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A Toolbox for EU-CEE Countries

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Abstract

The EU member states of Central Eastern Europe (EU-CEE) have experienced rapid convergence in the decades following their EU accession, and have built up strong export-oriented manufacturing sectors boosted by foreign direct investment inflows. While this growth model has brought many positives, there are indications that it is hitting its limits. Endogenous limits to EU-CEE's growth model are exacerbated by exogenous challenges of the 'twin' (green and digital) transitions, and the fallout of the pandemic and Russian invasion of Ukraine.

This reinforces the imperative for EU-CEE to transition to a more innovation-driven, new growth model, enabled by a comprehensive industrial policy. However, the EU-CEE countries have not only lacked a stable and strategic approach to industrial policy in their development paths, but also find themselves in a unique position due to EU membership. As a result, innovation and industrial policies are underdeveloped in the region. Based on an in-depth analysis of the industrial landscape and the industrial policy environment of the region, we propose eight pillars for creating a EU-CEE version of the entrepreneurial state.

Keywords: industrial policy, EU-CEE, convergence, transition, green, digital

JEL classification: L52, O25, F63, L60, P27, O40

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PART B – COUNTRY BRIEFING

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LIST OF ABBREVIATIONS

ADP	Advanced digital production
BERD	Business expenditure on R&D
CESEE	Central, Eastern and Southeastern Europe
CVM	Cooperation and Verification Mechanism
DESI	Digital Economy and Society Index
DII	Digital Intensity Index
EBRD	European Bank for Reconstruction and Development
EDRF	European Regional Development Fund
EIS	European Innovation Scoreboard
EU-CEE	Central Eastern European member states of the EU (Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia)
EU-SEE	Southeastern European member states of the EU (Bulgaria, Croatia, Romania)
FDI	Foreign direct investment
GDP	Gross domestic product
GERD	Gross expenditure on R&D
GVC	Global value chain
ICT	Information and communications technology
IoT	Internet of things
IPCEI	Important Project of Common European Interest
JIC	South Moravian Innovation Centre
MNE	Multinational enterprise
NKU	The Supreme Audit Office of the Czech Republic
OEC	The Observatory of Economic Complexity
OECD	The Organisation for Economic Co-operation and Development
OEM	Original equipment manufacturers
R&D	Research and development
RIS3	Regional Research and Innovation Strategies for Smart Specialisation
RRF	Recovery and Resilience Facility
SME	Small and medium-sized enterprise
SOE	State-owned enterprise
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization
V-Dem	Varieties of Democracy Institute
WDI	World Development Indicators

PART A

COMPARATIVE REPORT

Executive summary

The Central Eastern European member states of the EU (EU-CEE) have been one of the best performing parts of the global economy for the past 20 years, and achieved impressive catch-up with developed Europe. This was supported by structural reforms as part of the EU accession process, and a deep integration into global value chains (GVCs), most notably in the production of vehicles and electronics. The Visegrád countries and Slovenia belong to the top 30 most competitive manufacturing exporters in the world according to UNIDO, and the OEC's economic complexity index ranks Slovakia, Hungary, Slovenia and Czechia in the top 20 most knowledge-intensive product exporters in the world.

EU-CEE's FDI-led and export-oriented manufacturing focus has brought many positives, but there are indications that this growth model is hitting its limits. Following the rapid catch-up in the 2000s, convergence plateaued especially in the more developed, manufacturing-oriented EU-CEE economies. While productivity growth rates still remain generally above the EU aggregate, this gap has been closing. In a previous study, we argued that this was at least partly due to the over-specialisation in production and limited progress toward more sophisticated activities within value chains. We hypothesised that this could be evidence of an EU-CEE-specific version of the middle-income trap.

Endogenous limits to EU-CEE's growth model are exacerbated by exogenous challenges of the 'twin' (green and digital) transitions, and the fallout of the pandemic and Russian invasion of Ukraine. EU-CEE's adaptation to these changes represents a mixed picture at present. While there is a need to accelerate the 'green convergence' of the EU-CEE, the shares of electric cars in total car exports have notably grown in recent years and FDI in battery production and electric car assembly is flowing. Still, the Russian invasion of Ukraine will leave energy prices higher for several years, posing grave risks to EU-CEE's external competitiveness. Meanwhile in the digital sphere, the level of digitalisation of industry is above the EU and often even the German average in Slovenia and the Visegrád countries. However, most strategic decisions remain in the hands of Western European capital owners and there is limited transfer of R&D activities to EU-CEE, strengthening the region's existing development challenges.

This reinforces the imperative for EU-CEE to transition to a more innovation-driven, new growth model, enabled by a comprehensive industrial policy. Currently, innovation and industrial policies are underdeveloped in EU-CEE countries**.** Even in the cases where a vertical approach to FDI promotion is attempted, the sectors are often very widely defined. Meanwhile expenditures on R&D are well below Western EU nations across all EU-CEE. There are major divergences across the region in the availability of equity financing for young innovative firms. While Estonia leads by EU comparisons when looking at the volume of venture capital financing relative to the size of the economy, this channel is practically non-existent in Slovenia, Romania, or Poland. EU-CEE countries account for only a small fraction of innovation by the lens of the total globally granted patents, and no EU-CEE country is presently considered an innovation leader in the European Innovation Scoreboard.

Furthermore, when it comes to industrial policy, the EU-CEE countries find themselves in a unique position due to EU membership. This creates both constraints (state aid rules, competition policy) and opportunities (funds, participation in research networks). Importantly, industrial policy has taken on much more prominence within the EU in recent years, making it easier now than in the past for EU-CEE countries to scale up their state entrepreneurship. Still, the fact remains that EU-CEE countries' priorities and needs do not necessarily align with those of wealthier EU member states: EU-CEE countries were significantly underrepresented in Horizon 2020, and are likely to face similar challenges in other common EU industrial policy pillars as well, including the European Chips Act or the associated Chips for Europe Initiative. This fact limits the potential of joint EU policy instruments to bring about industrial upgrading in EU-CEE.

As the state capacity and quality of institutions varies widely across EU-CEE, states will need to be realistic about setting their own industrial policy and smart specialisation goals. Some countries, especially Bulgaria and Romania, have weak institutions and remain far away from Western European levels, while some others match or get close to German levels. However, successful past examples of effective industrial policy from Asia indicate that fully democratic systems are not full pre-requisites for effective industrial policy. Various measures can be employed to ensure discipline and accountability in countries with weaker institutions. Moreover, the strictures of EU membership itself can help to enforce some of the required scrutiny of institutions, even if this has not always worked fully in the past.

We propose eight key pillars for creating a EU-CEE version of the entrepreneurial state. First, a defining feature of an entrepreneurial approach is the creation of a collaborative network and a constant feedback loop between key ministries, academia, business agencies and the private sector. Within this forum, new ideas can be financed, tested, assessed and then adjusted and developed further. This should be tied concretely to national innovation systems. Very little of this exists at present. Therefore, EU-CEE countries need to define for themselves the sectors and business functions to be promoted and cultivated, instead of relying solely on external market forces to decide on the prosperity of individual sectors.

Second, EU-CEE countries should maximise the absorption of EU money and participation in EU research networks to drive industrial policy. Aiming to participate more widely in Horizon Europe or IPCEI is particularly important for the technologically less advanced countries of the EU. Moreover, EU-CEE countries benefit largely from the financial inflows from the common budget, also towards industrial policy objectives. Countries must improve their absorption and use of EU funds (there are some promising signs in this regard). Moreover, making full use of EU membership entails actively engaging in industrial policy debates at the EU level, to ensure EU-CEE interests are taken into account.

Third, EU-CEE countries should learn from each other's successes to emerge as frontrunners in the digital economy. While Estonia can be regarded as the natural blueprint, this is by no means the only positive example: the share of ICT graduates in Romania and Croatia, the digital startups from Czechia, the quality of public e-services in Baltic countries, or the adoption of ADP technologies through MNEs by the Visegrád countries and Slovenia all represent good practices to follow. At the same time, policies addressing the divide between smaller and larger firms need to be adopted, including IT-upskilling schemes, promotion of lifelong learning, expanding e-commerce and remote work possibilities, or helping SMEs with a digital presence.

Fourth, EU-CEE countries should align FDI incentives with national industrial policy and innovation strategies. MNEs represent main agents of innovation and core channels through which state-of-the-art managerial, organisational and technological know-how is disseminated across borders. However, rather than providing umbrella support to MNEs, EU-CEE countries need to strategically consider the sectors and business functions they want to attract, tying FDI incentives to a coherent industrial strategy. Much more thought must be given to how to increase the spillovers from big FDI projects across the economy, in order to build a network of domestic suppliers and customers around the incoming investor. Such spillover-generating policies could be comparable in their form to export promotion policies.

Fifth, EU-CEE countries should look for promising niches. As active industrial policy interventions are gaining momentum across the globe, it has also augmented the risk of overcapacity and inefficiency. Semiconductors stand out most prominently in this regard, which given the technological constraints of EU-CEE countries, are unlikely to present a viable path for diversification and upgrading. In this sense, EU-CEE policymakers are better off identifying promising sophisticated niche areas, and lift up and nurture these sectors. The likelihood of success is naturally augmented if these niches build on existing traditions.

Sixth, EU-CEE countries should improve their institutions. In recent years, the capacity and quality of institutions in some EU-CEE countries has been deteriorating. East Asia offers many examples of how to improve institutional capacity to support an entrepreneurial state, even in situations where state capacity overall is not at North-western European levels. The EU can play a more active role in incentivising improvements in governance through the ‘carrots’ and ‘sticks’ it has at its disposal. The quality of institutions presents a particular challenge when talking about local authorities. Supporting the emergence of a few peripheral success stories can have an important demonstration effect for many comparable regions.

Seventh, EU-CEE countries must manage the distributional consequences of structural change, to make sure that their populations do not bear the costs. The restructuring of EU-CEE economies in the light of the twin transition will require increased resources to be allocated to re-skilling programmes and income support. Special attention should be paid to workers in declining sectors, older workers, those with lower digital skills, those in rural areas, and employees of smaller firms. In this context, inspiration can be drawn from Scandinavia, whereby a flexible labour market was coupled with the provision of a sound safety net to ease the transition.

Finally, it is important for EU-CEE countries to tailor industrial strategies to their specific situation. Despite many common threads, these economies differ in many important dimensions. The Baltic countries skew towards services-oriented growth, and are quite well-positioned for the digital transformation. The main challenges for them will be the distributional implications of a digital-led growth, and negative demographic trends which deplete human capital. In Czechia, Poland and Slovenia, the focus should be on the switch from imitation to innovation. The cultivation of a National Innovation System, wider participation in common EU projects, and human capital aspects stand out most prominently. Despite a similar industrial structure, Slovakia and Hungary lag somewhat behind on key development indicators. Building on the presence of MNEs and focusing on spillovers to the domestic economy, as well as diversifying the sectoral and functional structures, need to be prioritised. Finally, in the case of the countries most behind the technological frontier (Bulgaria, Croatia, Romania), the priority is on importing knowledge and capabilities in a strategic way. Moreover, identifying opportunities to leapfrog to offset any development latecomer and geographical disadvantages proves especially relevant.

1. Introduction

The Central Eastern European member states of the EU (EU-CEE) marked impressive advancements in their socio-economic developments over the past decades, to the extent that they can be regarded as one of the most dynamic regions since the turn of the millennium. Following the initial shock of the early 1990's, the EU-CEE countries positioned themselves on a robust growth path, posting on average about three times the GDP growth rates of Germany between 2000 and 2007, and even reaching double digit growth in some instances. This dynamism helped facilitate convergence across the EU, and former socialist countries such as Czechia or Slovenia now even surpass a number of pre-2004 EU member states in their GDP per capita levels[1] (Grieveson et al., 2021). Along with important structural reforms and institutional changes facilitated by the eastward enlargement of the EU, the deep integration of EU-CEE countries into regional and global value chains (GVCs) played a crucial role in this catch-up process. The EU membership tore down barriers for foreign investors, keen to take advantage of the EU-CEE's relatively cheap yet qualified labour force. With the influx of foreign direct investment (FDI), most notably in the production of vehicles and electronics, the region became an integral part of what can be called the 'Central European Manufacturing Core' (Stehrer and Stöllinger, 2015).

From an industrial development perspective, such transition trajectory could be perceived as a success story: the Visegrád countries and Slovenia belong to the top 30 most competitive manufacturing exporters in the world today (UNIDO, 2020). Moreover, EU-CEE's exports are relatively sophisticated: the OEC's economic complexity index ranks Slovakia, Hungary, Slovenia and Czechia as top 20 most knowledge-intensive product exporting countries in the world, with Czechia taking the 8th place, above Austria or France[2]. Yet, as we highlighted in Grieveson et al. (2021), there are emerging fault lines in the EU-CEE's FDI-driven industrialisation process. The period following the Great Recession has seen unimpressive labour productivity growth along with a somewhat slower, and in some cases even derailed convergence process.

A key contributing factor to the post-2008 convergence slowdown in EU-CEE is the countries' almost pure positioning as 'factory economies'[3], and a struggle to occupy the more sophisticated stages within manufacturing value chains (Stöllinger, 2021; Grieveson et al., 2021). Considering their level of economic development, and based on a global sample, we found previously that EU-CEE countries are extremely over-specialised in production (Grieveson et al., 2021). Based on these previous results, and in line with the findings of others working on the region's economic development trends, we hypothesised that this could be evidence of an EU-CEE-specific version of the middle income trap (e.g. Győrffy, 2022; Grieveson et al., 2021; Fidrmuc et al., 2020).

The need for EU-CEE countries to break out of their possible middle income trap coincides with a time when the global economy seems to be undergoing its most momentous changes since at least 2008. The COVID-19 pandemic stimulated an increase in digitalisation of the economy that could otherwise have

1 Expressed in purchasing power parity terms

2 See OEC's Economic Complexity Index 2020: https://oec.world/en/rankings/eci/hs6/hs96

3 Using the distinction of 'factory' and 'headquarter' economies proposed by Baldwin and Lopez-Gonzalez (2015).

taken decades, while the supply chain disruptions that emerged in its wake stimulated trends towards near-shoring of production that are likely to see a fundamental re-shaping and to a large extent regionalisation of supply chains. Both of these developments will have serious implications for EU-CEE countries.

However, the most fundamental change in the global economy in recent years has been caused by the Russian invasion of Ukraine and ensuing sanctions. First, it has led to the highest inflation for decades, forcing central banks to abruptly tighten monetary policy, driving up borrowing costs sharply, and dramatically reducing the policy space that many EU-CEE countries had previously been able to use to limit the COVID-driven downturn in 2020. Second, the invasion and its fallout has led to a fundamental change in the European energy landscape that looks set to be long-lasting. European gas prices look set to remain several times higher than historical levels for many years, putting huge pressure on the energy-intensive industry of EU-CEE, and revealing the vulnerabilities of such heavy reliance on external sources of energy. Combined with the ever more obvious climate crisis, the energy shock caused by the war has increased the urgency of the green transition. Carbon-intensive sectors will need to undergo a rapid shift to more sustainable energy sources and practices. The challenges of this are huge for EU-CEE countries, which are heavily engaged in carbon-intensive processes and struggling to converge to EU levels from an environmental standpoint (Römisch, 2022).

From this point, it is possible to tell two distinct narratives about the future of EU-CEE. One is that the region is indeed in a trap, and will not be able to break out of it. Its future is therefore as a region of upper-middle-income countries, forced to hold down wages to remain competitive enough to attract FDI into production, and struggling to develop serious capacities in the more lucrative parts of the value chain. Moreover, as energy prices stay high for many years, EU-CEE struggles to attract much new FDI, losing out to regions with much lower energy costs. Meanwhile as its working age population shrinks, and it cannot match the Western European pace of adaptation to the green and digital transitions, convergence with wealthier Western economies becomes ever-more difficult.

There is, however, a second narrative, which is much more positive and in our minds is also eminently realistic for the region. Emerging from the findings of our previous study (Grieveson et al., 2021), we formulate a hypothesis that EU-CEE has plenty of options to break out of its ‘trap’, and that a new growth model—which would allow the region to broaden its function specialisation, tackle the green and digital transitions, and thereby achieve the next stage of convergence with Western Europe—is achievable. Our previous work on EU-CEE’s ‘functional specialisation trap’ left us with a fairly clear idea of what the basic contours of this new growth model would be. Having successfully secured a place in the global production network, EU-CEE’s transition to the next development phase requires climbing up the task hierarchy within GVCs (Landesmann and Stöllinger, 2019). This means, most fundamentally, that the region’s economies need to become more innovative. However, our findings that these functional specialisation patterns do not change over time makes it clear that the process will not be organic; it will require a fundamental overhaul of the policy setup in the region. This is especially the case given the need to undertake a transition towards a more innovative growth model at the same time as the whole of the EU grapples with a rapid energy transition and radically changed inflationary backdrop. We already hypothesised in a previous study that EU-CEE economies needed to develop in the direction of an ‘entrepreneurial state’ with a ‘national innovation system’: only with strategic planning and coordination between key ministries, academia, business agencies and the private sector can a true leap forward in the economy’s innovative capabilities be achieved.

Up to this point, the way forward in this second narrative seems quite clear. Yet as the experiences of a multitude of emerging countries reveal, building up sufficient technological capabilities to generate more domestic innovation and join the group of frontier economies represents a formidable challenge. A historical examination reveals that none of today's advanced countries have managed to achieve this without the active use of industrial policy in their development paths (Chang, 2003). During the past 30 years, industrial policy has played a minor if any role in EU-CEE (Popov, 2020), and it is our strong contention that given the developmental challenges and external shock, this will have to change.

Indeed, industrial policy is becoming an issue of growing importance in the EU as a whole, augmenting the public policy space to shape markets and coordinate economic activity towards greater societal goals (Mazzucato, 2016). The potential reshuffling of the global economic landscape as a result of the megatrends is an important contributing factor to this revival of industrial policy. The mobilisation of resources and shifting policy narratives is also suggestive of the unease of most developed economies from the new economic paradigm, in which the leading positions of countries are not yet strongly entrenched. New technologies that are emerging from the green and digital transitions, including artificial intelligence, additive manufacturing, cloud computing, renewable energy production, or alternative fuel vehicles, have unleashed an international race to occupy the 'commanding heights' of these value chains before others do (Wade, 2018; Chang, 2019). It is therefore this question—how to design an appropriate industrial policy to drive the next stage of economic convergence in EU-CEE—that we want to explore more concretely in this study.

When it comes to industrial policy, the EU-CEE countries find themselves in a unique position amongst emerging economies, as they must navigate the complexities of industrial policymaking within the context of EU membership. Undeniably, being a part of the EU has brought along an immense development boost, and cohesion policy instruments continue to target the convergence of lagging regions. EU membership can also contribute positively to elements of industrial policy. As well as large access to EU funds (increasingly so in the context of the RRF), EU state aid rules makes many exceptions for R&D and innovation spending, and the access to research collaboration such as Horizon programmes can further support more innovation as part of industrial policy. On the other hand, competition policy strictly constrains the scope for traditional 'protectionist' measures which have proven effective in numerous instances, most notably in the case of East Asia, but also in the development of Western European countries. Therefore, the decisive first step that the EU-CEE countries must take on their path to a new growth model is to strategically evaluate their options and prepare an appropriate industrial policy toolkit taking into account the very specific EU-CEE context.

EU-CEE finds itself at a crossroads: standing idle risks heading down an obsolete growth path and becoming stuck in the present development stage. Embracing the window of opportunity and stepping up the industrial policy agenda can equate to emerging as serious challengers to the status quo. The aim of this report is to guide EU-CEE policymakers in undertaking the latter. This involves making the best possible use of the policy space available at the national level, taking full advantage of the benefits that arise from being a part of the EU, while at the same time steering the industrial policy discussions at the EU-level to one that would better consider the position and capabilities of the EU-CEE (Landesmann and Stöllinger, 2019). Our aim is to contribute ideas that will see the region's economies continue to grow, to create new and better jobs, with rising living standards, and further convergence towards Western European per capita income levels.

The remainder of this report is structured in the following way: Section 2 lays the groundwork by defining industrial policy, introducing it in the EU context, and drawing key lessons that can be learned from past successful industrialisers, most notably in East Asia. Section 3 maps the EU-CEE's industrialisation experience and its current state of play, with a particular focus on green and digital aspects, in order to identify most promising growth areas, along with key areas of vulnerability. Subsequently, Section 4 dives deep into the discussion of flagship industrial policy instruments presently available to EU-CEE countries at the EU, national, as well as sub-national levels, and how they could be more effectively deployed. Pinpointing EU membership as the defining element of the EU-CEE region's development track, it discusses key considerations that this reality brings about from an industrial policy perspective, some encouraging and some challenging. Consolidating the key insights of the previous sections, Section 5 then outlines policy recommendations for the EU-CEE as it embarks on a new growth path, encouraging changes in the national but also in the EU industrial policy discourse. Finally, we also provide country-specific briefing notes for each of the 11 EU-CEE economies, highlighting each country's unique strengths and weaknesses, combined with country-specific policy insights.

2. Background: industrial policy as a catalyst for growth

If one were to ask a number of economists to define what they mean by industrial policy, each would likely give a different account of the scope of interventions the term covers. This lack of consensus on what constitutes industrial policy would likely even result in the divergence of opinions as to whether a certain country does or does not currently engage in industrial policy. For the purposes of this report, we take a relatively wider view on industrial policy, to mean any type of selective measure that serves to catalyse growth-enhancing structural change (Pack and Saggi, 2006). The core objective of industrial policy can then be framed as the fostering and the accumulation of productive capabilities (Andreoni and Chang, 2020).

Following the above definitions, we suggest that the focal point tends to skew towards the promotion of primarily, though not exclusively, sectors within manufacturing and its related business services, particularly for catching-up economies. The nature of tasks carried out in these sectors makes them particularly prone to economies of scale, both static (i.e. decreasing unit production costs with expanding output), and dynamic (i.e. a 'learning-by-doing' effect and associated implications on productivity and innovation) (Pieper, 2003). At the same time, these innovation-driven productivity gains are able to spread to the rest of the economy in a superior way through the multitude of linkages the sector has, both from the supply and demand side (Andreoni and Chang, 2016). With the rise of geographically dispersed production processes and constantly advancing digitalisation, certain exceptionally dynamic services - often tightly linked to manufacturing value chains, emerged. As a result, parts of the service sector have become increasingly 'industrial' in their nature, characterised by high tradability and productivity. Hence, the overall focus here is on structural change from stagnant, 'traditional' sectors to highly productive, 'progressive' sectors of the economy (Baumol, 1967), without necessarily constraining the discussion to *industry* in its literal meaning of the word.

2.1. THE EVOLUTION OF INDUSTRIAL POLICY IN THE EU CONTEXT

Industrial policy admittedly represents somewhat of an uncharted territory for EU-CEE countries. These countries have found themselves on different ends of the spectrum over the years, experiencing a command economy as well as a mostly laissez-faire stance, yet have lacked a constructive approach to industrial policymaking in their development trajectory so far. Under the socialist regime, the government fully took on the role of resource allocation through economic planning, which resulted in the deformation of the economic structure and hindered entrepreneurship (Grieveson et al., 2021). Though this arrangement could be regarded a form of a highly top-down industrial policy through which some industrial capabilities were accumulated, it lies far from an 'entrepreneurial state' approach, which does not replace market actors in making their own decisions, but actively steers the direction in which to develop.

As the EU-CEE countries emerged out of socialism and became a part of the EU, the bulk of the industrial policymaking was passed on to the European Commission to become the domain of common EU policy. More specifically, industrial policy in the EU is founded on Article 173 of the Treaty on the Functioning of the European Union ('Treaty'). Based on the grounding of the Treaty, the objective is for the EU and its member states to commit to the promotion of industrial competitiveness, structural change, development of small and medium-sized enterprises (SME), as well as innovation through research and development (R&D). To ensure industrial policy does not stand in conflict with competition policy, it is coordinated at the EU level, emphasising the importance of a level playing field. In this sense, the single market is viewed as the bedrock of the EU industrial policy, promoting competitiveness above all through openness and deep integration across member states (Terzi et al., 2021).

