle-ranked and peripheral regions, as well as countries that have to overcome massive structural challenges.

[26] See EPSC (2019). The German software company SAP may be an exception here.

[27] This is, for example, revealed by the Digital Economy and Society Index (DESI), available at https://ec.europa.eu/digital-single-market/en/desi

Some of these countries are seriously lagging or falling behind in economic development. Again, this assessment is supported by the figures: even though the cohesion countries benefit disproportionately from industrial policy-related support programmes from the EU budget –especially when the structural and investment funds are included – the share of R&D and innovation support going to the CEE member states is comparatively small. This is related to the tendering process through which R&D grants are allocated. While the open tendering process is doubtless a strong point in the design of EU R&D and innovation support programmes, it clearly favours countries with strong national innovation systems. Landesmann and Stoellinger (2019) have used the notion of *'appropriate (industrial and) innovation policy'* to emphasise that innovation policy has to target companies, regions and countries that are situated at different levels of technological know-how, so as to exploit the entire spectrum of innovation potentials in an economy.

Essentially, there are two ways to address this issue. One is to adjust the tender rules to ensure that research consortia that apply for Horizon Europe funds become more balanced geographically with regard to the participating institutions. This also implies developing and tailoring programmes that explicitly cover innovation activity to be implemented at different starting levels of technological know-how and capabilities. The alternative (but also complementary) approach is to refocus the ESIF towards creating and improving the national (and regional) innovation systems of (technologically) lagging member states and regions. At the national level, this would entail the creation of tertiary teaching institutions, like the European University Institute in Florence and high-quality institutes of technology in a number of other member states; but it would also support technical research agencies comparable to the Fraunhofer Institutes in Germany, with an explicit agenda that should include the design and execution of 'appropriate innovation policy'.

The emerging markets challenge

The dominance of EU industrial policy in support of technological leadership globally to some extent diverts attention from the challenge posed by catching-up economies and also from the cohesion process (discussed below). Both are crucial in the circumstances in which the EU (and closely connected neighbouring countries) currently finds itself. EU industrial policy needs to face up to the vital structural development issues that the European economy confronts in today's global environment. As recognised early on by authors such as Rosenstein-Rodan (1943), Hirschman (1958) and Gerschenkron (1962), such structural development issues have traditionally been at the centre of industrial policy strategies (see also Rodrik, 2009; Wade, 2012; Cimoli et al., 2009), and the EU would be well advised to reconsider their importance in the formulation of its future industrial policy initiatives.

The structural development issue is closely connected to the emergence of major new players in the global trade arena[28] – first and foremost China – because the greater overlap in economic structure between the CEE and Southern EU member states and emerging economies exposes them to fiercer competition. The key concern here is not the sectoral composition of economies that have strongly converged within the EU. Rather, it is the more recent functional and vertical dimension of specialisation that was opened up with the emergence of global value chains.[29] Recent empirical evidence in this

[28] Arguably, the CEE member states are also new actors in the global economy; but when referring to emerging economies we think of extra-EU partner countries.

[29] Functional specialisation refers to the specialising in specific segments of the value chain within an industry-specific value chain.

respect (Stöllinger, 2019; Timmer et al., 2019) suggests that the international division of labour with regard to value-chain functions (e.g. R&D, head office functions, production, back offices, etc.) within the EU continues to be very asymmetric, or in fact complementary,[30] with CEE member states specialising predominantly in production-related activities. In this respect, they resemble countries such as Mexico or the economies in the third and fourth rows of the South-East Asian 'flying-geese formation' (e.g. Vietnam, Laos or Thailand). Baldwin and Lopez-Gonzalez (2015) termed countries that specialise functionally in this manner 'factory economies', in contrast to 'headquarter economies', whose companies specialise predominantly in R&D and in organising global value chains.