Consequently, industrial policy as defined in the EU Treaty can be predominantly linked to so-called 'horizontal' policies, which do not aim to target specific sectors or entities, but rather intend to provide umbrella support for improving fundamental economic conditions (Peneder, 2017). The idea is to foster the standard necessary growth ingredients, including macroeconomic stability, human capital, sound infrastructure, or a conducive business environment (Cherif and Hasanov, 2019). As a result, when one speaks of industrial policy in the EU context, the reach can be often truly wide-spanning, to cover aspects such as innovation policy, SME policy, trade policy, competition policy, infrastructure, education/training policy, or even environmental policy.

By contrast, industrial policy in the *selective* sense as we defined above, has been largely muted from mainstream EU debates. This can be attributed to ideological misalignments between active state interventions and the economic philosophy dominant since the 1980's. Known as the Washington Consensus[4], the core idea was for the market to take charge of deciding the prosperity of different sectors (Barlett, 2014). The ex-command EU-CEE economies were particularly disciplined in taking on this laissez-faire philosophy: for one, having just divorced from central planning, they were quite keen to minimise the role of the state and embark on a free-market reform guided by international institutions. Moreover, the restructurings necessary for the EU accession have themselves internalised a flavour of the Washington Consensus, setting a policy direction for the candidate countries looking to join the single market (Howard-Jones and Hölscher, 2020).

In recent times, however, this long-held, purely horizontal approach towards industrial policy began to show signs of change. Notably, the EU became more targeted in its interventions aimed at growth-enhancing structural change. Such a more assertive stance towards industrial policy began to be especially visible since the early-2010's, whereby the European Commission upgraded industrial policy to become one of the seven core initiatives of the EU, and gradually opened up the policy space to also encompass '*vertical*', sector-specific initiatives (Peneder, 2017). Since then, the EU shows no intention to turn back from a more explicit and selective approach to industrial policymaking. In 2020, the European Commission has published its Industrial Strategy, updated following the COVID-19 crisis in 2021, laying out its objectives to take a leading role in the greener and more digital future amidst pursuing an 'open strategic autonomy' (European Commission, 2021a). While the openness of the single market continues to be at the centre of the EU approach, the EU's communication also makes explicit mention of specific industry 'ecosystems' and plans to rid itself of strategic dependencies in value chains (European Commission, 2021a). In an even bolder move, in 2022, the European Commission

[4] A term originally coined by Williamson (1990).

has unveiled changes to the Communication on state aid rules related to so-called 'Important Projects of Common European Interest' (IPCEI) (European Commission, 2021b). IPCEI are defined as such that have the potential to make a substantial contribution to EU's growth and industrial competitiveness, and given their risk-structure, would be underfunded if left alone to market mechanisms (European Commission, 2021b). As a result, IPCEI can receive direct public financial support from individual EU member states that collaborate in the specific projects, without being subject to scrutiny from competition policy. Following this reasoning, IPCEI can be regarded as a stimulus for EU member states to increasingly take on the role of 'entrepreneurial states', which in the light of high uncertainty, step in to foster the creation of new production and innovation capabilities (Mazzucatto 2013). In this way, emerging sectors such as hydrogen technology value chains or battery value chains have so far received direct government support (European Commission, 2021c; European Commission 2022a).

These developments at the EU level mirror the greater shifts in global sentiment regarding the state's role in industrial restructuring. The more open stance towards industrial policy in general can be linked to the changing operating conditions in the global economy: having seen the vulnerabilities that emerge out of an unregulated market following the Great Recession, coupled with China's rapid rise, and the urgent need to accelerate the green and digital transitions, economies dared to become more vocal about their industrial strategies (Chang, 2019). We argue this paradigm shift is to the benefit of the EU-CEE countries, as it expands the available policy and investment space to kick-start growth in the region, and if well-managed, the green and digital restructuring has the potential to open up leapfrogging opportunities.

In this sense, the key question of interest today turns from *whether* to engage in industrial policy to the issue of *how* (Rodrik, 2008). Yet, the 'how' question to industrial policy is quite a novel one to ask for EU-CEE policymakers: given the opening up of the EU-CEE coincided with the ascendency of the Washington Consensus, industrial policy objectives have not taken on a stable role in economic policy thus far in the development trajectory of the EU-CEE countries. Hence, as the EU-CEE countries look to advance with an industrial strategy of their own, we first take a step back and turn to past successful users of industrial policy in the next section, outlining how their experience could be related to the contemporary EU-CEE context.

2.2. DRAWING ON PAST SUCCESSES FOR STRATEGIC GUIDANCE: THE EAST ASIAN EXPERIENCE FROM THE LENS OF CONTEMPORARY EU-CEE

Unsurprisingly, finding the right industrial policy mix that would steer an economy towards sustained prosperity is an elusive quest. Indeed, following a minimax logic, inaction has been for a long time framed as the superior alternative to the cost of failed targeted interventions, as we have outlined. As Rodrik (2008) emphasises, no other policy sphere has been prone to the same reasoning: be it healthcare, schooling, or infrastructure provision, decision-makers' attitudes have always been proactive even in the light of occasional failure.

East Asian economies emerged most prominently in recent history as pioneers challenging this hesitant perception, and their 'miraculous' experience has been studied repeatedly and extensively. Between mid-1960's and 1990's, the East Asian countries of South Korea, Japan, Singapore, Taiwan, and Hong Kong all experienced decades of rapid and persistent growth (Page, 1994). In this time, they grew

roughly 5 to 6% annually—a pace the EU-CEE managed to uphold only for a few consecutive years even at its peak in the years leading up to 2008. While there were elements unique to each of the East Asian economies discussed here, the distinct role of the state has been pinpointed as the common defining feature of their development model (Page, 1994). This entailed active use of vertical industrial policy, including the cultivation of 'national champions' through infant industry protection, use of state ownership, tax advantages, preferential access to finance and targeted infrastructure building.

It may appear on the surface that the geo-economic characteristics of countries such as Singapore or Hong Kong are so unique that their experience offers little relevance for contemporary EU-CEE countries like Poland or Romania. Moreover, one would rightly argue that even despite EU's recent move towards more selective industrial interventions, protectionist policies utilised by these countries are simply out of reach for national policymakers of EU countries, as they must operate within the realm of Competition Policy. This is certainly true, but it does not imply that some pivotal elements of the East Asian experience cannot inform today's EU-CEE industrial policymaking. On the contrary, we suggest the following features that characterised the East Asian strategy can offer valuable insights for EU-CEE as it conceptualises suitable industrial policies for its next growth chapter.

i. Building up capabilities through global value chains

Like the EU-CEE, East Asian countries also represent major players in manufacturing value chains. Taking the size of exports relative to the size of their economies, countries from both of these regions come out together as some of the most open countries in the world. Hence, it is important to emphasise that proactive industrial policy does not equate to being closed off from forces of globalisation. Rather, the technological and organisational capabilities imported through the presence of multinational enterprises can offer a vital economic boost to converging countries, and they ought to be leveraged as much as possible. Here, the experience of Singapore can be particularly informative. As stressed by Chang (2019), incoming foreign direct investment (FDI) was an especially important component of Singapore's industrial upgrading. However, FDI policies were carefully aligned and integrated with an overall industrial strategy, to offer a long-term vision and coherence across different policy spheres. In this sense, following careful deliberation regarding the particular skills the country wants to develop, the government took a highly strategic approach to FDI promotion, which represented an indispensable component of its industrial policy. Rather than resorting to broad-ranging monetary incentives for incoming investors, sectorally targeted measures were preferred, which included investments for building up suitable infrastructure specific for the given sector. This was complemented by tailored technical and vocational education systems (UNCTAD, 2011). Furthermore, FDI policy was tightly linked to the country's innovation strategy, and formed a part of a greater policy mix aimed at GVC participation and upgrading. In this way, the goal was to create a holistically attractive environment for investors from preferred sectors, which would organically result in the agglomeration of productivity-enhancing industries in the country. In turn, the integrated policy environment would proceed to focus on spillover effects in the form of skill and technology transfer, as well as linkages with domestic firms (UNCTAD, 2011).

Likewise, in more recent times, Thailand's relative success in the automotive sector was achieved through strategically linking up local producers to the global production network, leveraging mainly Japanese inward FDI (i.e. FDI coming into the country) (Lee et al., 2021). Thailand relied on a 'join strategy', whereby local component producers specialised in certain narrowly-defined market segments,

and built up competitiveness in this niche to be able to supply foreign factories present in the country (Baldwin, 2016). China has also relied significantly on inward FDI for gaining access to the know-how and capabilities of technologically more advanced economies. Putting aside the joint-venture requirements imposed on foreign manufacturers, which hardly offers a realistic example for EU-CEE, the significance of China's FDI strategy also lies in the strong emphasis placed on linkages with the domestic economy (Chang, 2019). While the EU-CEE countries admittedly do not come anywhere close to China's market size, the region still offers solid leverage for skewing the conditions of incoming investments to better suit its development needs. As the econometric study by Jovanovic et al. (2021) shows, the ability of individual East Asian, and Central, Eastern and Southeastern European (CESEE) countries to attract FDI does not necessarily depend on monetary considerations like wage differentials, but is rather related to differences in the quality of transport infrastructure, governance, education, and fiscal stability. In this sense, the EU-CEE countries can set aside the view that investors need to be rewarded as much as possible to locate in their countries, and rather nurture and take full advantage of the key levers that favourably sets apart EU-CEE from other emerging economies.

ii. Long-term vision combined with agility

A pivotal element to the East Asian success lies in its upgrading to sophisticated sectors, far beyond these countries' initial comparative advantages (Lin and Chang, 2009; Cherif and Hasanov, 2019). This notion of going against the age-old economic principle of comparative advantage, which would suggest a country to specialise in the tasks it is presently relatively better at doing, is obviously a formidable task, and requires policies with an impact range well beyond a few political cycles. Given the aim of industrial policy is the orchestration of structural change, East Asian policymakers appraised the desired future specialisations, and in turn conceptualised a plan on how to get there. In what Cherif and Hasanov (2019) call a 'moonshot' approach to industrial policy, the East Asian countries were particularly successful in taking on this long-term vision, to gain a foothold into sectors for which the countries did not at the time have the required capabilities nor infrastructure. While the ambitions must be grounded in realistic expectations, an overemphasis on the present economic structure may lead to limiting path dependencies.

East Asia's forward-looking view is also apparent from the specific sectors it opted to nurture as its future comparative advantage. This exemplifies a particular skill in foreseeing market dynamics and allocating resources to areas of rising importance, be it in the case of the South Korean semiconductor industry (Kim, 1998), or more recently in China's leap into the renewable energy sector (Chiu, 2017). EU-CEE ought to apply similar foresight in the present age, where geopolitical developments are suggestive of increased regionalisation, and whereby the discussed 'megatrends' drive a reasonable amount of consensus as to which sectors and capabilities are likely to be strategic in the years to come.

Yet, given the difficulty of such an approach and the relatively high risk of failure, adaptiveness is of utmost importance. In this sense, East Asian policymakers were particularly skilled at evaluating the potential failings of their policies, and were willing to shift gears when they found them to be inappropriate (Chang, 2019). At the same time, they were also adaptive in their readiness to withdraw support when the desired results were not being delivered, limiting the space for wasted resources and 'zombie' firms in the economy (ibid.). Likewise, as stressed by Lee et al. (2021), industrial policy is effective when combined with discipline from domestic and foreign markets, as was the case of the

South Korean automotive industry: not only was there a fierce competition between emerging domestic carmakers, the firms were exposed to global markets from a very early point.

iii. Emphasis on the creation of a sufficient number of winners

Another critical facet to the East Asian development path is the co-existence of rapid growth with equality (Page, 1994). Some authors even illustrate that within-country income equality actually improved during the high growth periods of these East Asian countries (e.g. Birsdsall and Sabot, 1993; Cherif and Hasanov, 2019), though this holds less true in the case of China. This is in contrast to the general development experience, whereby times of high growth tend to bring about a deterioration in distributional outcomes (Page, 1994). This is because dramatic changes in the structural composition of the economy inevitably cause the rise of some sectors at the expense of others. Naturally, this dynamic implies the tendency to create 'winners' and 'losers' in the economy. Moreover, there tends to be a positive relationship between economic openness and the size of the state, motivated by the greater volatility that openness to external forces brings about (Rodrik, 1998). In this sense, it becomes particularly important for industrial policy in the highly open EU-CEE countries to create outcomes through which social cohesion is not fractured.

The East Asian experience can also be linked to the states' effectiveness in managing the social dimension of the structural transformation. While economic and political power was quite strongly concentrated in these countries, there was also sound effort to ensure the gains from growth are spread to the wider society. In Hong Kong and Singapore, the states own the lion's share of land, and through this channel, engaged in substantial public housing programmes. Likewise, Japan notably expanded its welfare services provision in its high-growth period of the 1970's (Fujimura, 2000). From a contemporary EU-CEE perspective, this is a highly relevant point to note. As we emphasised before, the green and the digital transitions open up new alleyways for countries to develop. However, they also bring about important distributional questions, as they favour certain skillsets and qualifications over others. Hence, the social dimension to industrial policymaking stands out as just as crucial as the economic dimension. Not only does this increase the likelihood of the industrial strategy's sustained success given greater public support, it aims not to diverge from the overarching developmental goal of 'leaving no one behind'.

3. Understanding the industrial characteristics of the EU-CEE economies

In the previous chapter, we defined what we mean by industrial policy and reviewed the evolution of EU's industrial policy as it advanced from a contentious, marginalised topic to taking centre-stage in contemporary economic policy debates. We also turned to the famous East Asian development model, and derived principles that can guide EU-CEE policymakers conceive successful industrial policies for their new growth chapter. With this knowledge, we now zoom into industrial characteristics of the EU-CEE, in order to gain a thorough understanding of these countries' economic structures. Above all, we focus on the state-of-play in the green and digital aspects of the economy, as these represent the core pillars of a future-proof industrial strategy.

3.1. INDUSTRIAL DEVELOPMENT OF EU-CEE: SUCCESSES AND FAULT LINES

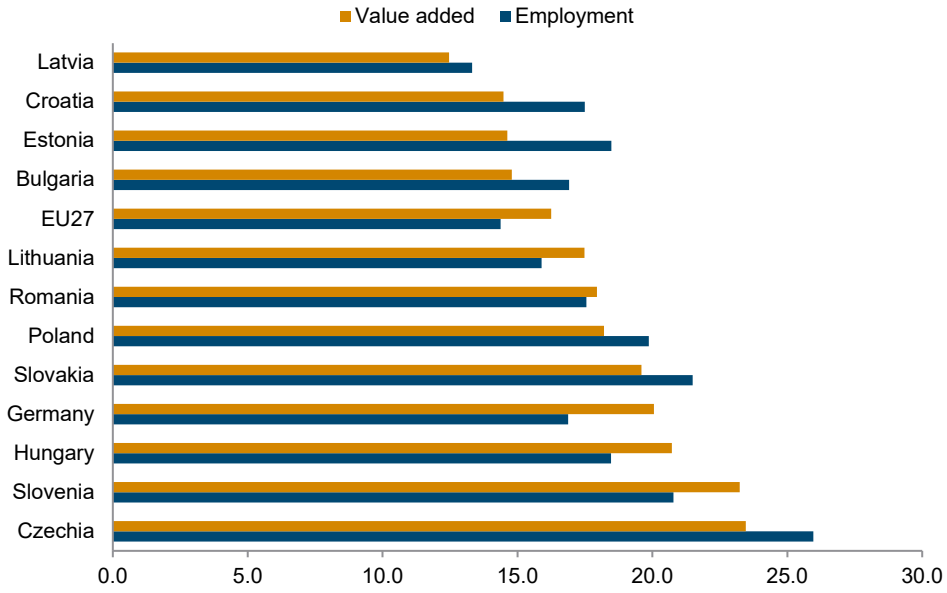
Undeniably, the unique, historical opportunity offered after 1989 for the CEE region has shaped its future path of industrialisation. Foreign companies took this opportunity to come to the region, also based on historical ties. Privatization played a major role, but also greenfield investment was of great importance. In addition, the one-off conditions stemming from EU accession contributed importantly to the industrialisation path of the region over the past two decades (Cherif and Hasanov, 2019). Through these integrative mechanisms, the EU-CEE countries transformed from transition nations to export-driven economies heavily engaged in the value chains of medium-to high-tech sectors (Grieveson et al., 2021).

The share of employment and value added claimed by manufacturing today is high above the EU average in the Visegrád countries, outpacing even traditional manufacturing powerhouses such as Germany (Figure 3.1). In fact, the Visegrád countries (and Slovenia), together with Ireland, Germany and Austria, are the most industrialized countries in the EU, by means of manufacturing share in total value added. While Ireland lies on top (with 37% in 2020), Czechia, Slovenia, Hungary, Slovakia together with Germany hold manufacturing shares of more than or about 20% of total value added. Still above the EU27 average lie Poland, Romania and Lithuania with shares of 18%. Below the EU average of 16% are countries like Bulgaria, Estonia and Croatia where the manufacturing sector accounted for 15% of total value added. Latvia is the least industrialized country among the EU-CEEs with a manufacturing share of about 12.5%. When looking at the employment shares, manufacturing is even more important in the total economy, pointing to the still more labour-intensive nature of manufacturing in the EU-CEE and lower labour-productivity levels.

As emphasised by the United Nations Industrial Development Organization (UNIDO) (2021), the manufacturing sector continued to be the backbone of economic growth in the post-pandemic world: a country's industrial capabilities and the size of its manufacturing sector played an important role in the greater resilience against the external shock brought on by the pandemic. In this sense, the EU-CEE's highly industrial nature, taking the size of the manufacturing sector, can be regarded a positive

predisposition going forward, which offers a solid foundation for the nurturing of a dynamic economic system.

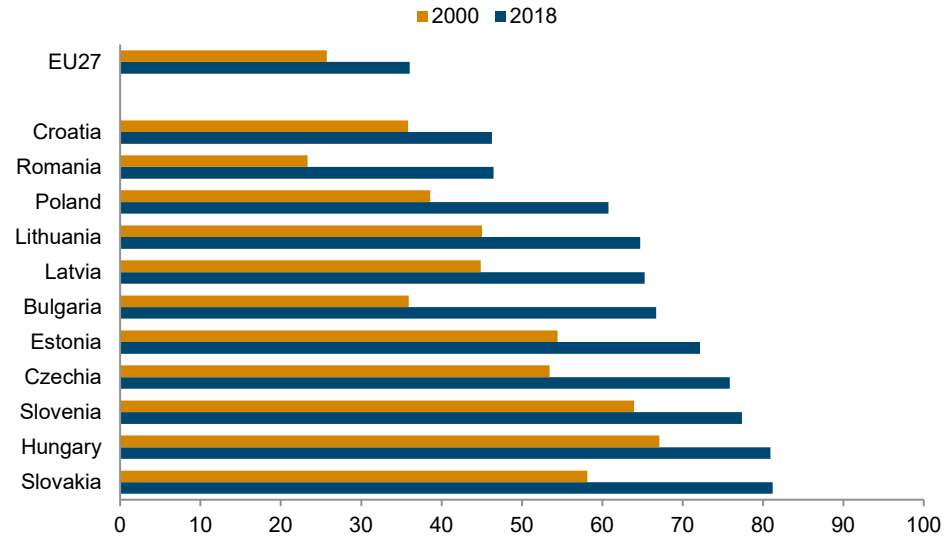
Figure 3.1 / Value added and total employment in manufacturing, in % of total economy, 2020



Source: Eurostat National Accounts

Figure 3.2 / Share of domestic manufacturing value added serving foreign final demand, 2000 vs 2018

(as % of total domestic value added)



Notes: Includes direct (exports of final goods and services) , as well as indirect exports (intermediately through other countries)
Source: OECD TiVA database

On the other hand, the EU-CEE's industry is strongly driven by external demand, making it particularly sensitive to changes in consumption patterns outside of these countries. Figure 3.2 illustrates this with the share of domestic value added embodied in foreign final demand, which captures how much of domestic value added is exported to foreign final consumers (OECD, 2022). Since the turn of the millennium, all of the EU-CEE countries' manufacturing sectors have become tightly linked to the demand from outside, and this integration is more than double the EU27 aggregate in the case of Estonia, Czechia, Slovenia, Hungary and Slovakia.

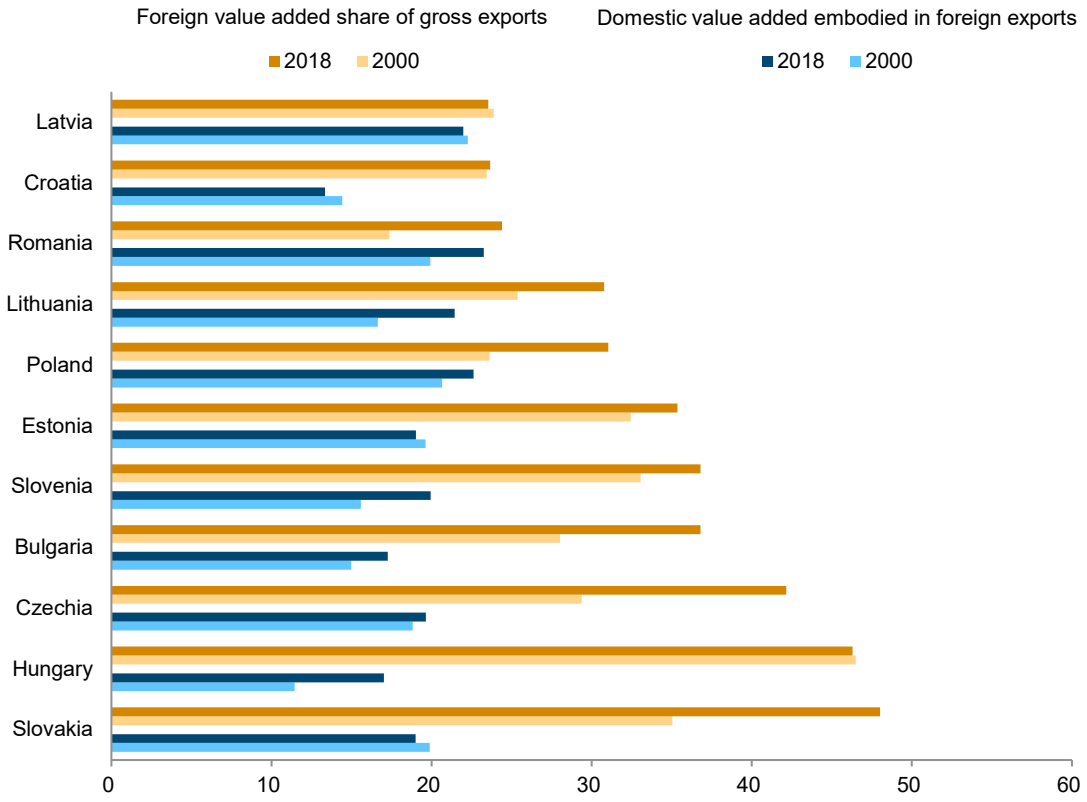
Figure 3.3 / Competitive industrial performance index*, 2020

Note: * The Competitive Industrial Performance Index, compiled by UNIDO assesses a country based on three dimensions: (i) capacity to produce and export manufactures; (ii) technological deepening and upgrading; (iii) world impact. It is calculated as a non-linear composite of 8 indicators centred around these dimensions, namely: Manufacturing value added per capita; Manufacturing value added share in total GDP; Impact of a country on world manufacturing value added; Medium- and high-tech manufacturing value added share in total MVA; Manufactured exports per capita; Share of manufactured exports in total exports; Share of medium- and high- tech manufactured exports in total manufactured exports; Impact of a country on world manufacturing trade.
Source: UNIDO.

At the same time, EU-CEE has plenty of room to improve from the perspective of industrial capabilities. The competitive industrial performance index compiled annually by UNIDO is a composite index that shows the ability of countries to produce and export manufactured goods competitively. It combines both

manufacturing value added indices and manufacturing export indices, and thus reflects both size and quality aspects of manufacturing. While this indicator echoes the standing of EU-CEE countries as successful industrialisers in their development paths, it also reflects the region's shortcomings. As Figure 3.3 shows, the Visegrád countries rank among the top of the world on the list (blue colour code), while the other EU-CEE countries all find themselves on the middle-upper range. However, we can also see that while in the pure size indicators discussed above, the Visegrád countries were well-ahead of all other EU countries, these countries fall behind the Western European countries more visibly in the industrial performance index. Here, only Czechia and Poland are ranked above the EU27 average, while all other EU-CEE countries fall below. This is suggestive of the countries lagging in the quality aspects.

Figure 3.4 / Backward and forward participation in GVCs, 2018



Note: Both measures expressed as a % of gross exports of the country under consideration.
Source: OECD TiVA database.

The limitations in industrial capabilities are also visible from the EU-CEE countries' nature of participation in GVCs. The gross exports of these countries embed strong backward linkages (i.e., there is a high share of foreign value added embedded in the country's exports), as Figure 3.4 shows. In three Visegrád countries (Slovakia, Hungary, Czechia), foreign countries' contribution reaches almost a half of the value added in exports. If one considers the manufacturing sector only, these figures reach up to 58% in the case of Slovakia. By contrast, forward participation is much smaller (i.e., the countries' value added contributes only modestly other countries' exports), oscillating around 20% in all EU-CEE countries. Furthermore, the gap between foreign contribution to domestic exports and domestic contribution to foreign exports has expanded over time in most countries under consideration. One can

see that while there are notable differences in the extent of backward participation[5] (among other factors, driven by differences in the ability to attract FDI), the ability to forwardly link up in GVCs using domestic capacities has been quite limited across the region.

The over-specialisation of EU-CEE countries in routine production activities within manufacturing value chains, and the inability to change beyond this specialisation over time, can be regarded as a crucial limiting factor in the EU-CEE's economic structure (see Grieveson et al., 2021). At the same time, (over-)specialisation in particular branches within manufacturing may be contributing to certain path-dependencies. In the case of the Visegrád countries – particularly in Czechia and Slovakia, by far the largest source of value-added content of exports is transport equipment, with foreign value added playing the main role (see Figure 3.5). A similarly undiversified picture is painted in Lithuania and Bulgaria, whereby the foreign value added content in the chemicals industry dominates in magnitude. By contrast, domestic value-added content of exports plays a more dominant role in Poland, Slovenia, and Romania. Still, in many EU-CEE countries, the domestic contribution tends to skew towards natural-resource intensive sectors such as wood and paper, food products, or chemicals and minerals, leaving space for potential sectoral upgrading.

[5] In line with the OECD TiVA indicators, the backward participation (the share of foreign value added in exports) reflects how much of a country's gross exports is created by value added produced outside the domestic economy via intermediate imports. The forward participation shows how much domestic value added is included, via exports, in the exports of other countries.

Figure 3.5 / Industry share in value-added content of gross exports, 2018

(domestic and foreign value added, as % of total gross exports)

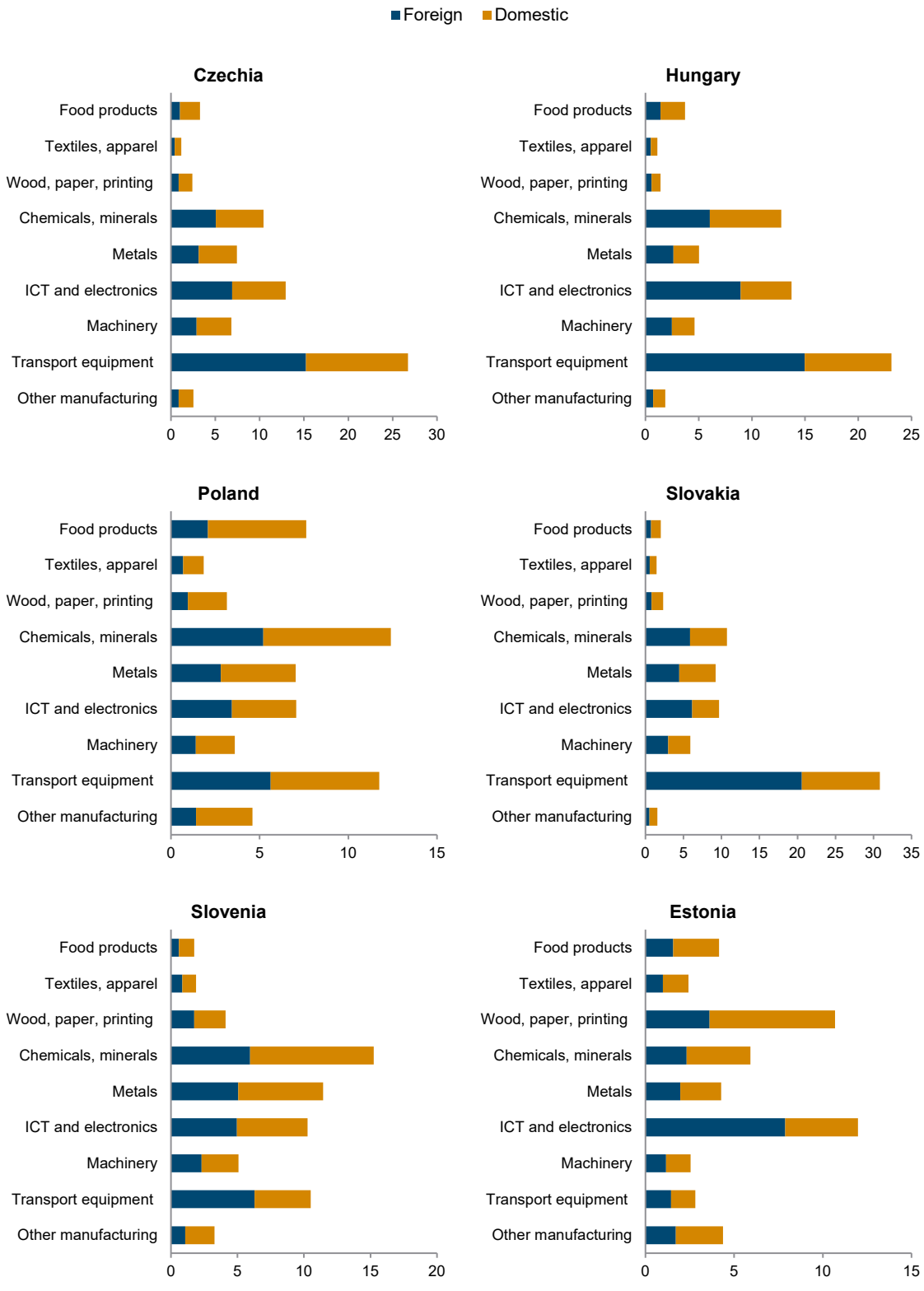


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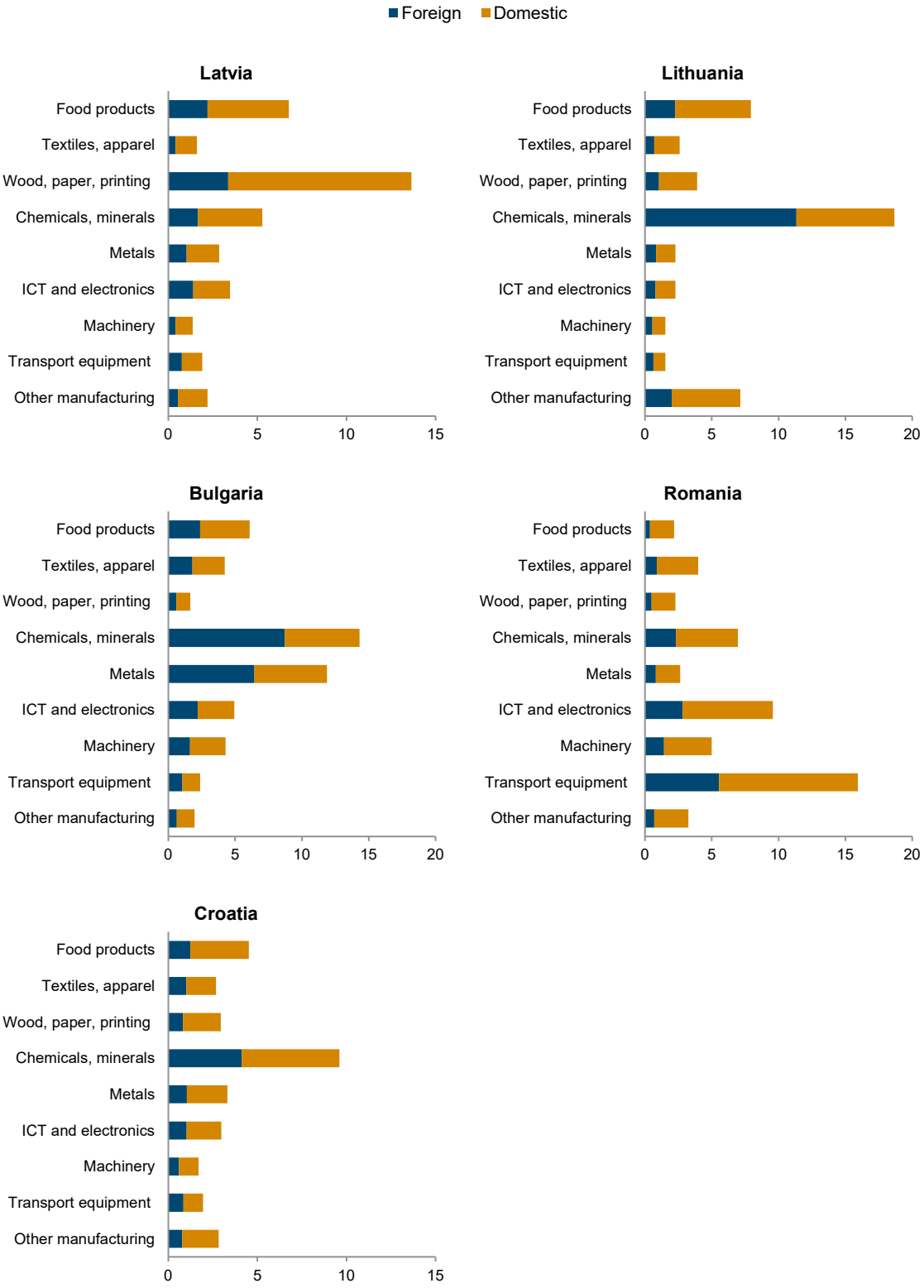
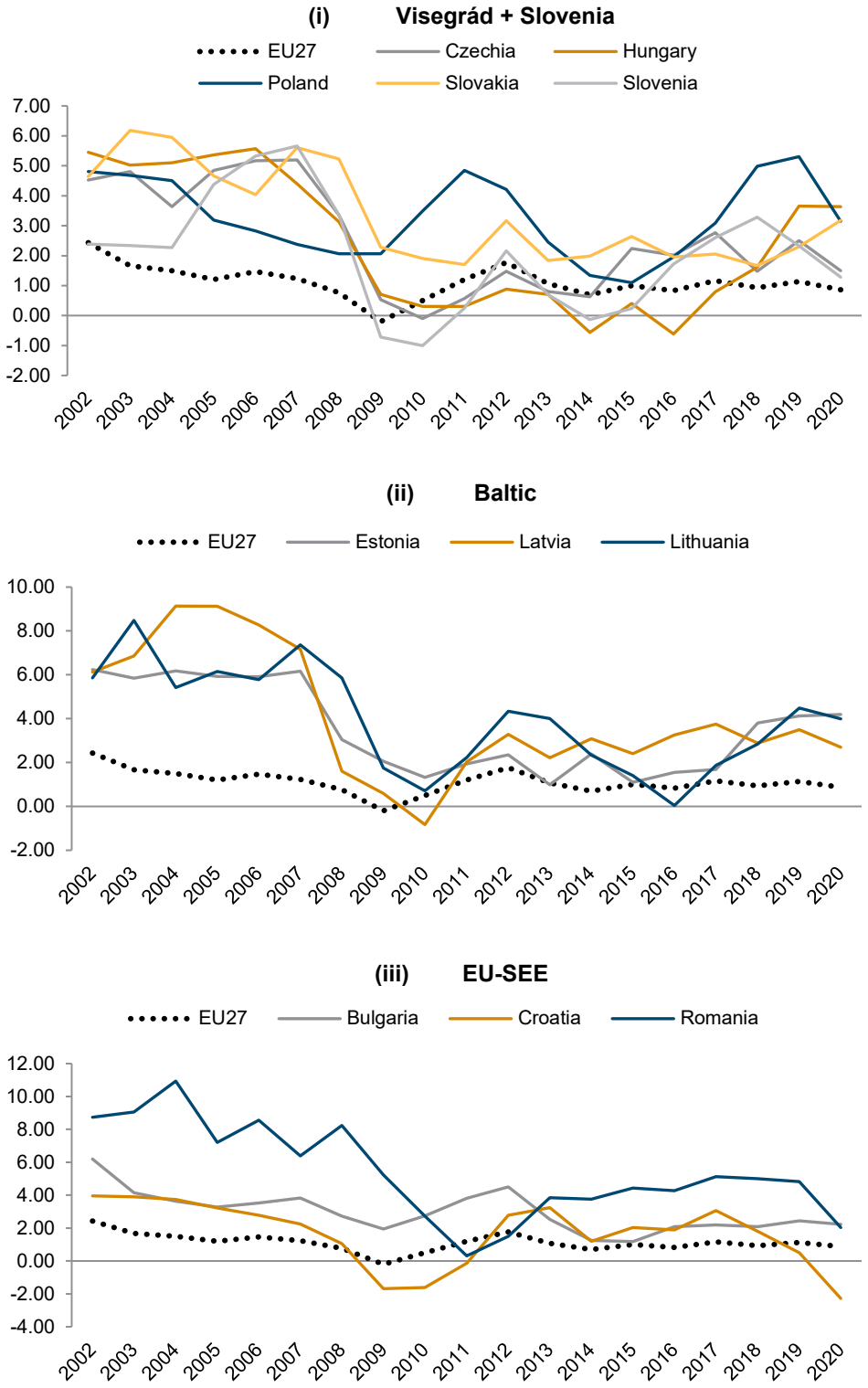
Figure 3.5 / Contd.



Note: The measure reflects the share, in total gross exports, of domestic/foreign value added in an industry's exports.
Source: OECD TiVA database.

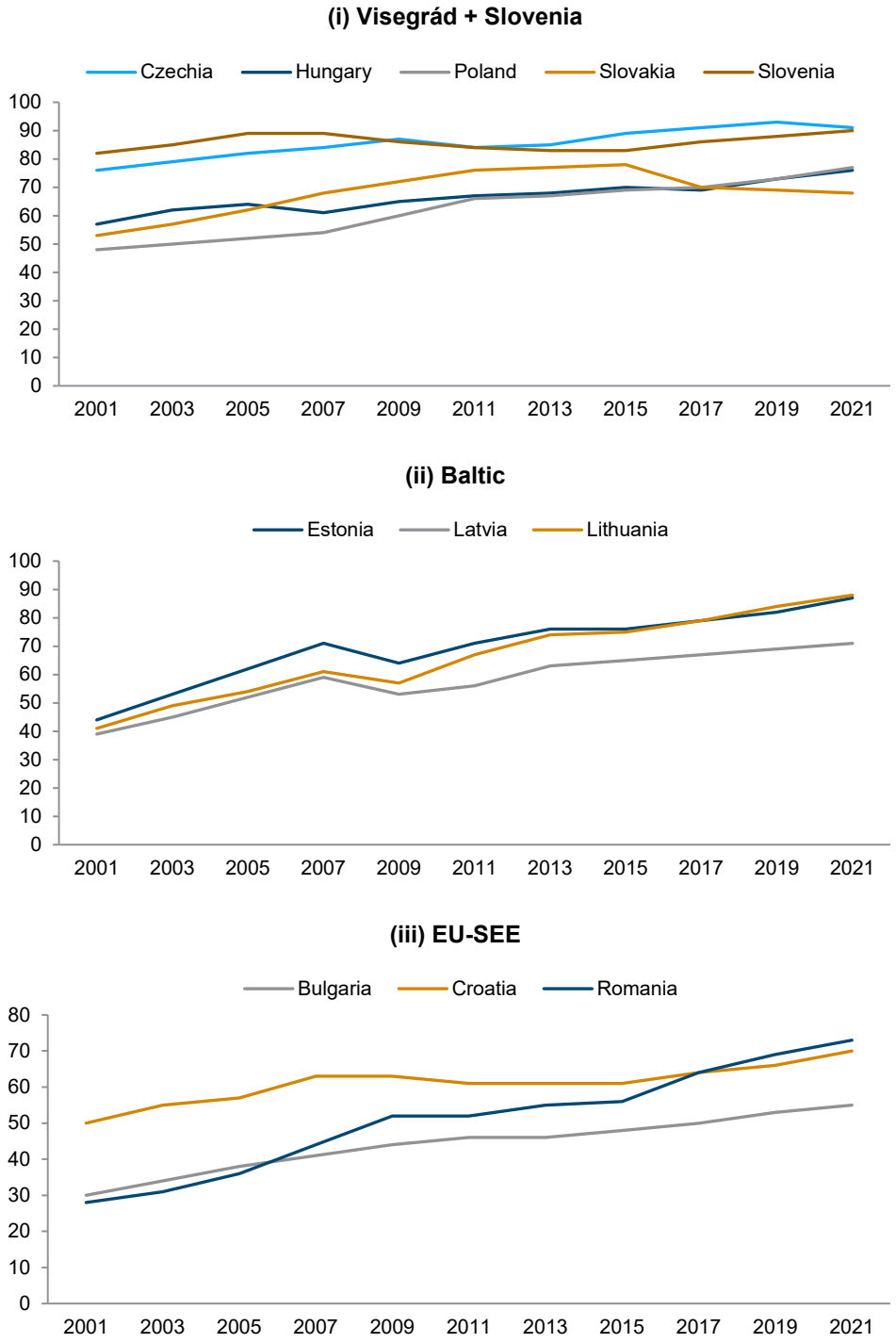
Figure 3.6 / Labour productivity growth in EU-CEE countries

(moving 3-year average, 2002-2020, in %)



Note: Moving averages calculated using the annual change in GDP per hour worked in constant prices.
Source: Calculations based on OECD data

Figure 3.7 / Purchasing power-adjusted GDP per capita (EU27=100)



Source: Eurostat

Against this background, the EU-CEE countries are increasingly facing emerging challenges in their industrial development paths. As Figure 3.6 shows, despite signs of recovery in the late 2010's, productivity growth in EU-CEE countries never fully recovered from the financial crisis (with the exception of Poland), and even displays a mildly downward trend in recent years. What is more, while

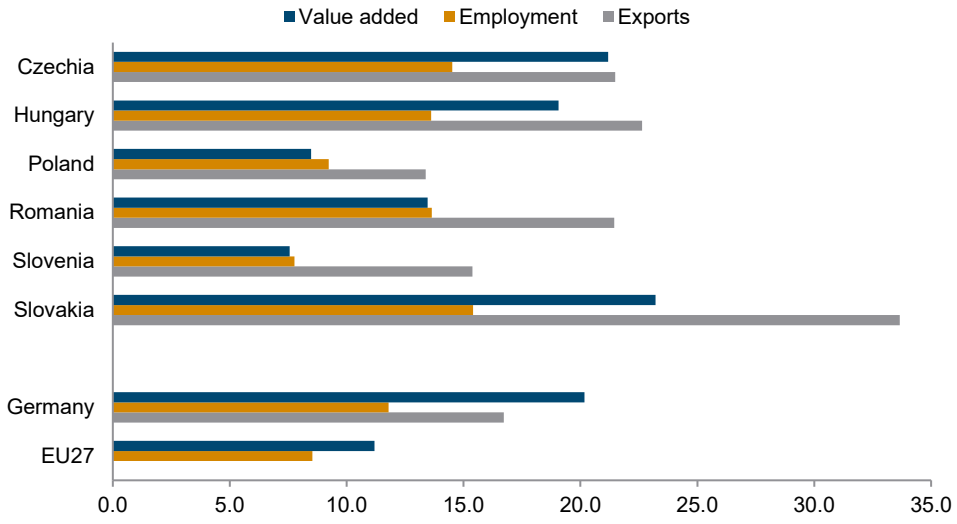
productivity growth rates remain generally above the EU aggregate, the gap has been closing in recent years. This is particularly visible in the economically least advanced EU-SEE countries, fuelling worries about potential middle-income stagnation and early de-industrialisation lying ahead. At the same time, following the rapid catch-up in the 2000's, convergence plateaued especially in the more developed, manufacturing-oriented EU-CEE economies such as Slovakia, Czechia, and Slovenia (Figure 3.7). In 2021 Slovakia fell back to 2007 levels in its purchasing-power adjusted living standards relative to the EU average. At the same time, we observe that the more services-oriented Baltic countries have so far leapt ahead in their catch-up to EU standards of living. Yet, given the discussions of distributional impacts of services-oriented growth without a sound industrial foundation (Singh, 2006; Singh 2012), the Baltic countries are exposed to a challenge of their own, facing higher income inequality levels compared to those EU-CEE countries with a stronger industrial base.

In this context, the importance of embracing the coming megatrends emerges: by directing resources to the digital and green sectors of the economy, a second (and positive-sum) transition could be aimed at, closing the remaining gap that exists with other EU member states. Consistent with this view, we zoom into the current conditions in these two promising sectors, which as discussed in Section 2.1, represent the focal point of present-day EU industrial policy.

3.2. GREEN TRANSFORMATION OF INDUSTRY

A sector which is most prominently affected by the inevitable green transformation of industry is the automotive sector. This sector faces numerous structural shifts in the next decades, of which electrification of cars is one of it. European regulation has spurred up the speed of electrification, which took off in 2020. With the new 'Fit for 55' package, the European Commission proposed to further curb CO_2 emissions from cars by 55% compared to 2021 levels by 2030 and 100% by 2035. This would mean de-facto a ban on the sale of internal combustion engine cars from 2035 onwards.

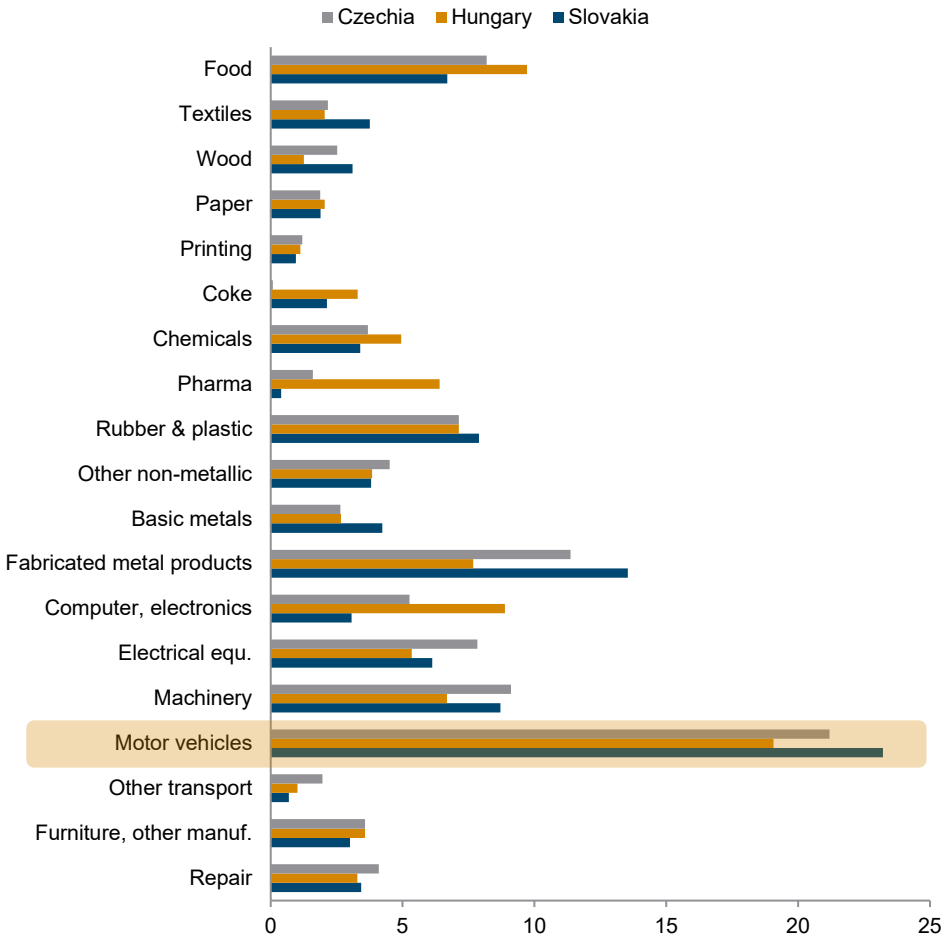
Figure 3.8 / Automotive industry: shares in manufacturing value added and employment and in % of total exports, 2019



Source: Eurostat National Accounts, UN Comtrade.