For these reasons, it is not surprising that in terms of exports, the 'China shock' has affected the CEE and Southern European member states much more than the rest of the EU (Ciani and Mau, 2019; Celi et al., 2018). The industrial policy response to these developments has to be – just as with the challenge of new technologies – to support structural adjustment processes in a forward-looking manner: i.e. make sure that the competitive challenge from emerging economies in low-wage, simple-skill activities is countered by a targeted approach of 'upgrading' and 'upskilling', so that the increased presence of emerging economies in global trade, in global production networks and in competition for the production locations of big multinationals is countered by a move towards higher 'value-added' activities, accompanied by efforts to provide the appropriate skill structure of the labour force. Added to that must be the improvement in logistics and transport infrastructure, and also a strong emphasis on the quality of institutions (at local authority and national levels).

The emergence and integration of significant new players in the global economy gives rise to new competitive pressures, but also to an increased scope for research and business collaboration, supplemented by mobility schemes for researchers, scientists and professional staff. Europe has considerable strengths (and the EU has considerable experience of such schemes) in this area. This could be used as a lever for the development of mutually beneficial relationships with new partners. In this respect, the EU is relatively well placed, as it has less of a stake in terms of geo-strategic rivalry with China than do other advanced economies, such as the US, or Japan or South Korea (in the East Asian regional context).

The cohesion challenge

Closely linked to the stiff global competition posed by emerging economies, but still in itself a challenge, is the EU internal cohesion process. As has been emphasised throughout this paper, a lot of resources are dedicated to cohesion objectives via the EU's ESIF. Yet, despite the substantial amount of money spent on cohesion objectives, 'peripheralisation' has become a critical issue at both the regional and the country level. This development has contributed to the issue of 'North–South imbalances', and severe tensions have arisen with respect to the formulation of a proper fiscal and structural policy framework at the EU level to deal with such imbalances (see Celi et al., 2018).

The issue of external imbalances is closely related to the agglomeration of industrial activity (see Stehrer and Stöllinger, 2015), but also to the same phenomenon in other tradable activities (business services, financial centres; see also Landesmann, 2015 and 2019). Apart from the macroeconomic implications,

[30] The same is true of other tightly integrated regional blocs, such as the USMCA agreement (the former NAFTA comprising the USA, Canada and Mexico) and ASEAN in South-East Asia.

agglomeration phenomena have the inherent characteristic of giving rise to cumulative virtuous and vicious cycles that can deepen persistent disparities across European regions. Economic geography has pointed to such dynamic processes, where the concentration of economic clusters goes along – especially in the context of the single market and its four freedoms – with factor mobility, and thus with disparate demographic developments and the concentration of skills (people with high levels of training, competence and education) in some centres and the outflow of such skills from – and a deteriorating age profile in – other regions (e.g. Martin, 2008; Iammarino et al., 2019). This cumulatively saps development potential from peripheral regions and countries, and has been shown also to have strong political implications (Rodriguez-Pose, 2018). All these trends raise some questions about the effectiveness of the EU's cohesion policy and the ESIF, an issue on which the empirical evidence is still inconclusive.

As mentioned earlier, a very promising avenue for improving the effectiveness of the EU's cohesion efforts is the concept of smart specialisation, which has been incorporated in the ERDF, one of the major EU funds. As a territorial approach, the smart specialisation strategies of countries and regions supposedly favour the relatively poor countries of the EU – i.e. cohesion and CEE countries. But it remains doubtful whether this is actually the case in the context of the ERDF programmes, as several cohesion countries are struggling with numerous implementation issues related to existing deficiencies in their (political) institutions.

A direct way to deal with weaknesses in the institutional and managerial capabilities of regional and national authorities is to place an emphasis on improving the soundness and quality of regional and national institutions and policy-implementing authorities (through monitoring and incentive/sanctioning devices, as well as direct support to raise institutional quality). A further measure to tackle this issue could be to change the support mechanism of the ESIF from a grant-based system to a support system that relies on financial instruments, essentially EU-backed guarantees administered by the EIB and involving commercial banks that would provide the actual finance for eligible projects. This would reduce the role of political institutions in the selection and implementation process; but it might also make the support less targeted, which must be seen as a major disadvantage in an era where industrial policy aspires to be linked to missions and societal challenges.