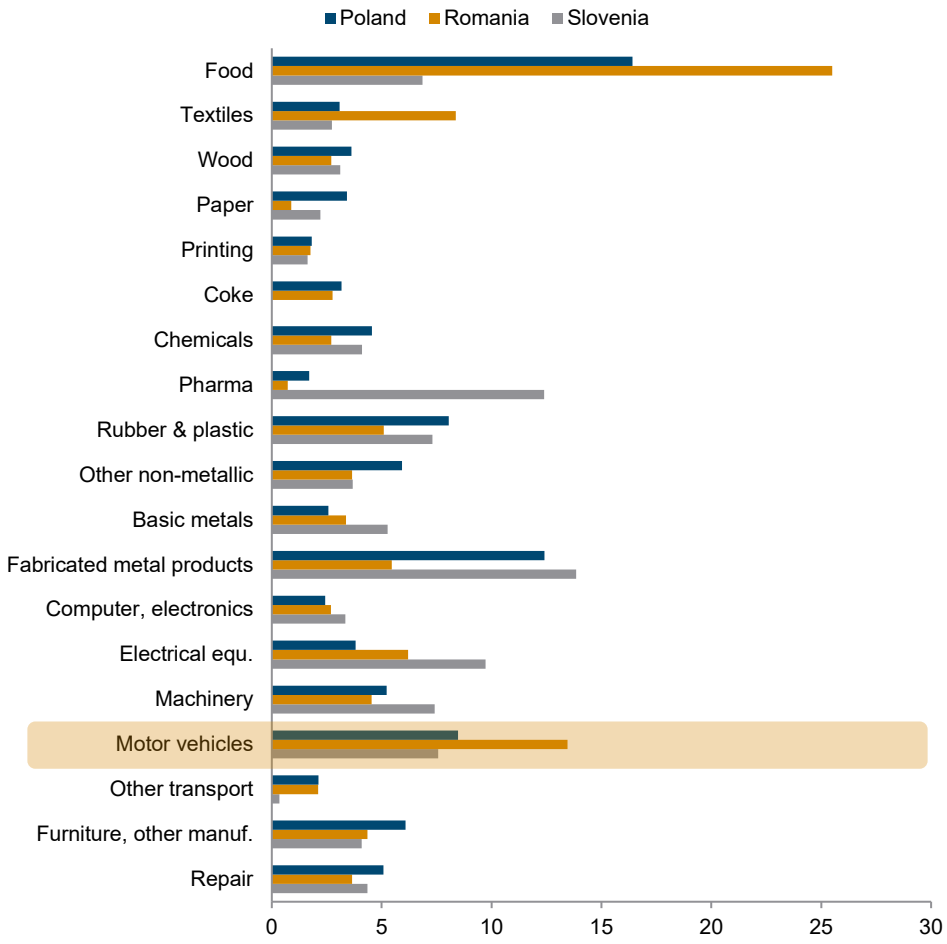
As the automotive industry represents one of the most prominent sectors in the region, the electric transformation is vital for future success. Strong specialisation in the sector and a lack of diversification in some EU-CEE economies makes the region especially susceptible to changes in the automotive industry. This holds particularly true for Slovakia, Czechia and Hungary, where the automotive industry is by far the most important manufacturing sector (see Figure 3.8 and Figure 3.9). In Slovakia, it accounts for 23% of manufacturing value added and 22% of total exports. On a similar scale, the automotive industry holds shares of 20% of manufacturing value added and 22% of total exports in Czechia and Hungary. Automotive production is of main importance also in Romania, just below the food industry, and accounts for a major share of exports. In Poland and Slovenia, specialisation is less prominent, but still represents one of the main industries in the countries (see Figure 3.10). Employment shares are in most countries smaller than value added shares due to the capital-intensive nature of the sector.

Figure 3.9 / Manufacturing industries value added in Czechia, Hungary and Slovakia, 2019, in % of total manufacturing



Source: Eurostat National Accounts.

Figure 3.10 / Manufacturing industries value added in Poland, Romania and Slovenia, 2019, in % of total manufacturing



Source: Eurostat National Accounts.

Furthermore, the regions' automotive sector faces specific challenges: transformed by the strong inflow of foreign direct investment during the last thirty years, the automotive sector became a competitive and export-oriented industry. German, French, but also Asian original-equipment manufacturers (OEMs) invested in the region into car-assembly plants and benefited from low labour-costs, tradition in mechanical-engineering, a well-educated workforce and geographical proximity. Also, car part suppliers followed their OEMs and settled in the region and created a dense supplier network. Thus, while benefiting from the inflow of foreign direct investment in the past, this foreign ownership now poses some drawbacks: companies in the region are dependent on the decisions taken in headquarters of OEMs, and innovation also tends to be kept at home, thus minimising the space for R&D activities to take place in the EU-CEE countries. However, there are also emerging innovators building on the strong sectoral orientation of the region, like the Croatian Rimac, producer of electric hypercars, or Sin Cars, a Bulgarian-German-UK company founded by a Bulgarian engineer, which produces a new multifunctional urban EV, the 'L City Bus', equipped with solar panels (see Delanote et al., 2022).

With the electric revolution in Europe starting in 2020, global automakers were eager to revise their production programmes and to announce new electrification plans and strategies. Also, the car makers in the EU-CEE presented their investment plans with some lag and spurred up production of hybrid and electric vehicles. Evidence of a good start can be found in the most recent export figures of full-electric and hybrid cars (i.e. shares in total car exports): In 2021, shares doubled in most countries compared to 2020, and Slovakia and Slovenia are now on top with 40% (matching Germany's share of 40%), other CECCS with 30%. New investment is flowing into the region: The most recent announcement has been made by Volvo Cars in July 2022 to build its third production plant in Slovakia and specialise on electric car production there. Also, in terms of battery production, Hungary and Poland successfully attracted investment from Asian producers (see Box 3.1). Electrification will change value chains: some parts will not be used any more, new ones will be added (e.g. batteries), others will increase such as semiconductors or rare earths, hence the automotive industry should strive to actively manage this transition and not be left behind. Industrial policy ought to take an active role to guide this transition process. On the European level, new European initiatives include the preparation of the European Critical Raw Materials Act, the European Chips Act or the EU Battery Regulation. Important projects of Common European Interest (IPCEIs) are now possible and state aid rules have been amended for this purpose. The first IPCEIs have been established in the field of microelectronics, batteries, and hydrogen which will help the automotive sector and its supply chains in particular. Also, the Recovery and Resilience Facility (RFF) supports the digital and green transition, reserving 37% of funds for green investment. This includes research awards, electric vehicle purchase incentives or building alternative fuel stations. Thus, the question that remains for EU-CEE is what can be done on the national level to support this process so that the transformation will be successful, a topic discussed in greater depth in Chapter 4.

BOX 3.1 / MAPPING REGIONAL SUCCESS STORIES: BATTERY MANUFACTURING IN EU-CEE

Batteries are indispensable to make the green transition work. While we use batteries in our daily life, in our smartphone, computer or even lawnmower, batteries are becoming increasingly important in one industry – the automotive industry. With the transition towards battery electric vehicles and the proposed ban of internal combustion engine cars in the year 2035, the supply of batteries has to be piled up. However, currently Europe heavily depends on imports from Asia, especially China (see European Commission, 2021d), motivating the need to build-up a battery-supply chain of its own to counter strategic dependencies.

Consequently, EU's industrial policy on batteries were formulated in 2017, with the creation of the European Battery Alliance. The Strategic Action Plan on batteries was subsequently adopted in 2018 and two IPCEIs (important project of common European interest) for batteries were established: the IPCEI Batteries includes two Polish companies, the IPCEI European battery innovation includes three Slovak ones, along with the aforementioned Croatian firm Rimac.

For the transformation of the automotive industry, batteries are truly of crucial importance as they are an imperative component of electric vehicles, contributing up to 40% of total costs of an electric vehicle. Production of batteries close to assembly of electric vehicles is reasonable, as the heavy weight of batteries makes long-distance logistics and shipping costly. Thus, investment into battery plants gives a hint, which locations are favoured and where the production of electric cars will be located.

While European battery companies are scarce, Asian companies are increasingly advancing to Europe and making investments in giga-factory projects. EU-CEE countries are making efforts to secure a role in battery production and to attract foreign direct investment in this area. Poland and Hungary have been most successful in this respect:

* in Poland, there is already one giga-factory in operation since 2017. South Korea's LG invested there eur 3.2 bn and pledged another expansion of investment recently. The factory employs nearly 10 tho. people, and the investment has been followed by a number of subcontractors, suppliers, and competitors. Meanwhile, Polish company, Impact Clean Power Technology, became on of the leaders in the segment of battery systems for trains and electric buses.

* in Hungary, South Korean SK innovation is planning its second plant, and also South Korean Samsung SDI plans to expand its plant there. Japanese GS Yuasa started operations of its first overseas lithium-ion battery plant in Hungary in late 2019. The newest announcement in this field has occurred in August 2022, when the world's largest battery producer Catl from China, pledged to invest into a greenfield (i.e. previously undeveloped, new) plant in Hungary. With a sum amounting to eur 7.3 bn, this will be the largest ever investment occurring in Hungary and with a capacity of 100gwh per year it will be the largest gigafactory in Europe. It is expected to create 9,000 jobs.

*in Slovakia, in 2019, the Slovak firm Inobat Auto and the US company Wildcat Discovery Technologies formed a strategic cooperation for a combined R&D centre and production line.

At the same time, large automotive companies, so called original equipment manufacturers, are stepping up efforts to internalise raw materials and battery production or forming joint ventures to secure their supply. Volkswagen for example plans to invest eur 20bn in six European battery plants, starting with Germany, Sweden and Spain. Czechia and Poland are the front-runners for winning another plant. Overall, according to announced investments, Germany would lead battery production in Europe, but Hungary and Poland are also well-positioned.

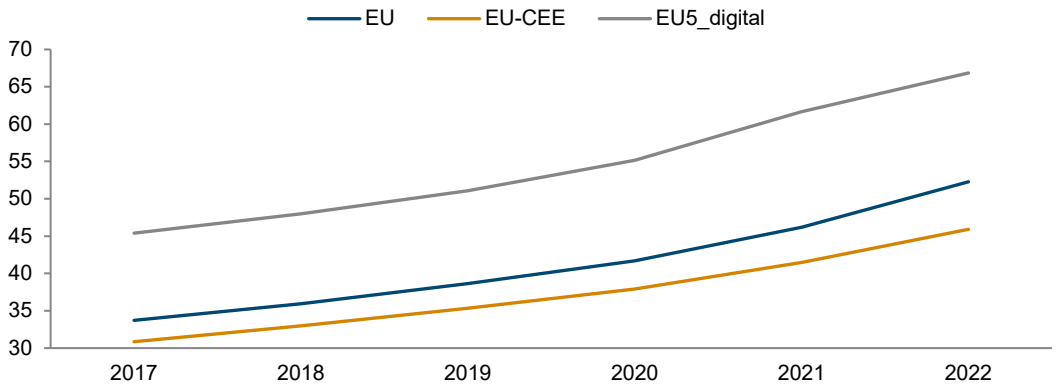
3.3. NEW TECHNOLOGIES AND DIGITALISATION

Another major transformation the global economy faces is the transition to Industry 4.0, facilitated by rapid technological change. This entails the digitalisation of production processes and implementation of advanced digital production (ADP) technologies, in a way that leads to a cyber-physical transformation of manufacturing. As we stressed in Grieveson et al. (2021), the deployment of digital technologies and automating production processes holds notable potential to boost productivity growth and alleviate persistent labour shortages in EU-CEE countries. Furthermore, it offers a chance for economies lacking a strong manufacturing base to build up and leverage capabilities and infrastructure to diversify into dynamic, technology-enabled services. At present, the EU-CEE countries can be regarded as relatively well-positioned for becoming major 'digital challengers' in Europe (McKinsey, 2020), though they still need to close numerous gaps against technological front-runners, as will be explored in this section.

Despite a boost from COVID-19 to intensify digital transformation in EU-CEE, the region as a whole still has to catch up on broad digitalisation with leading economies. Bridging the digital gap is likely to be a

long process, especial for Romania and Bulgaria, lagging behind in many dimensions. The Digital Economy and Society Index (DESI) 2022, a composite indicator which captures various dimensions of digitalisation in EU, reveals a gap between EU-CEE (46) and EU averages (53). At the same time, the distance of EU-CEE region from digital front-runners – top five EU countries by DESI scores (67)[6] has slightly increased over the last five years (Figure 3.11).

Figure 3.11 / Evolution of average DESI scores in 2007-2022 for groups of countries



Sources: European Commission, Eurostat, own calculations.

Still, some EU-CEE countries—mainly the Baltics and Slovenia, stand out in a positive light: Estonia, Slovenia and Lithuania all score above EU averages in their overall DESI scores. Furthermore, Estonia and Croatia show particularly good results in the Human Capital sub-dimension; Slovenia, Lithuania, Croatia and Estonia all outperform the EU average for Integration of Digital Technology; while Estonia, Latvia, Lithuania and Slovenia demonstrated better than average scores for Digital Public Services. By contrast, Bulgaria and Romania occupied the lowest positions in the EU-wide DESI 2022 ranking, and the Visegrád countries also left much room for improvement (Table 3.1).

Table 3.1 / Relative position of EU-CEE countries by DESI sub-dimensions relative to EU average in 2022

	EE	SI	LT	LV	CZ	HR	HU	SK	PL	BG	RO	EU
DESI	56.5	53.4	52.7	49.7	49.1	47.5	43.8	43.4	40.5	37.7	30.6	52.3
Human resources	13.5	11.1	10.6	11.0	11.4	13.0	9.6	11.0	9.3	8.1	7.7	11.4
Connectivity	11.1	15.0	12.3	12.5	13.2	12.0	14.4	12.5	11.6	12.7	13.8	15.0
Integration of digital technology	9.1	10.0	9.3	6.5	8.5	9.2	5.4	7.0	5.7	3.9	3.8	9.0
Digital public services	22.8	17.4	20.4	19.7	16.1	13.4	14.4	13.0	13.9	13.0	5.3	16.8

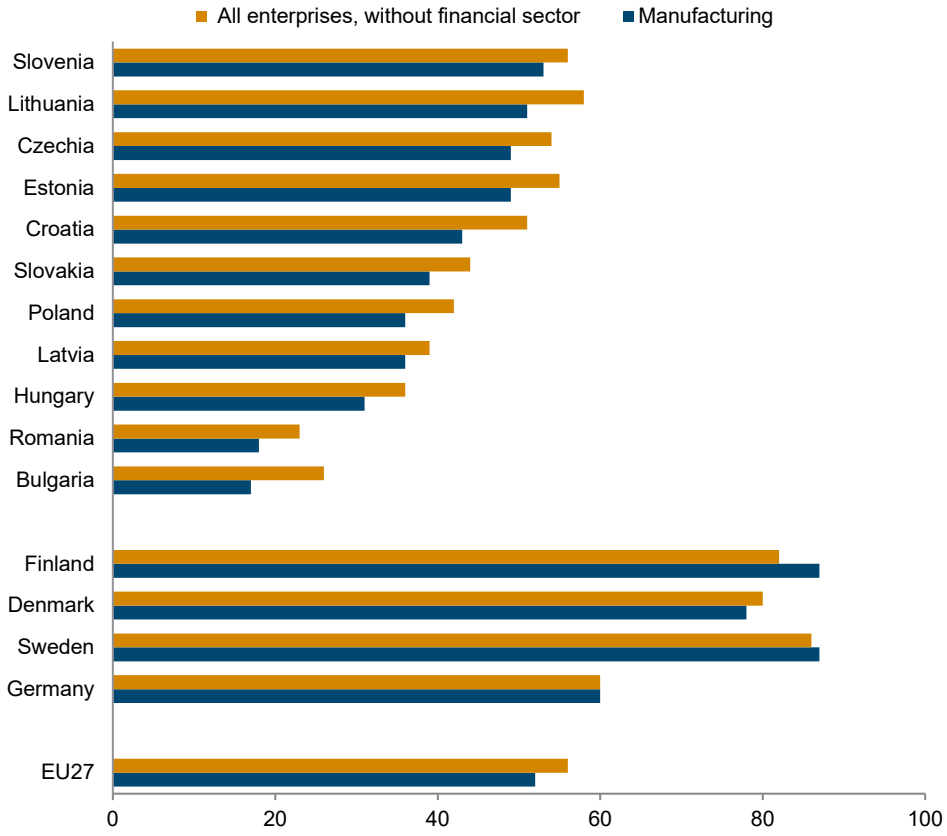
Sources: European Commission, Eurostat, own calculations.

Comparable disparities in how far along a country is in the digital transformation are visible also on the firm level. An overall digital intensity of firms measured by the digital intensity index (DII) 2021, a composite indicator calculated by Eurostat, is generally below the EU level: 56% of EU firms on average reached at least basic level of digital intensity, whereas in EU-CEE, the simple average was 44%. In

[6] Top five EU countries by DESI 2022 scores include Finland, Sweden Denmark, Netherlands and Ireland.

manufacturing, the gap is even larger: 52% of EU firms, and only 38% of EU-CEE firms, had at their disposal at least basic levels of digital technologies. A dramatic digital gap of 70 percentage points is observed between leading Sweden and Finland (87%), and lagging Bulgaria (15%) (Figure 3.12). On the other hand, Slovenia and Lithuania performed slightly above the EU average, and some countries were relatively successful in particular DII dimensions, such as Czechia and Poland for innovation capabilities, or Estonia, Slovenia, Lithuania, Croatia in developing a digital economy.

Figure 3.12 / Share of enterprises reaching basic level of digital intensity in 2021, in %



Note: enterprises with ten or more employees and self-employed person. 'A basic level entails the use of at least four of twelve selected digital technologies (such as using any AI technology; having e-commerce sales account for at least 1% of total turnover; etc.). A basic level includes businesses with a low, high and very high level of the Digital Intensity Index (DII), excluding the very low level'.
Source: Eurostat.

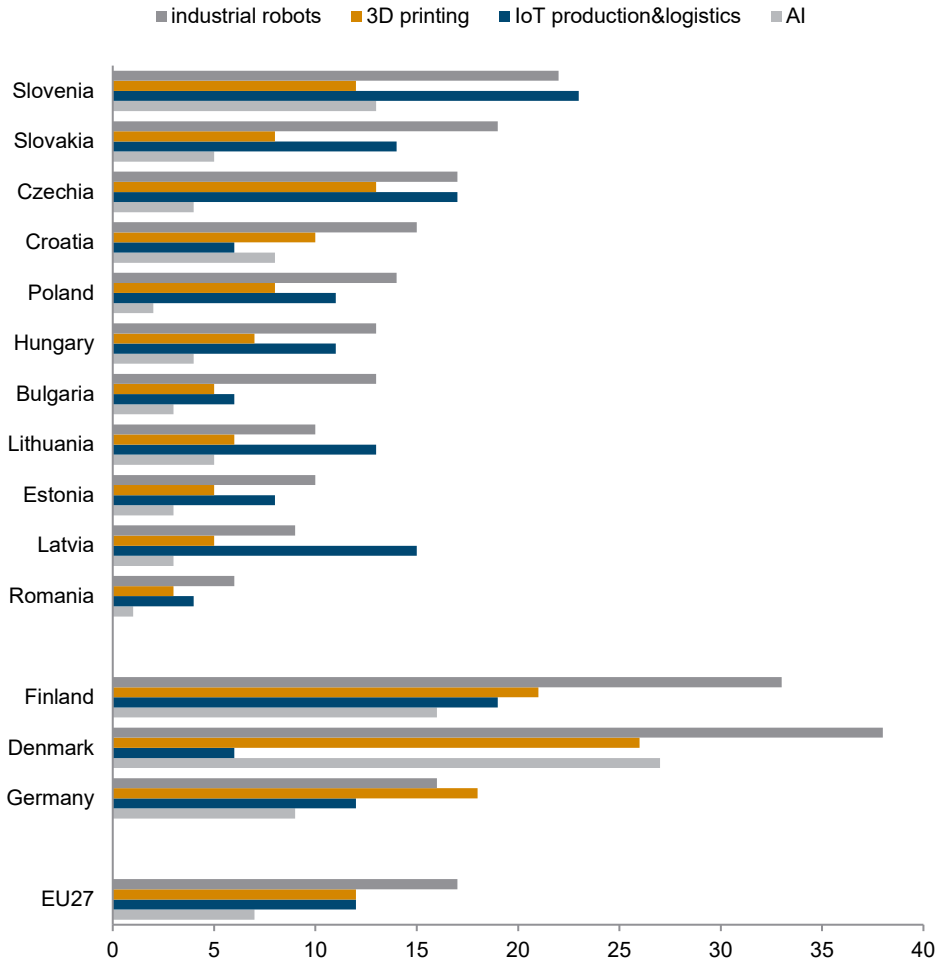
Global comparisons reveal (UNIDO, 2020) that manufacturing specialisation in technology and digital intensive industries[7] is favourable for a better uptake of ADP technologies, technological upgrading and productivity growth. Consistent with these findings, the uptake of industrial robots in manufacturing is particularly high in the Visegrád countries and Slovenia (Figure 3.13). These countries have received a valuable boost in robotisation through MNEs heavily investing in production capabilities via inward FDI[8]. As a result, the diffusion of 3D printing in manufacturing, broad use of artificial intelligence (AI)

[7] Computers and electronics; electrical machinery and machinery; and transport

[8] In Hungary, Czechia and Slovakia share of foreign-owned firms in value added is especially high (24%, 22% and 20% respectively), for Slovenia this share amount to 14%.

technologies, as well as the application of Internet of Things (IoT) in production in logistics reveals the competitive positioning of these countries' industries, in many cases outperforming not only the EU average, but also Germany. This highlights the relevance of leveraging FDI as a means of upgrading into areas where capabilities for the digital transition are still missing, as strong ties along European manufacturing GVC can boost the transfer of new technologies from digital leaders (Cséfalvay, 2020).

Figure 3.13 / Share of enterprises using selected advanced digital production technologies in manufacturing in 2021, in %

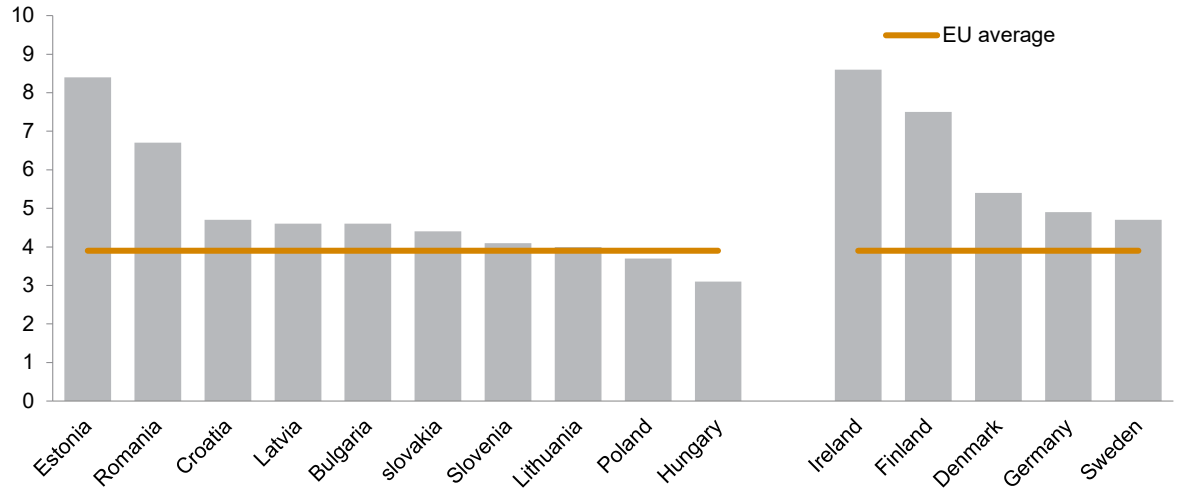


Note: selected ADP technologies include industrial robots and 3D printing (data for 2020), IoT in production and logistics, using of at least one of various AI technologies.
Source: Eurostat.

Still, it is important to note that the above-discussed ADP uptake is often confined to large, multinational firms involved in global production networks. Productivity spillovers to domestic firms seldom materialise on their own. This creates the risk that countries become 'digital factory economies', upgrading into innovative sectors without moving up the value chain into more sophisticated activities. At the same time, the digital divide between SMEs and large firms is an important risk factor in the light of the digitalisation megatrend (McKinsey, 2020). Hence, the development of a favourable ecosystem for domestic linkages and the dynamic growth of start-ups is essential.

Taking a forward-looking view, the region's relatively successful cultivation of ICT skills offers a promising springboard for the digital transformation. Most EU-CEE countries have a larger share of graduates in ICT than the EU average (3.9%) (Figure 3.14). Especially in Estonia (8.4%), Romania (6.4%) and Croatia (4.7%), ICT graduates represent the same share as in the 'front-runner' EU economies, namely those in Scandinavia and Ireland. The strength of the EU-SEE countries in particular is encouraging, as it can allow these economically less advanced countries to gain a foothold in the digital services associated with global production networks, which do not require massive capital investments to the extent of most industrial technologies.

Figure 3.14 / Share of graduates in ICT, in % of total graduates

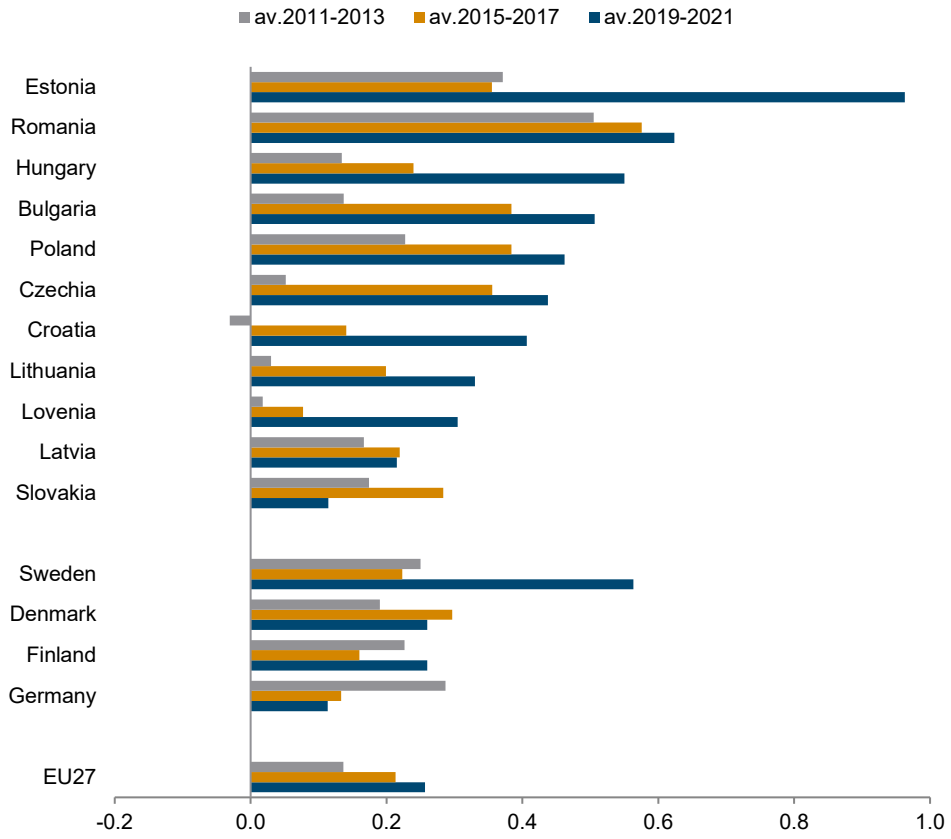


Source: Eurostat

Even a narrowly defined ICT sector[9] is already making a positive contribution to the economic performance of EU-CEE countries. In virtually all countries of the region (with the exception of Latvia and Slovakia), its average contribution to real GDP growth over the past three years has been above the EU average of 0.3 pp. For Estonia in particular, ICT is an important driver of growth, with a contribution to real GDP growth averaging around 1 pp in 2019-2021, the highest in the region. Estonia also saw the largest increase of all EU-CEE countries (by 0.6 pp) in ICT's contribution to real GDP growth against its three-year average in 2011-2013. The macroeconomic importance of ICT for the domestic economy has also increased visibly in Hungary, Bulgaria, Czechia and Romania which all recorded a positive change in real GDP contribution of around 0.4 pp in 2019-2021 against the three-year average between 2011-2023 (Figure 3.15).

[9] ICT sector is defined in a narrow sense as an economic activity J – information and communication according to the classification NACE Rev.2.

Figure 3.15 / Contribution of information and communication activity to GDP growth, in pp

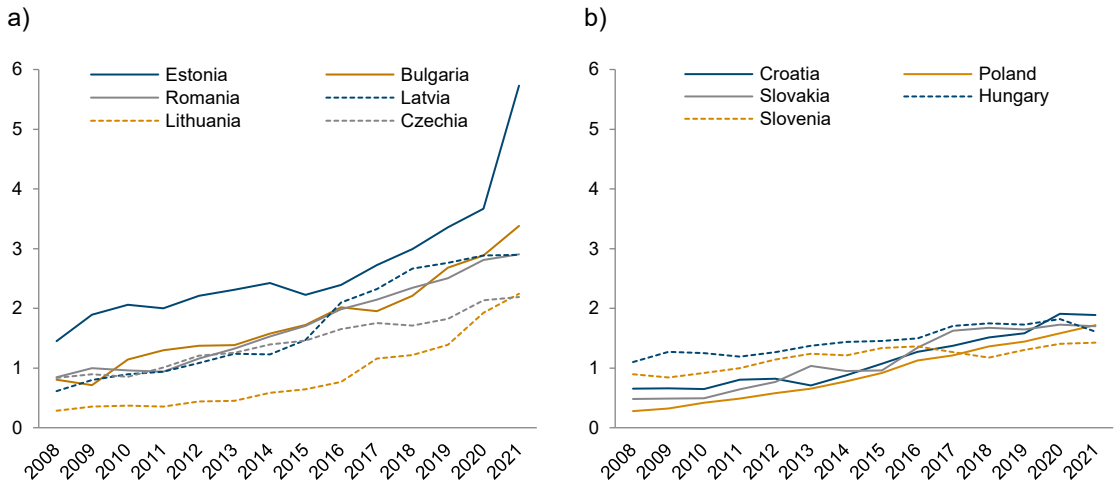


Note: Information and communication activity is defined in a narrow sense as an economic activity J – information and communication according to the classification NACE Rev.2.
Source: Eurostat.

In addition to the direct positive impact of the ICT sector on the domestic economy, the development of exports of ICT services as a share of GDP reflects a slightly growing impact of this economic activity on the external positions of EU-CEE countries (see also Box 3.2). With the exception of Estonia and Hungary, exports of ICT services[10] amounted to less than 1% of GDP of EU-CEE economies in 2008 (the earliest available data point). By 2021, six of EU-CEE countries (part a) of Figure 3.16) – Estonia, Bulgaria, Romania, Latvia, Lithuania and Czechia – have more than doubled the share of ICT services exports in GDP to over 2%, with the largest increase in Estonia to 5.7% in 2021. By contrast, in the five remaining countries (part b) of Figure 3.16), the importance of ICT exports for the economy is rising only slowly.

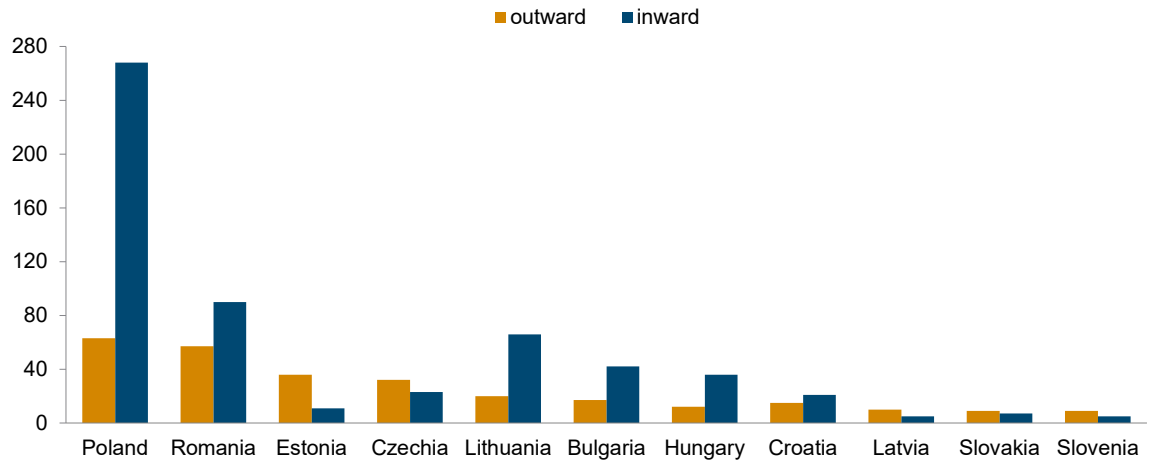
[10] According to the BOP methodology

Figure 3.16 / Exports of ICT services as a share of GDP, in %



Sources: Word Bank WDI, own calculations.

Figure 3.17 / Outward and inward pledged greenfield investments in software and IT services in EU-CEE in 2020-2022, number of projects



Sources: fDi Markets, own calculations.

Along with the export of services, some ICT companies originating from EU-CEE economies are deepening their presence in international markets through FDI. Over 2020-2022, outward FDI (i.e. FDI originating from the country)[11] in software and IT services from EU-CEE countries amounted to EUR 2.3 billion. Of these investments, Poland, Romania, Estonia and Czechia account for around 67% of all projects. Inward investments into EU-CEE from other countries are still prevailing in the sector, and the region attracted EUR 7.5 billion over the same period according to fDi Markets data. In five countries of the region – Estonia, Czechia, Latvia, Slovakia and Slovenia – the number of outward greenfield projects even exceeded the number of attracted projects in 2020-2022 (Figure 3.17), though some of these countries recorded only minor greenfield FDI activity in both directions. Two sub-sectors are particularly

[11] Pledged greenfield foreign direct investment.

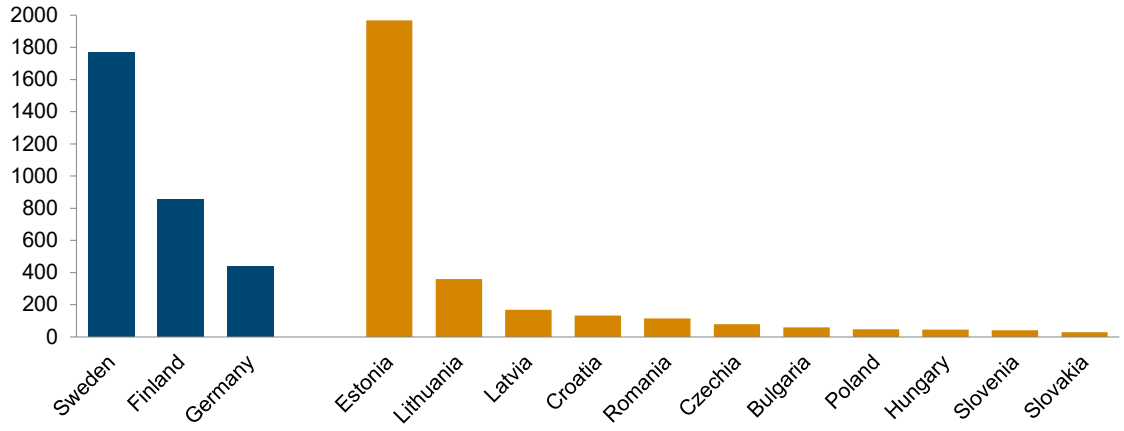
dominant: *customer programming services* clearly dominate inward FDI (51% of projects and 67% of pledged investment), and *software development (except videogames)* represents 34% of inward projects and 22% of capital in 2020-2022. For outward FDI projects, the shares claimed by these two sub-sectors are more equally distributed for the number of projects (44% and 42%), while capital predominates in *customer programming services* (57%) compared to *software development except videogames* (28%), suggesting a less capital-intensive nature of FDI projects in the latter sub-sector.

BOX 3.2 / EMERGING DIGITAL CLUSTERS IN EU-CEE COUNTRIES

Rapidly rising venture capital investment in the EU-CEE region over recent years points to an upward trend in innovative IT firms in the region. Apart from a well-educated and inexpensive labour force, favourable business environment, stimulated by state policies, plays an important role. Estonia and Lithuania - which are among top twenty countries in Global Startup Ecosystem Index ranking 2022 by StartupBlink (13th and 17th respectively) - have also attracted largest per capita venture capital investment over 2005-2021 period, with Estonia being an overall European leader (Figure 3.18). This confirms that a broad digitalisation and favourable digital eco-system are beneficial for digital services and start up development.

Figure 3.18 / Cumulated venture capital investment in EU-CEE and selected other EU countries over 2005-2021

(euro per capita)



Source: Dealroom.co, 2021

An analysis of leading companies among existing and new information technology firms allows to identify the following clusters: gaming (Poland, Slovenia), cyber security products and software development (Czechia, Slovakia, Romania), fintech (Lithuania, Poland), digital education (Poland, Hungary, Romania) and e-health solutions (Romania, Poland). Those companies are also global players, selling and investing abroad. Among these promising companies founded in EU-CEE, thirteen can be identified as 'unicorns'- defined as technological firms exceeding the valuation of USD 1 bn (McKinsey, 2020; Dealroom, 2021). Success stories in countries, which lag behind in many dimensions of digitalisation, for example, Romania, emerging as a promising success story for start-up development, shows that even without broad

digitalisation, it is possible to EU- CEE economies to leapfrog into rapidly growing services activities. UiPath - a 'unicorn' firm founded in Romania, specialised in robotic process automation software, has recorded the largest exit with a valuation of EUR 29.3 billion in 2021, and currently employs 4200 employees, with a headquarter in the US and local offices in Romania and Poland.

Apart from successful subsidiaries of foreign ICT multinationals, two cybersecurity companies founded in EU-CEE are also found among the top 500 firms by turnover according to COFACE CEE TOP500 2021 ranking: Avast Software from Czechia (ranked 317, EUR 670 million turnover and around 1000 employees in 2020, second global anti-malware vendors in 2020, specialised also on IoT, acquired by NortonLifeLock in 2022) and ESET from Slovakia (ranked 427, EUR 534 million turnover and around 1000 employees in 2020). Moreover, several 'Industrial Tech' start-ups from EU-CEE can be also considered as success stories (Dealroom, 2021): InPost, a 'unicorn' firm in logistics founded in 2006 in Poland, manufacturer and operator of new technology of automated parcel lockers for receiving and sending parcels (a record IPO with EUR 8 bn valuation in 2021 and around 5000 employees, addressing climate change issues in its strategy); Rimac group, a 'future unicorn' from Croatia, specialised on advanced hyper-cars and high-performance electrification technologies, (USD 875 million attracted funding), Gideon Brothers, a 'rising star' in robotics and artificial intelligence from Croatia (USD 35million of attracted funding). Polish game production is another example of an IT industry from EU-CEE that has reached an established place in global markets, building on strong IT programming education. In 2021 it spanned nearly 500 companies that employed over 12 tho. people and released over 600 game titles sold globally. Next to the leaders: CD Projekt (valuation over EUR 3 bn in 2023), Ten Square Games, Playway and 11 Bit Studios, there are multiple smaller studios that explore market niches (Rutkowski et al, 2021).

4. The industrial policy landscape of the EU-CEE region

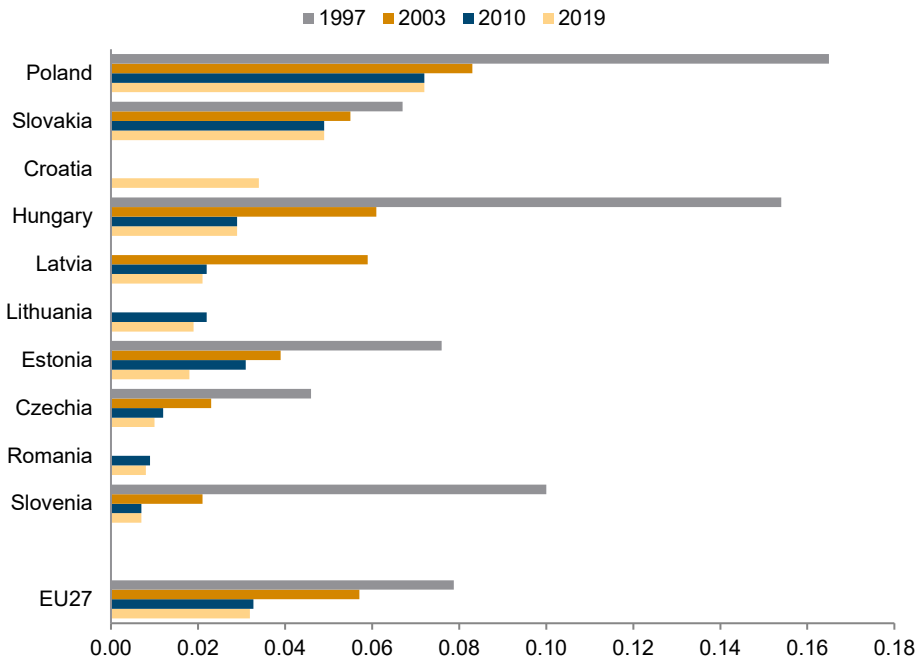
Having mapped the industrial landscape of EU-CEE in Chapter 3, highlighting the emerging green and digital sectors, we now turn our attention to the policy environment. This entails principal EU industrial policies introduced in Chapter 2, but also national as well as certain sub-national industrial policy initiatives. We supplement the discussion of these policies with the experience of the most industrialised economy of the region, Czechia, to illustrate the strong-points and shortcomings of the current setup. Consistent with the definition guiding our study, we mostly limit the discussion in this chapter to selective industrial policy measures, without diving much into the various horizontal support mechanisms in place, though admittedly, the distinction in the EU context is not always so clear-cut.

4.1. NATIONAL AND SUBNATIONAL INITIATIVES IN THE EU-CEE

Investment promotion policies

Importing know-how and generating jobs via inward FDI has been one of the focal points of the EU-CEE economies' industrial development strategies since their EU accession. To this end, investment promotion policies represent prominent industrial policy instruments deployed by national decision-makers in these countries, generally approved by the EU through cohesion objectives. Since the late 1990's, barriers to foreign investment have been dismantled to reach minimal levels even by EU standards (Figure 4.1), which was coupled with the adoption of broad-ranging FDI incentive schemes that offered concessions to firms interested in investing in the given country. This is particularly true for the Visegrád and the EU-SEE countries, whereby wide-spanning forms of FDI subsidies and rebates are offered, giving special preference to foreign enterprises in the economy (Table 4.1). By contrast, the Baltic countries are much less aggressive in their investment promotion efforts, operating without a broadly-defined legal framework for FDI promotion.

Figure 4.1 / FDI Regulatory Restrictiveness Index



Note: The Index ranges from 0 (open) to 1 (closed). The values are derived considering foreign equity limitations, FDI screening, foreign employment restrictions and other restrictions.
The EU27 average is calculated as a simple average of EU member states, excluding MT, CY and BG.
Source: OECD

At the same time, there are some efforts on the side of EU-CEE countries to formulate FDI promotion policies that give preference to certain favoured sectors. Only Latvia, Lithuania, and Slovenia make no mentions of specific industries. As shown on Table 4.1, there is particular emphasis in the region on the promotion of the services sector, with ICT-enabled shared service centres being subject to special treatment in seven of the eleven EU-CEE nations. Still, even in the cases where a vertical approach to FDI promotion is attempted, the sectors are often very widely defined (e.g. the entire manufacturing sector being targeted in the case of Bulgaria, Croatia, Czechia, Romania, Slovakia; or the very wide scope of service industries listed in Bulgaria), with no contextualisation of the choice with an overall economic strategy or evidence-based assessment of local conditions. Moreover, Hungary leaves the support mechanism highly vague and ad-hoc, offering ‘VIP schemes’ on a case-by-case basis to foreign investors. Such approach clearly falls short of the experience of East Asian countries noted in Section 2.2, whereby FDI promotion objectives followed a clearly laid out direction as to where the economy is headed.

Table 4.1 / Overview of FDI promotion and facilitation policies in EU-CEE countries

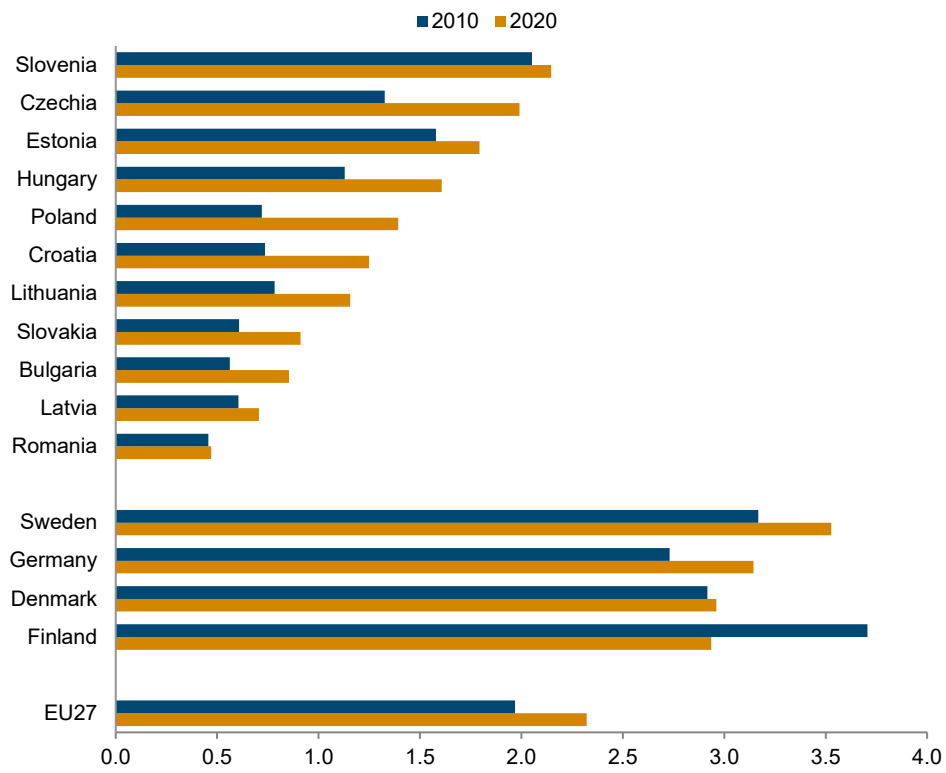
Country	Policy	Nature of support	Sector-specific support
Bulgaria	Act No. 37/2004	Institutional support; transfer of state and municipal property at reduced prices; financial assistance for the training and acquisition of employees; financial support for infrastructure; tax and social contribution exemptions	Manufacturing, software publishing, computer programming, ICT services, accounting services, architectural and engineering services, education, health, residential care, warehousing, office administrative support, call centres, business support services
Croatia	Act on Investment Promotion OG 63/22	Concessions for leasing and purchase of property and infrastructure; financial support for new job creation, training and requalification	manufacturing sector, R&D centres, business support centres, tourism-related services, creative services, engineering services
Czechia	Act No. 72/2000 Coll	Income tax rebates; transfer of land at a discounted price, material support for the creation of new jobs, for the retraining or training of employees, for the acquisition of tangible and intangible fixed assets; exemption from property tax in favoured industrial zones	Technology centres, business support services centres, manufacturing industry, manufacturers of special medical product
Estonia		No legally defined FDI support mechanisms; consultancy and support via the Estonian Investment Agency	Shared service, business process outsourcing, and R&D centres
Hungary	Decree 210/2014 (VIII. 27.) on the use of the Earmarked Scheme for Investment Promotion	Asset- and personnel-related investment cash subsidy; tax rebates and allowances; subsidies based on individual government decision	Subsidies awarded on the basis of individual government decision; preference given to business process outsourcing and R&D centres
Latvia		Creation of 5 Special Economic Zones	N/A
Lithuania	Law on Investments No. VIII-1312	Creation of 7 Special Economic Zones; tax incentives; full or partial personnel retraining subsidies; state credit guarantees; state-owned land leased without auction procedures; subsidies for infrastructure investments	N/A
Poland	New Investment Support Act	Creation of Polish Investment Zones, in addition to former 14 regional Special Economic Zones; corporate income tax exemptions; employment-, investment- and training-based cash grants	R&D centres, business support services, a list of 8 strategically important manufacturing industries
Romania	Acts No. 332/2014 and 807/2014 on state aid schemes to support investments	Subsidies of wage costs; subsidies of renting costs, construction expenses, capital expenditures on technical installations, and intangible assets	Manufacturing industry
Slovakia	Law on Investment Support 57/2018	Subsidies for tangible and intangible fixed assets; income tax relief; financial support for the creation of new jobs; transfer or lease of property at reduced prices	Industrial production, shared services centres, technology centres
Slovenia	Investment Promotion Act (ZSInv)	Same conditions as domestic firms. Subsidies; credit guarantees and interest rate subsidies; purchase of property owned by a self-governing local authority at discounted prices	N/A

Sources: Compiled based on information from national legislations; national investment promotion agencies; UNCTAD Investment Policy Hub; United States Department of State (2020)

Innovation strategy and venture capital

Moving away from the discussion of foreign investment, the domestic investment environment is also of major importance for a dynamic economic system from which new enterprises can emerge. Cultivation of new industries and fostering entrepreneurship in a country is pre-conditioned by the availability of financing of such efforts. A major area requiring EU-CEE's stepped-up efforts lies in the resources spent on R&D. Expenditures on R&D amounted to less than 3% of GDP for all EU-CEE economies in 2020, well below Western EU nations (Figure 4.2). At the same time, it must be emphasised that there are large disparities among individual EU-CEE countries, and some show promising developments. While R&D expenditures reached only to 0.5% of GDP in Romania, Slovenia and Czechia spent 2.1% and 2% of GDP respectively. An increase in relative R&D spending over the last decade was largest in Poland and Czechia (by 0.7 percentage points). Together with Hungary, Croatia and Lithuania, they represent the five EU-CEE countries where increases in R&D expenditures relative to the size of their economies outpaced the EU average in the past decade[12].