The environmental challenge

The most recent and (arguably) the most pressing and fundamental challenge – one that extends far beyond industrial policy, and in fact beyond the economic sphere – is climate change and environmental protection more generally. This challenge has recently received due attention at the EU and the national level through the formulation of 'mission-oriented policies' and 'innovation policy' (i.e. policies directed at the technological leadership challenges), as well as within the context of regional policy (and thus under the schemes supported by cohesion funds) (European Commission, 2019).

As with S3 policies, it will be important to monitor the effectiveness of 'mission-oriented' policies (which take a systemic view of policy interventions) once they have been implemented for some time and can be evaluated. Given the comparatively strong regulatory framework in environmental issues, European industry is bound to adapt to and incorporate resource efficiency, emissions reduction and sustainability. The implications for the competitiveness of European industry of such a shift towards the desired circular

economy are as yet unclear, and are not the same across different industries. On the one hand, regulations that force firms to rely increasingly on sustainable or reusable goods (including packaging) may develop first-mover advantages in a series of new materials and technologies. On the other hand, several of these regulations will initially impose additional costs on firms producing within the EU. In a longer-term perspective, however, the balance can be expected to be positive, especially if the mission-oriented approach is successful and leadership in environmentally sustainable technologies can be obtained. Acting quickly in order to secure first-mover advantages could be vital in this respect, as the latest industrial policy strategies of Korea and China also clearly target 'green' technologies and green industrial policies more generally. Unfortunately, speed of action is not the EU's greatest strength. Still, the integration of mission orientation and smart specialisation into the EU's industrial policy formulation is an important step in the right direction. Ideally, we would see horizontal and vertical initiatives, as well as the supranational, national and regional levels of industrial policy interacting with each other to support the defined missions and the territorial approach demanded by the smart specialisation concept. The coming years will show whether EU member states are capable of moulding the various interests and objectives into well-defined missions, the achievement of which will help meet the key challenges ahead.

4. CONCLUSIONS

Apart from a general discussion of the industrial policy set-up in the EU and of the main challenges it faces, this paper has gone beyond the usual investigation of official documents to make a serious attempt to reveal the actual amounts spent on EU industrial policy and the priorities targeted by it. A first (and rather unexpected) finding is that the supranational level – while on average still subordinate to the state aid activities of national governments – has also become important. Especially for the CEE member states, the funding of industrial policy by EU programmes is of the utmost importance and is much larger than national expenditure. Given the substantial amounts disbursed via the EU's regional and structural funds, the overall industrial policy budgets for this country group are large, even by historical standards, and are comparable to those seen in the 1970s.

If one adds to the EU industrial policy programmes the European Commission's regulatory power in areas such as competition policy (including state aid, mergers and acquisitions, and public procurement) and trade policy, it is obvious that the EU level has become a central pillar, even if formally member states remain the primary actors.

The growing importance of the EU institutions in designing and implementing industrial policy is welcome, since none of the key challenges – ranging from technological leadership to environmental transformation – can realistically be met by any of the member states individually. The flip side of this is that the EU's industrial strategies as a whole, as well as individual programmes, need to be designed and implemented in a coherent and effective manner. With the incorporation of mission-oriented thinking about industrial and innovation policies, and at the regional level the concept of smart specialisation, the EU has made formidable progress in the formulation of industrial policy. In many instances, however, effective implementation of the sophisticated strategies is stymied by policy incoherence (with rival or even contradictory objectives) and by a host of programmes and initiatives, many of which lack critical mass. If the official announcements are to be believed, the upcoming budget period (2021-2027) will see a noticeable reduction in the number of programmes and the elimination of duplication.