Figure 4.2 / R&D expenditures as a share of GDP, in %



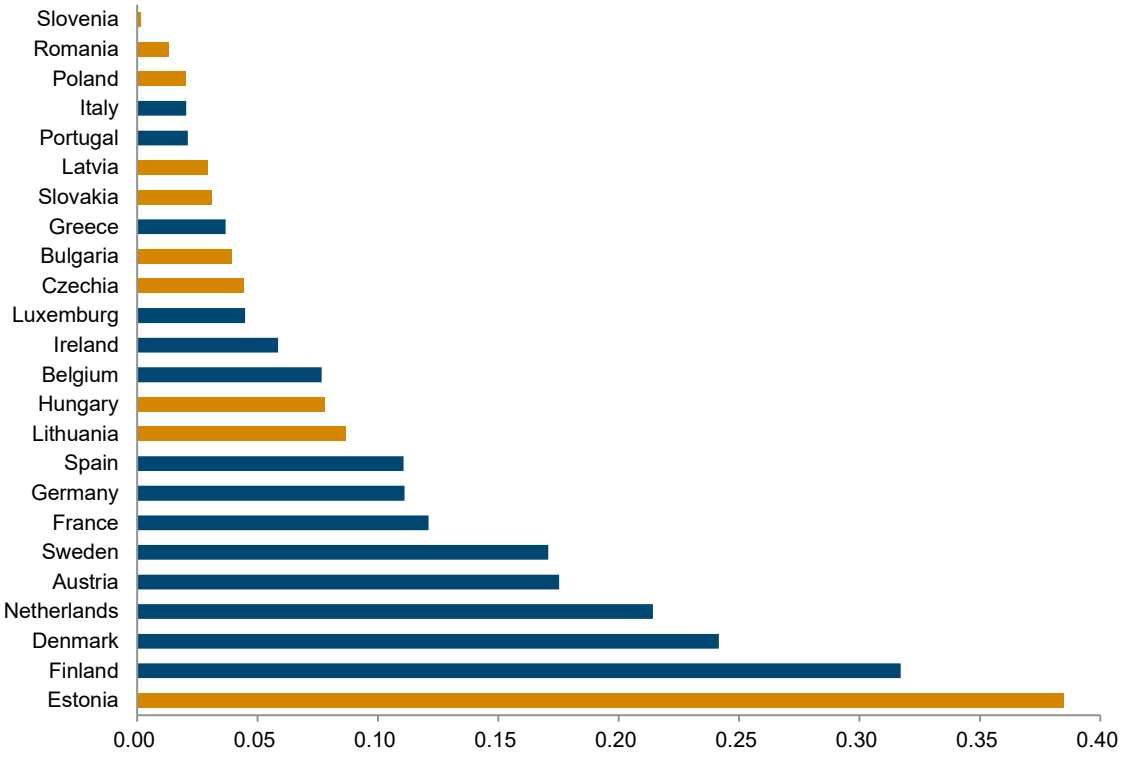
Source: WDI World Bank.

As Figure 4.3 depicts, there are also major divergences across the EU-CEE in the availability of equity financing for young innovative firms. While Estonia leads by EU comparisons when looking at the volume of venture capital financing relative to the size of the economy, this channel is practically non-existent in Slovenia, Romania, or Poland. This makes it highly difficult for domestic firms and entrepreneurship to flourish, as access to capital is limited. Policy has a role to play in making financing

[12] At the EU level, R&D expenditure grew by 0.35 percentage points

more accessible for promising high-growth enterprises, especially given the general scarcity of local funds in EU-CEE investing in start-ups and innovative small and medium enterprises. Hungary is a notable exception, with significant venture capital activity conducted locally, orchestrated by the state, though the efficiency of these state-funded investment schemes has been called into question due to the institutional challenges the country has been facing (Bucsky, 2022). Still, some efforts to make innovation financing more available are worthy to highlight. For instance, the Baltic Innovation Fund- a collaboration between the Baltic national promotional institutions and the European Investment Fund- intends to pool smaller capital markets of the Baltic countries, and has successfully raised almost EUR 1bn and invested in almost 70 small innovative enterprises in these countries (European Investment Bank, 2022).

Figure 4.3 / Venture capital investments, 2021 (as % of GDP)



Note: Data unavailable for Malta, Cyprus, Croatia.
Source: OECD Entrepreneurship Financing database

Still, the EU-CEE countries account for only a small fraction of innovation by the lens of the total globally granted patents (0.4% in 2020)[13]. Even when considering patents granted across EU countries only, EU-CEE's share is rather low (2.6%), mostly driven by Poland (1.3%) and Czechia (0.5%): the two countries that have also most notably stepped up their R&D spending efforts over the past decade, as shown above. By contrast, leading Sweden and Finland account for 6.9% and 3.1% of total patents granted in the EU, respectively. Hence unsurprisingly, none of the EU-CEE countries can be presently considered as innovation leaders according to the European Innovation Scoreboard (EIS) 2022. The best positioned are Estonia, Slovenia, Czechia and Lithuania, which are all classified as moderate

[13] WIPO, own calculations.

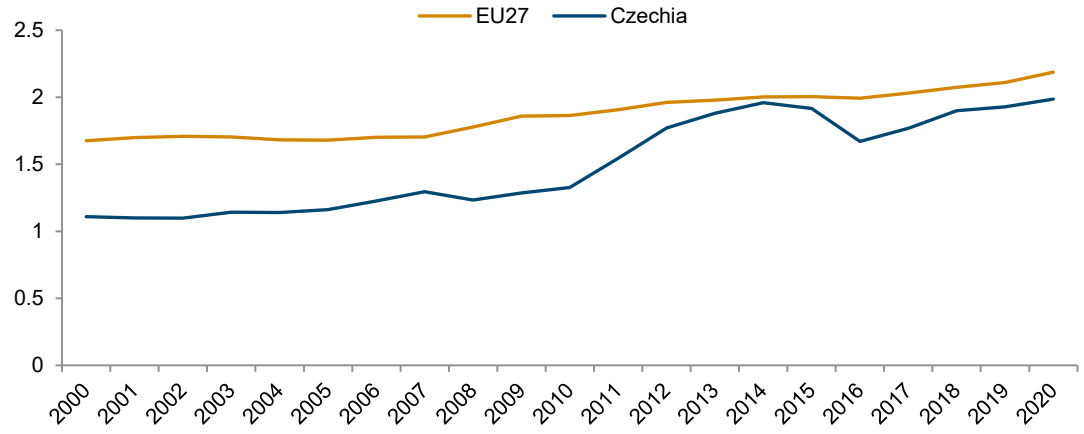
innovators, with all remaining EU-CEE countries placed in the last category of emerging innovators. For the countries scoring better on the EIS, the main aspects that set them apart from the other EU-CEE countries lie in their involvement of SMEs in innovative activities, attractive research system (especially international scientific cooperation), as well as the human capital dimension (tertiary education, life-long learning, employment in innovative activities)[14].

BOX 4.1 / THE CZECH NATIONAL INNOVATION SYSTEM

Czechia is the most industrialized and one of the most innovative economies of the EU-CEE, which managed to achieve significant convergence to EU standards of living in the past decades. Its industrial policy shows examples of good practice as well as a room for improvement in certain areas, which shed insight for the wider region. For these reasons, it was selected as a case study of industrial policy applied in the EU-CEE region, discussed below and in Box 4.2.

Czechia is considered a moderate innovator by the EIS (see Appendix A1); while the capital city region of Prague is well-positioned among the strong innovators (European Commission 2021). Gross expenditure on R&D (GERD) (see Figure 4.4) is approaching 2 % of GDP, still below, but gradually converging to the EU average. Stimulated by the current government strategy (The Innovation Strategy of the Czech Republic 2019-2030), the increasing trend in R&D spending is anticipated to continue.

Figure 4.4 / Gross expenditure on R&D (% of GDP)



Note: The decrease in GERD observable in 2016 is attributable to a temporary decline in EU funding.
Source: OECDStat

Private R&D activities dominate in the country, and contribute to GERD by more than 60 % (OECDstat, 2022). Nevertheless, they are relatively concentrated and dependent on international funding (OECD, 2017a), i.e. in foreign-affiliated companies. This highlights the usefulness of GVC integration in driving innovation on the one hand, but on the other hand, hints at the lagging domestic economy and the greater issue of spill-over generation from foreign to Czech enterprises. Domestic companies demonstrate relatively low R&D density (European Commission, 2019a) due to their predominant

[14] See Appendix A1 for a detailed breakdown.

position in the production part of the value chain, where R&D expenditures tend to be low. Mirroring the presence of large foreign investors, R&D spending is dominated by the manufacturing industry (50 % of business expenditure on R&D (BERD)), out of which the automotive sector plays a crucial role (15 % of BERD). However, the IT-related R&D is recently on the rise, contributing 25 % to BERD in 2021 (CSU, 2021). Here, a group of innovative and fast-growing SMEs tend to collaborate extensively with other subjects, creating the potential for future involvement in higher-value-added activities.

Public R&D investments have so far demonstrated a high degree of dependence on EU funding, echoing the importance of EU membership for EU-CEE countries' industrial strategies, and the relative weakness of EU-CEE governments in driving innovation with their own capacities. Public innovation support to firms has been cumbersome, procedurally difficult and time-consuming, which deters especially SMEs with relatively small administrative capacity. Especially early-stage financing (proof of concept stage) is hard to get as the venture capital market is still relatively underdeveloped[15] , and public support is also limited in this segment. Business angel networks and syndicates are rare compared to the EU15 economies. Moreover, the networks tend to be informal and unstructured. The room for industrial and innovation policy intervention in this regard therefore remains. Another underused tool for policy intervention is public procurement. According to OECD (2019), government procurement expenditures exceed the OECD average; however, there is no clear plan on how to use public procurement to boost innovation locally or nationally. R&D-related institutional setup is highly fragmented among multiple ministries and governmental organisations[16].

Another key issue in the utilisation of R&D financing is the lack of focus on the marketability of the generated knowledge, and the relatively weak collaborative network across stakeholders. University and research institutions' funding is only loosely related to innovative output. Also, the degree of cooperation between universities and companies is weak compared to the most advanced EU countries. Moreover, collaboration is generally short-term and project-based (European Commission, 2019a). Czech universities are insufficiently incentivised to create spin-offs. Unclear ownership rules and lack of start-up funding belong to significant issues addressable by government policies.

There are, nevertheless, examples of good practice of network-state-building activities that are worth highlighting. Charles University in Prague established an independent subsidiary to develop spin-offs. Technical University in Liberec, which focuses, among others, on nanotechnologies, hired specific faculty members to search for and broker cooperation with the private sector. A group of universities and research institutes from Brno[17] established the Central European Institute of Technology (CEITEC), which provides training and facilitates internships between firms and academia (OECD, 2020).

Another good practice to introduce cooperation between public research institutions and private companies are innovation vouchers provided by the Ministry of Industry and Trade, regional and municipal governments. Innovation centres that also interconnect R&D institutions with private

[15] Availability of venture capital is expected to improve gradually in the future after Rohlik.cz and Productboard became unicorn startups recently.

[16] Ministry of Industry and Trade, Ministry of Education, Academy of Science, Czech Science Foundation (GACR), Technology Agency of the Czech Republic (TACR), CzechInvest, Office of Government, Research and Development Council and specific programs run by other ministries (OECD 2016).

[17] Masaryk University, Brno University of Technology, Mendel University, Veterinary University Brno, Veterinary Research Institute, Czech Academy of Sciences Institute for Physics and Materials.

companies can be found all around the country. Successful examples are the South Moravian Innovation Centre (JIC, discussed in the subsequent section, see Box 4.2) and Moravian-Silesian Innovation Centre. Among multiple technology transfer offices, InQbay, a Czech Technical University transfer office, can be considered good practice in transferring and commercialising academic research outcomes (OECD, 2020).

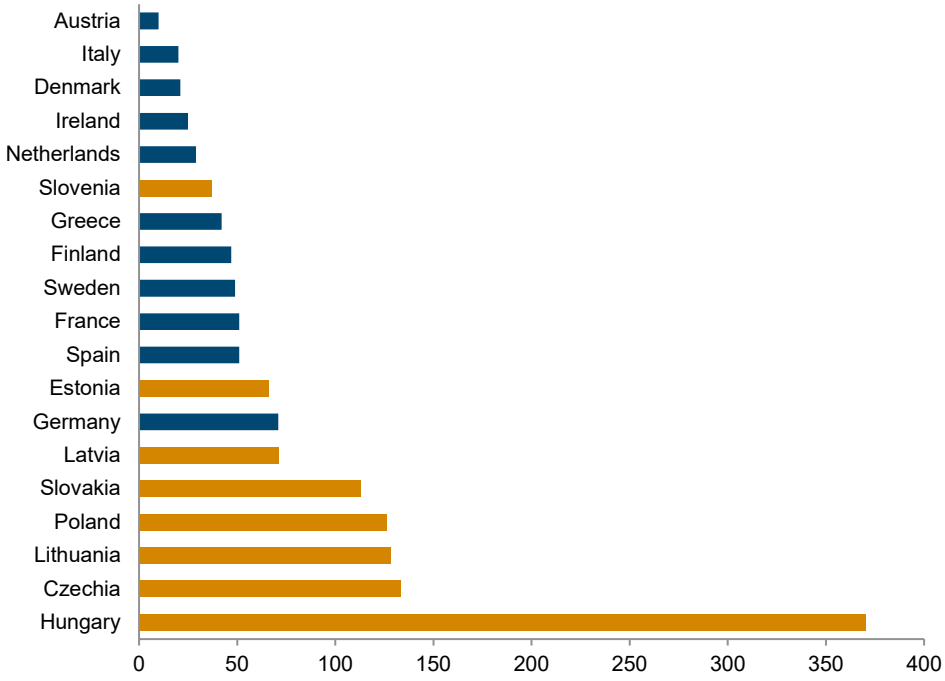
State-owned enterprises

Another powerful channel through which governments mould the economic structure is by directly engaging in the market through state ownership of enterprises, particularly in sectors that are prone to market failure. Historically, post-communist EU-CEE countries were characterised by a large presence of state-owned enterprises (SOEs) in their countries, and despite a wave of (piecemeal) privatisations, the legacy is still reflected in the higher share of state employment against comparable countries with no socialist history (European Bank for Reconstruction and Development (EBRD), 2020). While it is difficult to find reliable and timely data on the sizes of the SOE sector across different countries, the EBRD (2020) estimates that in EU-CEE countries, SOEs tend to employ around 10% of the workforce, with the share being the highest in Lithuania and Latvia (just below 20%), and lowest in Poland and Romania (at around 5%)[18]. Similarly, the OECD (2017b) shows that as of late 2015, Hungary (370 SOEs), Czechia (133), Lithuania (128), Poland (126) and Slovakia (113) have among the highest numbers of SOEs in the 40 OECD and non-OECD countries considered (Figure 4.5). Therefore, given the sheer size of the sector, ensuring the efficiency and competitiveness of SOEs stands out as a particularly important industrial policy question in the EU-CEE region, where institutional quality becomes especially vital (discussed in Section 4.3). In this regard, one should be wary of recent distortive attempts to create 'national champions' using the SOE channel, especially in primary sectors where the productivity-enhancing potential is limited.

At the same time, given the majority of SOEs in the region are concentrated in the transport and energy sector, with heavy representation in fossil fuels (OECD, 2017), there is a special role to be played by SOEs in managing the green transformation. In this sense, it is important to highlight that most EU-CEE countries continue to spend significant amounts of their state budgets on fossil fuels via SOEs, including coal combustion. Figure 4.6 provides an overview of the energy subsidies each EU member state made in 2019. Whereas in the aggregated EU data, renewable energy sources are most prominently subsidised, one can see that in the case of countries such as Hungary, Romania, Lithuania or Poland, fossil fuels make up the lion's share of energy subsidies. Hence, a better alignment of the advantages given to SOEs with overall socio-economic objectives is needed, to ensure that industrial policies do not stand in conflict with each other. For SOEs, this can entail greater engagement in green innovation, creating demand for state-of-the-art green technologies, or setting energy prices in a way that promotes the shift away from carbon (EBRD, 2020). Achieving it requires however overcoming opposition from incumbent, fossil energy producers, as exemplified by Poland. In recent years, PKN Orlen (its national champion, with a strong partisan element) focused rather on consolidating and strengthening its monopoly position in oil and gas manufacturing than on diversifying towards renewable energy sources and attached technologies (cf. Brauers, Oeil 2020).

[18] 2016 estimates.

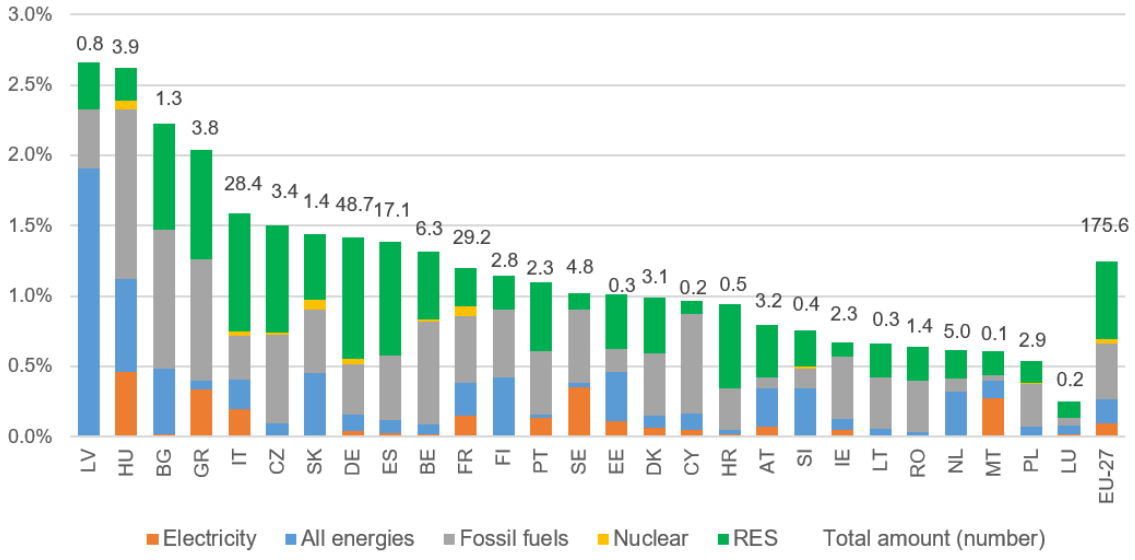
Figure 4.5 / Number of SOEs by country, 2015



Note: Data unavailable for MT, CY, BG, RO, HR, BE, LU, PT.
Source: OECD dataset on the size and sectoral composition of national state-owned enterprise sectors (2015).

Figure 4.6 / Subsidies for different energy sources, 2019

(as percent of GDP and in EUR bn)



Note: RES stands for renewable energy sources. Electricity refers to general non- technology specific support for electricity, while all energies refer to measures that cannot be assigned to a single technology (or multiple technology support).
Source: European Commission (2021e, p.5)

Sub-national industrial policies

With large regional disparities representing a major issue for EU-CEE countries, the enhancing the competitiveness of lagging regions represents a crucial component of industrial policymaking: as we emphasised in Section 2.2, distributional implications are a vital aspect of what constitutes successful industrial policy. To this end, the EU's Smart Specialisation Strategy (RIS3) is available to EU member states as both a vertical and horizontal policy tool tackling the question of sub-national industrial capacities. Rooted in the notion of comparative advantage, the rationale is to motivate the specialisation of individual regions in innovation activities that the region is likely to be superior based on its scientific and technological capabilities — identified through what is called an 'entrepreneurial discovery process' (Forey et al., 2011). Using this bottom-up approach involving various stakeholders to set strategic priorities, the aim is to incentivise lagging regions to diversify into the jointly-identified promising niche areas (Interreg Europe, 2020). Overall, RIS3 has been received with sound enthusiasm on the side of EU policy makers (Foray et al., 2011), and in numerous aspects understandably so: the inclusiveness of the 'entrepreneurial discovery' approach, the focus on knowledge acquisition, agility and adaptiveness, as well as the specificity of the vertical aspect, along with other factors, make it an appealing industrial policy instrument to facilitate intra-national convergence and boost the overall competitiveness of an economy.

However, in lagging regions of the EU, there are formidable obstacles to be addressed if smart specialisation is to have the wished success. While Tsipouri (2017) finds that regional development policies can be conducive to positive economic restructuring in the medium- to long-term, there are numerous challenges involved that make it a formidable task: notably, in the cases where peripheral regions succeed in the deployment of such sub-national initiatives, they often remain isolated 'pockets of excellence'. Furthermore, experience has shown that there are significant capacity limitations in the less economically advanced regions, starting already at the strategy formulation phase. An 'entrepreneurial discovery process' is naturally rather challenging in the absence of capable stakeholders: given the submission of a Smart Specialisation strategy is a pre-requisite to securing EDRF financing, it can lead to pro-forma formulation of strategies and a fixation on arbitrarily-selected sectors (Karo et al., 2017). Moreover, as Trippl et al. (2018) highlight, implementation is similarly an issue as regional institutions are often ill-equipped in terms of their technical capacities. Given that a significant share of least-developed regions is found also in the EU-CEE, these barriers prove highly relevant for these countries. In the section that follows, we again focus on the Czech experience with this segment of industrial policy.

BOX 4.2 / THE CZECH APPROACH TO REGIONAL INDUSTRIAL POLICY

In line with the study's focus and consistent with Box 4.1, this section reviews and draws lessons from the Czech experience with subnational investment promotion policies and the Smart Specialisation Strategy (RIS3).

Regional targeting of investment promotion policies

Investment promotion policies in Czechia date back to 1998, when the government approved first investment subsidies. A coherent investment promotion legislation was approved in 2000[19]. After 2000, investment incentives got a significant regional attribute as the qualification requirements and potential support granted differed based on the level of regional economic development and regional

[19] Act no. 72/2000 Coll.

unemployment rate[20]. Such investment promotion subsidies should have contributed to unemployment reduction in less developed regions, consistent with overall policy aims. However, the amount of approved and subsidised projects continued to grow steadily until 2018, despite declining unemployment rates in these regions. This seeming contradiction can be attributed to an inefficient policy setup, whereby applicants continued to receive subsidies without further evaluation once they fulfilled the set legal requirements. Such a scheme granted the predictability of the system. However, such system did not enable scaling down the support after broader unemployment-related goals seemed to have been fulfilled. Nor did such a system enable further sectoral targeting that would enable desirable structural changes in the economy towards higher value-added production.

Since 2012, technology-enhancing investments and shared services centres began to figure as priority areas for investment subsidies, aiming for structural upgrading of the Czech economy. Nevertheless, 97 % of the approved projects continue to support the manufacturing industry[21], especially the automotive sector, where the most significant investments by OEMs (including Hyundai, Toyota, Nexen and Škoda) were undertaken. Based on the Czech Supreme Audit Office (NKU, 2020), neither the state nor the external auditor required by EU legislation evaluated to what extent the investment promotion policies contributed to the primary aim of unemployment reduction and economic development.

Following amendments in 2019[22], positive steps have been taken to remedy the above-discussed systemic challenges related to investment promotion policy. The current framework requires higher value added to the investment-related activity, and the support provided at the regional level will be subject to policy evaluation by the government. After the system had been amended, the number of approved projects decreased sharply (CzechInvest, 2022)[23]. Although such a system requires a high degree of institutional quality, especially low levels of corruption and mismanagement of public funds, it also enables the government to use this tool to achieve the industrial policy goals set. It is important to note that from the perspective of institutional capacity to conduct industrial policy, Czechia is quite well equipped, especially in the EU-CEE comparison (see Section 4.3). At the same time, the government investment promotion agency CzechInvest's network of local and regional offices, which maintain regular contact with local companies, can act as a blueprint for other EU-CEE countries. This gives CzechInvest a unique insight into the needs and capabilities of local economic actors. Due to its long-term contacts with local companies related to investment promotion aftercare, CzechInvest is capable of promoting local industrial and innovation networks. In addition, CzechInvest supports regional science and technology parks, innovation centres, technology transfer centres, business incubators and business angel networks, which is meant to boost the absorption capacity of local companies. They are located in important industrial centres with high innovation potential that also promote the network effects and innovation capacity in the regions. Hence, as Radosevic and Ciampi Stancova (2018) highlight, the agency CzechInvest and regional technology centres are good examples to follow.

[20] For subsidies in manufacturing industry that generated 97 % of all the approved projects, overall investment volume, investment volume in the new machinery equipment and required number of created jobs differed between structurally disadvantaged and other regions at the NUTS 4 level.

[21] Transport equipment: 29,4 %; machinery: 11,7 %; rubber and plastics: 10 %.

[22] Act no. 210/2019 Coll.

[23] Such decrease shall not be attributed solely to the change in the investment promotion rules, the covid pandemics and the following global supply shortages also played a role.

Regional Smart Specialisation strategies

Company executives in Czechia generally show a positive attitude towards more targeted industrial policy interventions, most favouring subsidies related to R&D activities, as those demonstrate relatively long-term and uncertain returns, justifying an entrepreneurial state (Hnát et al., 2020). In this regard, the RIS3 strategy can serve as a good starting point for the potential further development of national and regional industrial policies. The RIS3 strategy offers room not only for horizontal but also for targeted industrial policy at the regional and sectoral levels alike. It presents clear aims and evaluation indicators that the policymakers can use to adjust the policy over time and refrain from providing relatively inefficient flat subsidies that do not contribute to the policy goals set. Moreover, the RIS 3 strategy allows for regional and sectoral targeting and the overall improvement of the domestic business environment demanded by entrepreneurs. The regional specialisation domains are based on a defined methodology; therefore, the expectation would be that regional comparative advantages would be reflected quite well. In reality, Czech regions differ widely in their capacities to support regional development, and the extent to which they are capable of identifying their future prospective sectors. In the past strategy (2014-2020), certain industrial sectors tended to be repeatedly acknowledged as regional domains of specialisation, especially machinery and transport equipment, which was not present only in three regions. This is, to a great extent, in line with the current regional specialisation; however, it also points to the difficulty of adjusting the regional industrial strategy towards desired structural change, which foresees higher value-added production. In some cases, e.g. biotechnology in the South-Bohemian region, the necessary skills are present in the public R&D centres without sufficient linkages to the entrepreneurial sector, which need to be developed using active policy intervention.

Out of the fourteen Czech self-governance units, the South Moravian Region (CZ 064) might serve as a best practice example. The South Moravian Region builds on reputable universities in the regional capital Brno[24] which provide young graduates who are the driving force of innovation and entrepreneurship, and demonstrates multiple attributes of sound innovation policy at the regional level. Already in 2002, regional innovation expert David Uhlíř founded South Moravian Innovation Centre (JIC) to support innovative entrepreneurship and the commercial exploitation of R&D. JIC provides consultation services to local entrepreneurs in pre-incubation, start-up and scale-up phases. With ca. 100 internal experts and a large network of contacts to business angels and venture capital funds, JIC managed to create and maintain a local community and innovation ecosystem that can cooperate on complex projects. JIC herewith contributed to the foundation of successful companies like Ysoft or Kiwi.com. Due to its profound knowledge of the local capabilities, contacts and data, JIC was given the responsibility to propose and discuss the regional innovation strategy with other stakeholders. Except for JIC, the regional RIS3 working group incorporates members from local academia, chamber of commerce, municipalities, and selected companies. The founder of the JIC also acts as the regional RIS3 manager. Major benefits of the above-described system are its bottom-up design and coordination by JIC professionals with up to 20 years of experience in the field and the incorporation of a broad range of relevant local actors.

In sum, Czech regions' experiences with RIS3 strategies showcase the general difficulty for local actors to effectively identify key strategic sectors to be supported. However, there are useful demonstrative cases to be found: the example of South Moravian Region in particular manifests that such a complex task greatly benefits from the presence of regional development professionals with profound local knowledge and sufficient capacity to interconnect the actors relevant for local development.

[24] The following three universities are among the 1000 best rated worldwide, based on the QS World University Rankings 2022: Masaryk University, Brno University of Technology, Mendel University in Brno.

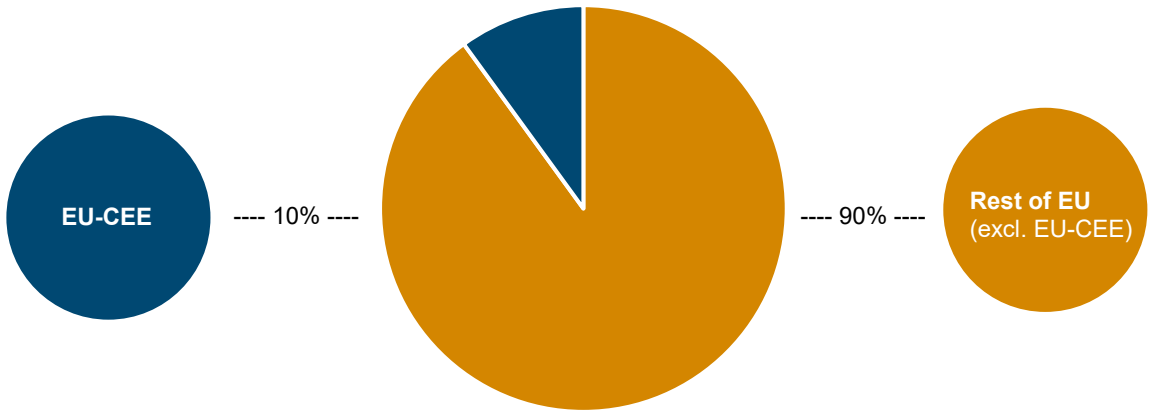
4.2. EU-CEE'S POSITION IN COMMON EU INDUSTRIAL POLICY INITIATIVES

While much of the industrial policy space available to EU member states falls under the scope of the EU Treaty, it is still useful to distinguish between EU-CEE's participation in joint industrial policy instruments of the EU, orchestrated by EU institutions, and the EU's regional industrial policies which are steered by individual member states (Landesmann and Stöllinger, 2020). As we highlighted earlier, the EU has been particularly stepping up the common industrial policy agenda in recent times, to tap into the growth-boosting potential of the twin transition. Integrated industrial policy responses at the EU level are deemed particularly beneficial in areas characterised by significant positive externalities, such as R&D activities, making the pooling of resources for the investment-intensive twin transition an efficient strategy. Moreover, from the perspective of EU-CEE countries, cross-country collaborations and international mobility with the technologically more advanced EU countries offers a valuable chance to facilitate learning experiences and knowledge spillovers.

There are several pillars to the supranational effort, falling under the umbrella of the European industrial strategy. Of these, initiatives supporting innovation, technology, and R&D activities have been the largest recipients of EU industrial policy funding (Landesmann and Stöllinger, 2020). The flagship instrument in this area is the Horizon Europe (succeeding the former Horizon 2020), with an allocation of €95.5 billion for the period of 2021 to 2027 (up from €80 billion for Horizon 2020), directed at boosting industrial competitiveness and approaching the UN Sustainable Development Goals. A part of the Horizon programme is also the establishment of the European Innovation Council, aimed at an 'entrepreneurial state'-type support in giving grants and creating markets for breakthrough technologies. Yet despite being a collaborative effort of the bloc, the extent to which individual member states are involved in the initiative markedly differs. The experience from the recently concluded Horizon 2020 reveals that the EU-CEE countries were significantly underrepresented, which naturally limits the potential of such instruments to bring about industrial upgrading in these countries (Figure 4.7)

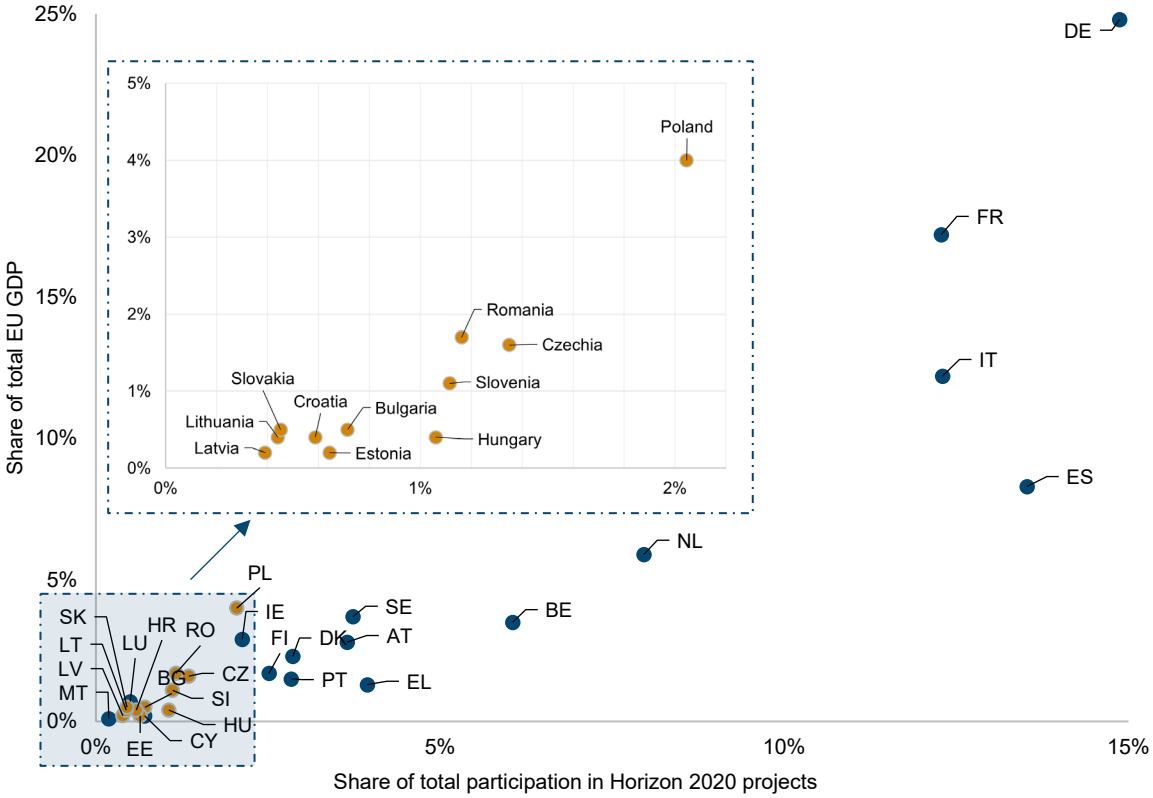
Figure 4.7 / Number of organisations participating in the Horizon 2020 projects by country groups, 2014-2020

(as % of EU total)



Source: European Commission Horizon Dashboard

Figure 4.8 / Participation in Horizon 2020 projects over the programming period 2014-2020 and GDP share by country, as % of EU total



Note: GDP based on current prices, 2021 figures.
Source: European Commission Horizon Dashboard; Eurostat

The distribution in the participation between the EU-CEE and the original EU members closely mirrors the contributions of each country to the combined EU GDP (Figure 4.8): a simple correlation exercise reveals that the share of total participation in Horizon 2020 projects and the share of EU GDP claimed by each country is highly intertwined, with a correlation coefficient of 0.902. What this suggests is that unlike Cohesion Policy instruments aimed at bringing about convergence across member states and regions, the uptake of EU industrial policy instruments rather appears to be a function of economic strength.

On the other hand, while the number of Horizon proposals submitted by EU-CEE countries are far smaller than the 'old' EU members in absolute numbers, the success rate of the eligible proposals is comparable to the more advanced countries of EU. Even the least developed country of the group, Bulgaria, has a comparable proportion of retained Horizon Europe proposals (20.4%) as Germany (21.0%).[25] In this sense, the issue does not appear to be the quality of the submitted proposals, but rather the quantity of submitted applications in the first place (Cedzová et al., 2021). As highlighted by Box 3.1 and Box 3.2, there are promising innovative entities and clusters emerging in the EU-CEE countries, yet their scarcity is apparent and ought to be tackled.

[25] Values obtained from the European Commission Horizon Dashboard.

The EU-CEE countries are likely to face similar challenges in other aspects of the common EU industrial policy pillars as well, including the European Chips Act, intended for capacity-building in semiconductor value chains, or the associated Chips for Europe Initiative, aimed at supporting the development and deployment of next generation semiconductor and quantum technologies (European Commission, 2022b). In this regard, the involvement of certain EU-CEE countries in various green and digital IPCEI represents an encouraging development (Table 4.2, see also Box 3.1), especially considering the first IPCEI related to microelectronics (approved by the European Commission in 2018) was a consortium of exclusively Western EU countries: France, Germany, Italy and the UK (European Commission, 2018). Unsurprisingly, the EU-CEE countries presently participating in these state-of-the-art endeavors are those that appeared to be most advanced in the transition to a digital and green economy (see Chapter 3): Estonia, Czechia, and Poland, to a lesser extent Slovakia.

Table 4.2 / EU-CEE participation in approved IPCEI

Country of origin	Organisation	IPCEI	Year
Estonia	Elcogen	Hydrogen Technology value chain – Hydrogen Generation Technology	2022
Estonia	Stargate	Hydrogen Technology value chain – Hydrogen Generation Technology	2022
Poland	Synthos	Hydrogen Technology value chain – Hydrogen Generation Technology	2022
Estonia	Elcogen	Hydrogen Technology value chain – Fuel Cells Technology	2022
Czechia	Iveco	Hydrogen Technology value chain – Fuel Cells Technology	2022
Slovakia	NAFTA	Hydrogen Technology value chain – Storage, Transportation and Distribution Technology	2022
Czechia	Iveco	Hydrogen Technology value chain – End User Technology	2022
Poland*	SGL Carbon	Battery value chain – Raw and advanced materials	2021
Poland	Eneris	Battery value chain – Raw and advanced materials	2019
Poland*	Umicore	Battery value chain – Raw and advanced materials	2019
Slovakia	InoBat Auto	Battery value chain – Battery cells	2021
Poland	Eneris	Battery value chain –Cells and modules	2019
Slovakia	Energo Aqua	Battery value chain – Battery systems	2021
Slovakia	InoBat Energy	Battery value chain – Battery systems	2021
Croatia	Rimac Automobil	Battery value chain – Battery systems	2021
Poland	Eneris	Battery value chain – Battery systems	2019
Slovakia	ZTS VaV	Battery value chain – Recycling and sustainability	2021
Poland*	SGL Carbon	Battery value chain – Recycling and sustainability	2021
Poland	Eneris	Battery value chain – Repurposing, recycling and refining	2019
Poland	Elemental	Battery value chain – Repurposing, recycling and refining	2019

* jointly with Germany and Belgium, respectively.
Source: Information compiled based on European Commission (2022b; 2021c; 2019b)

Still, the issue remains that common EU industrial policy frameworks tend to be skewed towards maintaining the competitiveness of the economically stronger countries of the bloc, with little consideration given to supporting the convergence of less advanced countries to the technological frontier. Such ‘one-size-fits-all’ set-up risks exacerbating undesired lock-in effects that the EU-CEE countries are trying hard to get out of. In this sense, it becomes particularly important at the EU level to reconsider the appropriateness of the current joint industrial policy efforts for all of its member states,

taking into account the heterogeneity in development levels, technological, as well as organisational capabilities (Landesmann and Stöllinger, 2019).

BOX 4.3 / EU FUNDS FACILITATING INDUSTRIAL POLICY AT THE NATIONAL LEVEL

While EU membership implies the need for coordinated industrial policies (which comes with the above-discussed challenges for EU-CEE), it does not suggest a complete lack of agency on the side of the member states to decide on the ways in which the available financing and policy space is implemented. On the contrary, as Landesmann and Stöllinger (2020) show, national industrial policy expenditures have significantly exceeded the financing of common EU initiatives in previous programming periods, making industrial policy a shared competence between the EU and its individual member states. The Next Generation EU, a € 806.9 billion recovery stimulus unleashed to support primarily the green and digital objectives following the COVID-19 crisis, further amplifies this point. With each country active in formulating the necessary reforms, milestones, and investments, there is new space created for targeted and suitable industrial policy interventions, managed by each member state. Furthermore, what is particularly important in the context of these EU-guided national and subnational initiatives is that unlike the common EU industrial policy instruments, here the EU-CEE countries stand to benefit from disproportionate allocations relative to the size of their economies. This holds true not only for the cohesion financing of ESIF (Landesmann and Stöllinger,2020), but also in the case of the Recovery and Resilience Facility (RRF), whereby the allocations are also suggestive of a redistributive approach between most economically developed countries and the least advanced.

What additionally stands out is that much-higher importance is placed on EU funds to support industrial policy endeavors in EU-CEE relative to member states' own subsidies, compared to Western EU countries, as Landesmann and Stöllinger (2020) illustrate. Hence, EU instruments (including the RRF, the European Regional Development Fund (ERDF) and the Cohesion Fund), represent a particularly important tool for industrial upgrading in the region; yet, their implementation has often been a point of struggle for certain EU-CEE countries. Croatia, Slovakia and Romania belong to the group of countries with especially low absorption rates of EU finances at below 40%, suggesting the available investment boost is far from being utilised to its full potential. On the other hand, Baltic countries boast the highest absorption rates in all of EU (Darvas, 2020), offering space for cross-country sharing of best practices at the EU-CEE level. At the same time, there are qualitative considerations beyond the sheer ability to spend allocated finances. For instance, it is important to note that there is a persistent inclination on the side of EU-CEE countries to over-emphasise 'concrete' investments such as infrastructure or facilities building, with much smaller support given to intangibles such as R&D activities, as well as green issues and sectoral industrial policy measures (Astrov et al., 2022; Landesmann and Stöllinger, 2020). Furthermore, the effectiveness of investments relies on good governance, which is instrumental to delivering value for money (Darvas, 2020). In this context, the institutional backsliding witnessed in numerous EU-CEE countries in recent times is a concerning development (Grieveson et al., 2020), hindering the ability to proceed with successful industrial policymaking (see Section 4.3). These struggles are already evident in the delays and blockages seen by some EU-CEE countries in the disbursement of EU funds.

4.3. INSTITUTIONAL CAPACITY FOR INDUSTRIAL POLICY IN EU-CEE

The most prominent arguments against active government involvement in the economy are the issues of government failure and state capture. It seems reasonable to assume that governments lacking sound institutions and with a high degree of effectiveness in their economic policymaking will not be able to cooperate effectively with academia and the private sector, to formulate good industrial policy, or to properly implement it. This is an important consideration in the EU-CEE context. These countries underwent fundamental post-communist institutional reforms in the 1990s, and then achieved a degree of institutional convergence with the most developed EU member states as part of their EU accession process. However, in the last decade or so, there is evidence that some of these countries have become stuck at a level of institutional quality far below that of the most advanced EU member states. Moreover, in some cases even institutional independence has been called into question. Most worryingly, 15 years after acceding to the EU, Romania and Bulgaria remain subject to the Cooperation and Verification Mechanism (CVM), effectively an acknowledgement that their institutions had not reached EU standards when they joined the bloc, and that this problem has not been remedied in the years since[26]. More recently, the need to respond to the COVID pandemic and its economic and social fallout saw an increased role of the state in the economy, something that is unlikely to be fully unwound as the impact of the pandemic fades.

The quality of institutions is a (possibly even *the*) key determinant of economic development (Rodrik et al. 2004, Acemoglu and Robinson 2008). In middle-income countries and those not at the frontier of economic development, the relative weakness of institutions versus developed countries makes successful industrial policy harder to achieve (Altenburg 2011). Industrial policy in these countries tends to be hamstrung by vested interests (who can steer resources earmarked for industrial policy in their own interests) and a lack of resources and incentives. Some argue that even for the successful cases of East Asia, industrial policy in the first years was quite ineffective due to a lack of institutional quality; only when institutions improved did industrial policy really take off (Chang 2006). This also could imply a step-by-step mutual learning approach, with institutional quality and industrial policy effectiveness improving in tandem (Altenburg 2011).

The importance of institutions is particularly relevant when it comes to smart specialisation strategies, which require a higher level of institutional capacity to be effectively implemented (Racic et al. 2021). This requires not only strong state capacity of the central government, but also strong institutional capabilities among a range of relevant public and private sector actors. The knowledge to fully understand how industrial policy should be formulated is not held by the government alone, but diffused among business agencies, the private sector and academia (Rodrik 2014). Smart specialisation requires the involvement of non-government actors in the policy formulation process via a ‘continuous entrepreneurial discovery progress’ (Radosevic, 2021). Effective monitoring of the implementation of smart specialisation measures, and the evaluation of these data to adjust policy, is also crucial to make it work. The set up must be such that the relevant parts of the private sector and state bureaucracy are ‘embedded’ in an institutionalized system allow constant interaction to adjust goals and policies (Evans 1995, Rodrik 2014). It is within this process of constant discovery that the government can understand exactly what kind of interventions it can most usefully make. All of this requires a high level of institutional capacity.

[26] Dealing with judicial reform, corruption and (in the Bulgarian case) organised crime.

This is something that is quite new for all EU-CEE economies and will certainly be challenging to implement in the early stages. A middle ground must be found between laissez faire capitalism and state capture, something that is not easy in any country, but could be particularly challenging in at least some parts of EU-CEE where some elements of state capture can already be observed. This also requires a level of institutional capacity that may not currently exist across the whole of EU-CEE. As the state capacity and quality of institutions varies widely across EU-CEE, states will need to be realistic about setting their own industrial policy and smart specialisation goals, with the threat of overreach and policy failure very real. One key element in ensuring that relevant government departments and agencies remain independent is the professionalism of the staff and level of reputation (Rodrik 2014). Even without formal mechanisms to ensure independence, technical competence and a track record of success can help to ward off political interference (Greenwald 2013).