With regard to policy priorities, the existing focus of industrial policy on R&D and innovation support is likely to remain, and these areas will be strengthened, according to the European Commission's current budget proposal for the period 2021-2027. What seems important here is that efforts in the realm of R&D and innovation policy should aim not only at the technological frontier and the leading edge vis-à-vis the USA (and increasingly China). Rather, in line with the initial smart specialisation concepts, R&D and innovation support also need to function as a policy tool for the EU cohesion countries. While this is fully acknowledged by official rhetoric, the actions on the ground seem to be different, as certain regions of the CEE economies (and laggards such as Bulgaria and Romania, in particular) are underrepresented in the various pilot projects and R&D co-operation initiatives within the smart specialisation strategy (e.g. when it comes to European innovation hubs).

An additional aspect of the EU R&D and innovation strategies is that they, too, suffer to a certain degree from an overload of rival programmes. While this may to an extent be understandable (given that such programmes are necessarily a compromise, reflecting the interests and priorities of all member states), it is necessary to have better-defined technological priorities, which are derived from a vision of the technological trajectory that European societies want to follow. This is where a mission-oriented policy comes into play again. How this trajectory may look can be gauged from national governments' industrial policy priorities, where the state aid figures clearly identify ecological transformation as the number one target.[31] In other countries, a concentration on avoiding a drift into a vicious cycle of 'peripheralisation', and on aiming instead for a more balanced pattern of economic development across the European Union, will be the priority.

Whatever member states decide that the missions should be (and they will be enshrined in the next R&D framework programme, the Horizon Europe programme), it should be clear that they need to be limited in number, and ideally not more than three or four at any one time. Otherwise, there is a risk that projects for the achievement of the missions will remain underfunded, and that the fragmented policy efforts will not develop to their full potential. Provided member states identify the missions and the underlying societal challenges, it is also likely that those projects at the regional level funded by the structural funds will be aligned with the defined missions. If the smart specialisation strategies work out, each region should find its niches in the key enabling technological domains needed to complete the missions. Hence, what is needed above all is consensus on the appropriate missions. If achieved, that would substantially support the EU's competitive position in tomorrow's industries.

[31] Translating 'green' industrial policies into missions therefore seems the logical next step. If industrial policies aim at altering the economic structure, then the shift towards a sustainable, less resource-intensive and circular economy based on renewable energies is the obvious policy target, given the pressing challenge of climate change and the policy priorities revealed by member states. To this one should add that the prevalence of multiple market failures in the context of a greening of the economy – including massive externalities and path dependencies favouring pollution-intensive technologies– makes a drive for ecological transformation the number one objective for a credible industrial policy at the European level.

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APPENDIX A.1. MAPPING OF BUDGET ITEMS IN THE MFF 2014-2020 TO THE INDUSTRIAL POLICY THEMES

The discussion of the EU's budgetary expenditure on industrial policy-related issues during the period 2014-2017 is based on a selection of items within the Multiannual Financial Framework (MFF) 2014-2020 which are subsumed in the realm of industrial policy. Table A.1 lists all budget items that were selected to qualify as industrial policy related.

Table A.1 / Industrial policy item within the MFF 2014-2020

Section in MFF	Description	Assigned industrial policy category
1.1.10	European Fund for Strategic Investment (EFSI)	Infrastructure
1.1.11	Implementation and exploitation of European satellite navigation systems (EGNOS and Galileo)	Sectoral policy
1.1.13	European earth observation programme (Copernicus)	Sectoral policy
1.1.31	Framework Programme for Research and Innovation (Horizon 2020)	RDI
1.1.4	Programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME)	SME
1.1.6	EU Programme for Employment and Social Innovation (EaSI)	Employment, education, training
1.1.81	Energy	Infrastructure
1.1.82	Transport	Infrastructure
1.1.83	Information and communications technology (ICT)	Sectoral policy
1.1.9	Energy projects to aid economic recovery (EERP)	Infrastructure
1.2.5	Youth Employment Initiative (specific top-up allocation)	Employment, education, training
1.2.6	Contribution to the Connecting Europe Facility (CEF)	Infrastructure
2.0.4	Programme for the Environment and Climate Action (LIFE)	Ecological
1.2.11	Less developed regions (Regional convergence)	Regional – for breakdown see Table A.2
1.2.12	Transition regions	Regional – for breakdown see Table A.2
1.2.13	More developed regions (Competitiveness)	Regional – for breakdown see Table A.2
1.2.14	Outermost and sparsely populated regions	Regional – for breakdown see Table A.2
1.2.15	Cohesion fund (incl. contribution to the CEF)	Regional – for breakdown see Table A.2

Source: European Commission at http://ec.europa.eu/budget/graphs/revenue_expediture.html

APPENDIX A.2. MAPPING OF THEMATIC OBJECTIVES IN THE ESIF TO THE INDUSTRIAL POLICY THEMES

For the budget items representing expenditure of the European Structural and Investment Funds (ESIF), additional information on the 'thematic objectives' of the funds was used. However, for these targets, only the figures from the projected expenditure, as allocated in the MFF 2014-2020, were available. This information was exploited to assign the regional policy expenditures to individual targets/objectives. The implicit assumption here was that the actual disbursements (both from the EU budget and national co-financing) have the same distribution across objectives as the projected amounts in the MFF 2014-2020. Since the classification of the MFF 2014-2020 does not allow a distinction to be drawn between expenditure under the European Social Funds (ESF) and the European Regional Development Fund (ERDF), these two funds are treated together, distinguished, however, by objectives. The data on regional fund allocations are to be found at: https://ec.europa.eu/regional_policy/EN/funding/available-budget/

Spending under the Cohesion Fund that was not found in the budget allocations is assigned to infrastructure, as it must be assumed that this spending is made in respect of the Connecting Europe Facility (CEF), which is also included in this budget item.

Table A.2 / Categorisation of the thematic objectives in the ESIF into industrial policy themes

Code	Target objective of structural funds	Assigned industrial policy category
1	Research & innovation	RDI
2	Information & communication technologies	Sectoral policy
3	Competitiveness of SMEs	SME
4	Low-carbon economy	Ecological
5	Climate change adaptation & risk prevention	Ecological
6	Environment protection & resource efficiency	Ecological
7	Network infrastructures in transport and energy	Infrastructure
8	Sustainable & quality employment	Employment, education, training
9	Social inclusion	Social
10	Educational & vocational training	Employment, education, training
11	Efficient public administration	Institutions
12	Outermost & sparsely populated	Social
TA	Technical assistance	Institutions
DM	Discontinued measures	Not assigned

Source: European Commission at https://ec.europa.eu/regional_policy/EN/funding/available-budget/

For national co-financing, no actual numbers are available. Therefore, the ratio of budget allocations between EU financing and national co-financing was assumed also to prevail for the actual financing.

IMPRESSUM

Herausgeber, Verleger, Eigentümer und Hersteller:
Verein „Wiener Institut für Internationale Wirtschaftsvergleiche“ (wiiw),
Wien 6, Rahlgasse 3

ZVR-Zahl: 329995655

Postanschrift: A 1060 Wien, Rahlgasse 3, Tel: [+431] 533 66 10, Telefax: [+431] 533 66 10 50
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Offenlegung nach § 25 Mediengesetz: Medieninhaber (Verleger): Verein "Wiener Institut für Internationale Wirtschaftsvergleiche", A 1060 Wien, Rahlgasse 3. Vereinszweck: Analyse der wirtschaftlichen Entwicklung der zentral- und osteuropäischen Länder sowie anderer Transformationswirtschaften sowohl mittels empirischer als auch theoretischer Studien und ihre Veröffentlichung; Erbringung von Beratungsleistungen für Regierungs- und Verwaltungsstellen, Firmen und Institutionen.

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