Nevertheless, a degree of public accountability is also central to ensuring that key public institutions retain the level of quality and interdependence to effectively play their required role in industrial policy formulation and implementation. Outside of fully liberal and democratic countries, this is still possible. Rodrik (2014) highlights the successful accountability achieved in Asian countries via various means, including presidential oversight in South Korea, the high level of pay in making corruption less attractive in Singapore, and the need for regional officials to remain business friendly in order to attract investment and fiscal support in China.

EU-CEE institutional development and implications

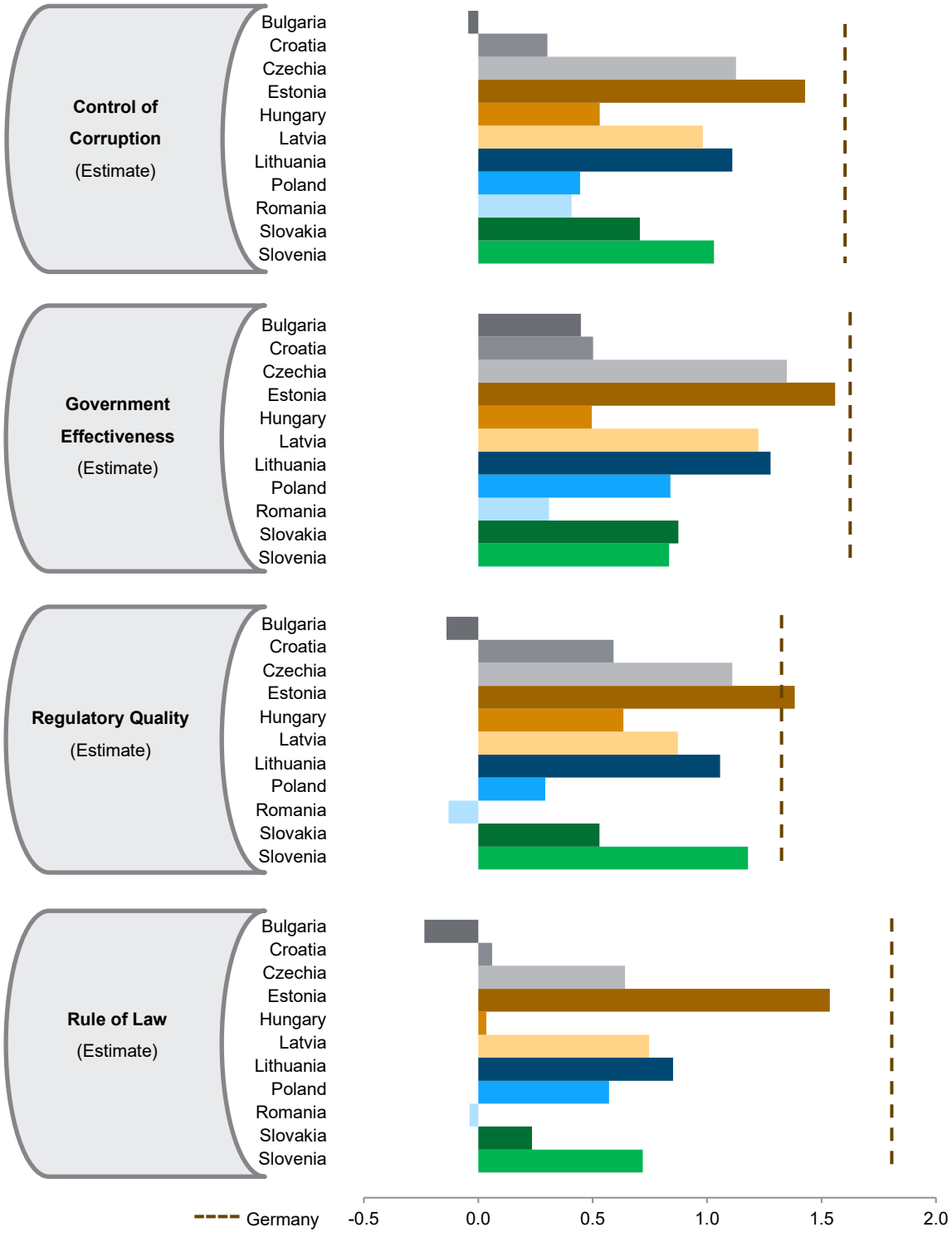
The level of institutional quality across EU-CEE is quite uneven based on the World Bank Worldwide Governance Indicators (Figure 4.9)[27]. Some countries, especially Bulgaria and Romania, have low scores and remain far away from Western European levels. However, several countries match or get close to German levels. Estonia stands out as being at or close to German levels across all four indicators, and is even ranked slightly higher than Germany for government effectiveness. Estonia is also clearly the leader in EU-CEE when it comes to control of corruption. However, Czechia, Latvia, Lithuania and Slovenia all post scores which are not far from German levels on at least one of the indicators, implying a decent level of institutional development which could support the implementation of industrial policy and smart specialisation measures.

In trying to understand the effectiveness of industrial policy and smart specialisation in this institutional context, it is also important to understand the rate of change. Here, the picture is again very mixed (Figure 4.10). Since 2007, several countries have made very clear improvements across the same four indicators. The three Baltic states, Czechia and Croatia register improvements for control of corruption, government effectiveness, regulatory quality and the rule of law. On the other hand, Hungary has gone backwards on all four indicators, while Bulgaria, Poland, Romania and Slovenia register a decline on at least one of them. Broadly, the picture seems to be that the more developed states show progress, while the least developed have struggled more, which could imply that higher economic development helps to entrench and drive forward institutional upgrading. Croatia is an interesting (positive) outlier, but this could be to do with the fact that in 2007 it was still six years away from EU accession, and it is exactly in the years before accession when the big institutional improvements across the region have taken place.

[27] Here, we choose the four World Bank Worldwide Governance Indicators that we see as most directly relevant for industrial policy: control of corruption, government effectiveness, regulatory quality and the rule of law.

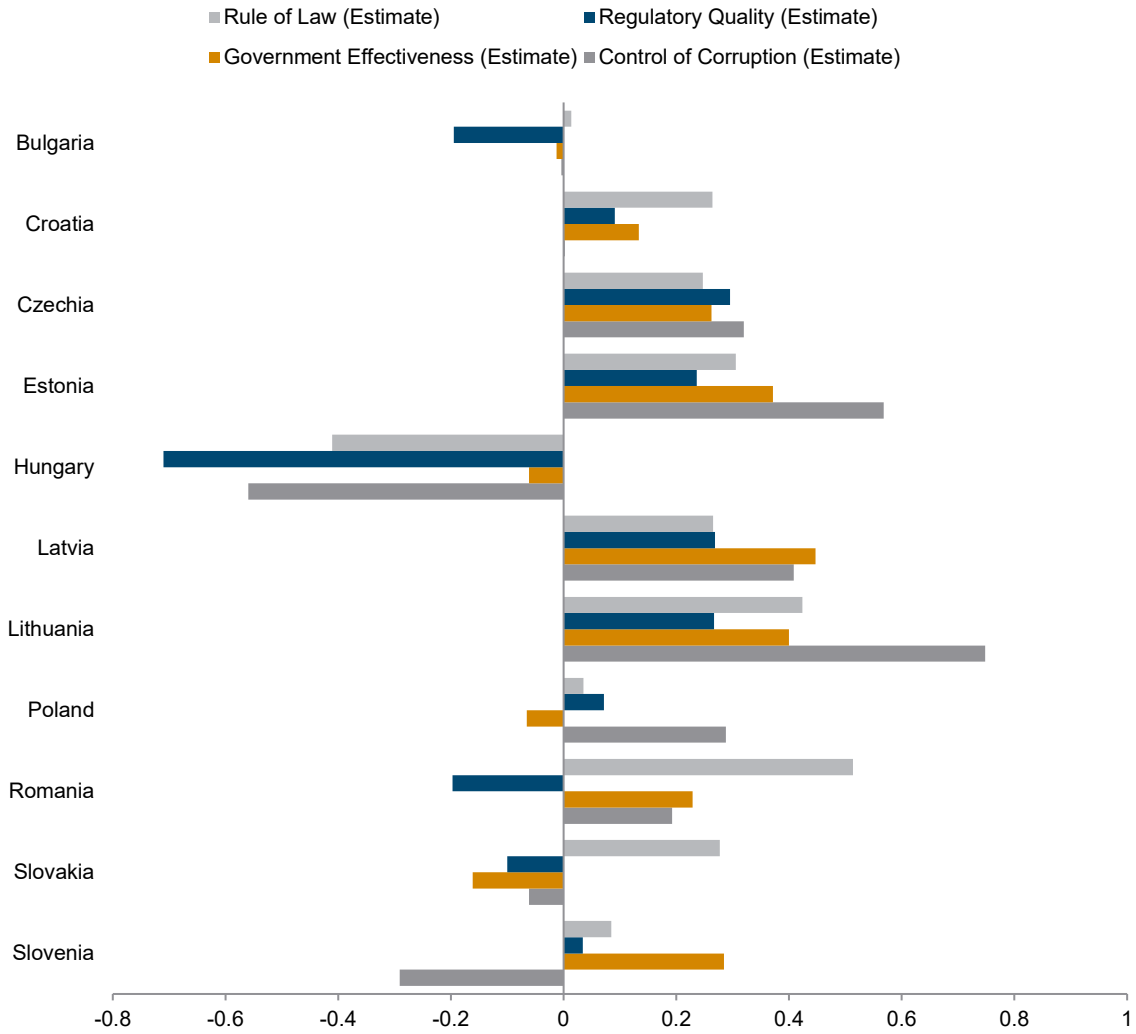
The negative outlier is Slovenia, although here the government effectiveness score at least increased strongly, which is a positive sign for the formulation of effective industrial policy.

Figure 4.9 / World Bank Worldwide Governance Indicators score; max = 2.5, min = -2.5



Source: World Bank Worldwide Governance Indicators.

Figure 4.10 / World Bank Worldwide Governance Indicators; change 2021 vs 2007



Note: The score for government effectiveness reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. The score for regulatory quality reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. The score for rule of law reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Source: World Bank Worldwide Governance Indicators.

A key driver of institutional regression in EU-CEE over the last 15 years or so has been changes in voting patterns and the make-up of governments. Although far from uniform across the region, in certain countries the populist share of the vote has increased strongly and stayed at a high level. In its Democracy Report 2020, the Varieties of Democracy Institute (V-Dem) at the University of Gothenburg said in relation to Hungary that the EU 'has its first non-democratic member'. In recent years, populist parties have also been part of governing coalitions in several other EU-CEE countries. Explanations for the retreat of democratic standards and increased strength of populist parties differ. Theories include 'resentment at liberal democracy's canonical status and the politics of imitation (of the West)' (Holmes and Krastev 2019), an EU-CEE-specific 'ersatz liberalism' that never put down deep roots (Dawson and

Hanley 2015), and resentment at the onerous austerity imposed on the region by institutions such as the IMF after the 2008-09 global financial crisis (Tooze 2018).

However, the examples from Asia outlined earlier in this section indicate that fully democratic systems and the absence of state capture are not full pre-requisites for the implementation of effective industrial policy, although they can make it harder. Various measures can be employed to ensure discipline and accountability, even in countries where institutions work less than perfectly. Moreover, the strictures of EU membership itself can help to enforce some of the required scrutiny of institutions, even if this has not always worked fully in the past.

Within EU-CEE, it is clear that there will be no one size fits all set up for institutions as part of industrial policy and a smart specialisation strategy. Hungary represents a very particular case given the scale of the institutional deterioration there, and this is a problem that the EU has so far failed to solve. Particularly concerning in the context of industrial policy has been the apparent widespread misuse of EU funds[28]. Against this backdrop, it is highly questionable whether sound industrial policy can be formulated and implemented in Hungary in the current political context. The weakness of Romania and Bulgaria on the WGI scores also emphasize the need for caution in being too ambitious, at least to start with, in the implementation of wide-ranging industrial policy and smart specialisation strategies there. By contrast, in other parts of EU-CEE such as Czechia, Slovenia and the Baltic states, continued institutional upgrading and convergence indicates much more fertile ground for the successful implementation of good industrial policies. In these countries, we can hypothesise that we are seeing something like the East Asian experience referenced above, as institutional upgrading, better industrial policy and economic development could take place in tandem.

BOX 4.4 / RECENT INDUSTRIAL POLICY ATTEMPTS IN POLAND: SUCCESSES, CHALLENGES, AND LESSONS FOR THE REST OF THE REGION

Important lessons on the role of institutional framework for effective industrial policy can be drawn from the developments in Poland after 2015. New industrial policy was in fact one of the building blocks of the political programme of the ‘United Right’ party, which has ruled the country since then. It assumed a fundamental break with a previously dominant mode of policy making, which was perceived as an element of the liberal and dependent mode of industrial development, possibly leading to a middle-income trap. Conversely, the new policy regime was built on the populist ideational change, which included concepts of regained economic sovereignty (vis a vis foreign capital), economic patriotism, and an increased role of state interventionism. In 2017 it was developed into a ‘Strategy for Responsible Development’, known also as ‘The Morawiecki Plan’ (after the name of the prime minister) (cf. Białek & Oleksiuk 2020). Its priorities were to increase investment rate and innovativeness, in particular of domestically-owned business, in order to enhance non-cost sources of competitiveness and reduce the dependency on foreign capital (Toplišek 2020).

The Strategy, inspired by i.a. experiences of Asian Tigers and Marianna’s Mazzucato concept Entrepreneurial State, involved a profound institutional change oriented at improved coordination, and enhanced human and financial capacity. Previously dispersed numerous government agencies were now consolidated into the Group of Polish Development Fund (PFR). PFR was founded in 2016 to

[28] https://www.nytimes.com/2019/11/03/world/europe/eu-farm-subsidy-hungary.html

coordinate broadly defined industrial policy, including the areas of investment, innovation, exports, and entrepreneurship promotion. Formally speaking, it is a state-owned enterprise, which was given a substantial political independence and financial capacity (this one often supported by a peer institution, state development bank BGK). It offers several funding and advisory instruments, which support companies (including start-ups), and local governments.

New policy objectives were to be achieved not only by new institutions, but also thanks to a fundamental personnel change. Interestingly enough, the new development policy was coordinated by persons from the managerial elites, rather than by the traditional bureaucrats (Naczyk 2022). Mateusz Morawiecki and his close collaborators were former experienced managers from banking and financial sectors. They introduced new, business-like style of policy making into the public administration, which was strengthened by PFR's recruitment of multiple specialists from the private sector. Similar attempts at personnel and cultural change were conducted in other vital segments of industrial policy – the key ministries, and some state-owned enterprises. These attempts were however much less successful, which undermined the overall efficacy of institutional change and resulted in tensions between the institutions later on.

The strategy implementation succeeded only in some of its priority areas, in particular the ones directly related to finance, e.g. building a venture capital ecosystem, increasing R&D expenditures (both public and private ones), and nationalizing parts of the banking system (with the adjacent benefits for investment and fiscal policies). These turned out to be very useful during COVID-19 pandemic, when PFR coordinated the financial shields for businesses. Another priority, namely the selective industrial policy and the so-called flagship projects in strategically important industries, has brought ambiguous results. Consequent and effective policy support was designed only in some industries, mostly ones with already strong local industrial base (e.g. games, furniture, trains manufacturing). Two notable exceptions were production of drones and manufacturing of batteries for electric vehicles – in both cases political determination facilitated sectoral development. Other projects failed or were quickly discontinued due to lack of political will, low institutional capacity or little demand for policy support from businesses (e.g. ships and ferries manufacturing, cybersecurity services, smart mining) (Supreme Audit Office 2021). Stakes are still open in the case of Polish state-owned electric vehicle brand Izera.

Introduction of new industrial policy in Poland has faced many obstacles, and its partial failure can be explained only to some extent by weak capacity of post-communist and neoliberal institutions. Political conflicts within the power block and weak embeddedness of policy makers in the industry were two other important reasons. Goals of industrial policy often clashed with other priorities of the ruling party, which was best visible in the case of SOEs. Instead of becoming true champions, important e.g. for energy transition, they were quickly subject to cronyism, and a massive partisanship. Similarly, the populist government's recurring clashes with the European Commission undermined the goals of industrial policy (e.g. by blocking the inflow of EU funds), instead of supporting shift towards more sovereignty.

Altogether the results of Poland's sovereign attempt have been ambiguous so far. Institutional capacity has been enhanced for sure, and new ideas of state interventionism prevail. However, investment rate remained low, while industrial development, and competitive position are still concentred in foreign capital (Toplisek 2020). This substantiates the political economy view that successful industrial policy requires also some embeddedness in local productive structures, which would form a base for policy interventions.

5. Industrial policy for a new growth model: key recommendations for EU-CEE economies

Our previous study (Grieveson et al., 2021) found that EU-CEE countries had entered something of a development trap, and it was time to switch to a new, more innovative growth model. In the policy proposals to that study, we identified six broad areas to transition towards a new model. We proposed using the (then quite significant) fiscal and monetary policy space; using EU resources to embrace the green and digital transitions; tackling the region's demographic decline by pushing automation and creating a more flexible labour market; and creating a better social safety net to make sure workers themselves do not bear the costs of the transition and to encourage young families to stay in the region. With the exception of the policy space—which is much reduced, at least for some time, due to the energy price shock and much higher interest rates—all of this still applies. However, in this paper we zoomed in on the other core recommendation from the previous study: the use of industrial policy, a national innovation system and the aspiration to create a EU-CEE version of the entrepreneurial state in order to shift the direction of the region's economies in a more lucrative, innovative direction. This, we believed, had a very significant potential to allow the region both to escape its development trap, and manage the transitions it is undergoing, in a way that would kick-start a new phase of convergence with Western Europe and improve the lives of the people of EU-CEE.

In this study, we have outlined the context, explored the challenges, and assessed the region's strengths and weaknesses in the creation of an industrial policy. In this final section, we set out our policy recommendations for industrial policy in the region as a whole. Our thoughts on the specific measures that each country should employ are detailed in the following section. There is often a fatalistic sentiment in the region regarding the ability to manage domestically the future course of economic development. Challenging this perception, in this final section, we want to highlight that an effective deployment of industrial policy represents an indispensable component to a new growth strategy, and that there are numerous policy options available to EU-CEE policymakers as they look to advance with a suitable industrial strategy response.

5.1. BUILD AN ENTREPRENEURIAL STATE TO FOSTER INNOVATION AND DEVELOP INDUSTRIAL POLICIES THAT MEET THE NEEDS AND CAPABILITIES OF THE ECONOMY

In our previous study, we already recommended the building of an entrepreneurial state, but in this study, we have gone much further to examine how this could be done in EU-CEE. A defining feature of such an entrepreneurial approach is the creation of a collaborative network and a constant feedback loop between key ministries, academic, business agencies and the private sector. Within this forum, new ideas can be financed, tested, assessed and then adjusted and developed further. This should be tied concretely to national innovation systems, which set clear industrial policy priorities for each of the EU-CEE countries.

As we highlighted in the report, very little of this exists at present. The EU-CEE countries have generally lacked a stable, strategic approach to industrial policymaking in their development paths so far, and there is plenty of room for improvement in terms of linking up the relevant actors. Their opening up to FDI, and the inflow of MNEs in the manufacturing sector that followed, has undeniably resulted in growth-enhancing structural change. However, EU-CEE countries were rather passive recipients of this structural change, rather than their catalysts.

Therefore, in the future, there arises a need for identifying on their own terms the sectors and business functions to be promoted and cultivated, instead of relying solely on external market forces to decide on the prosperity of individual sectors. This holds especially true as the EU-CEE countries look to functionally upgrade into more sophisticated parts of the value chain, which do not tend to be offshored to the same extent as routine production activities. Here, the role of the domestic economy becomes ever-more important. Moreover, as the specialisation in certain sectors becomes so strongly engrained that it poses a risk for certain EU-CEE countries, diversification into other products and services needs to be appraised in a way that boosts competitiveness. In this sense, it is important for EU-CEE policymakers to be reminded of the different channels of structural upgrading that they need to simultaneously target in their industrial policy: from product and process upgrading, sectoral upgrading, to functional upgrading (Humphrey and Schmitz, 2002).

Clearly the state cannot and should not try do all of this alone. The full involvement of all relevant actors from both the public and private sectors is crucial. This inevitably requires a holistic approach to industrial policymaking, engaging actors from various parts of the public sector, private sector, as well as the academia to achieve a common goal. Local actors, with specific their regional knowledge and linkages also play an indispensable role, particularly through Smart Specialisation Strategies. Hence, it echoes the importance of formulating and communicating a clear, overarching industrial policy mix that would create a synergetic environment across different policy spheres. In turn, the task of different actors involved is to contribute their part to approaching these ambitions. For instance, if a country aspires to become more competitive in its ICT-related business services, an effective industrial policy response is likely to be quite multi-faceted: FDI policy might give explicit preference to MNEs looking to set up such service centres in the country. Infrastructure policy would ensure that state-of-the-art network infrastructure is present in the country to carry out the tasks in a competitive manner. Education policy would ensure there is a sufficient pool of well-trained human capital in this area. In turn, the government might itself try to catalyse demand through the channel of public procurement, increasingly utilising various e-government ICT services.

5.2. MAXIMISE PARTICIPATION IN EU FINANCIAL FLOWS AND RESEARCH NETWORKS TO DRIVE INDUSTRIAL POLICY

EU membership is a defining feature of industrial policymaking in the CEE countries under discussion. Operating under the realm of competition policy inevitably constraints the ability of these countries to engage in certain policy interventions, comparable to the well-known East Asian experience. However, as we have shown, EU membership does not imply a lack of agency on the side of member states to actively steer economies towards a desired structure, especially in the light of the presently-expanding industrial policy space. In this sense, EU-CEE countries should strive to become more active in making use of all the available instruments. With the single market as a bedrock of the EU-wide industrial policy,

there are joint initiatives that allow EU-CEE to learn from frontier economies in an unparalleled manner to other emerging economies; be it through international mobility or collaborations in strategic areas. In this sense, aiming to participate more widely in Horizon Europe or IPCEI is particularly important for the technologically less advanced countries of the EU. Moreover, EU-CEE countries benefit largely from the financial inflows from the common budget, also towards industrial policy objectives. However, the low absorption rates in certain countries, combined with the often-ineffective use of EU finances is suggestive of a need for improved ability to manage the incoming funds.

Moreover, making full use of EU membership entails actively engaging in industrial policy debates at the EU level, informing the specific needs faced by the EU-CEE countries. As our study shows, economically less advanced countries face great challenges in participating in the common EU industrial policy initiatives. This is a missed opportunity for facilitating convergence across the EU, as these common strategies could represent a fruitful means of knowledge acquisition in the EU-CEE. In this sense, skewing the EU debate to provide greater equality of opportunity for lagging countries would be particularly important for EU-CEE.

5.3. LEARN FROM REGIONAL SUCCESS STORIES TO EMERGE AS DIGITAL FRONTRUNNERS

As discussed in this report, EU-CEE countries are relatively well-positioned to emerge as serious players in the digital economy. This potential should be leveraged, considering the entry barriers in the ICT-driven service sector generally tend to be lower: this is because the head start of other economies is so far more limited, and the infrastructure needs and location (dis)advantages are less pronounced compared to other sectors within manufacturing (Grieveson et al, 2021). We identified significant cross-country differences in how far along individual EU-CEE countries are in different aspects of the digital transformation, and these advantages (or disadvantages) in particular digital technologies or dimensions imply a differentiated set of policy instruments that are needed. Yet these differences across the EU-CEE should also serve as a basis for mutual learning in the region. While Estonia can be regarded as the obvious blueprint to follow (a point we also put forward in Grieveson et al. (2021)), this is by no means the only positive example: the focus on ICT in higher education of the economically less advanced Romania and Croatia, the digital startups originating from Czechia, the quality of public e-services in all Baltic countries, or the adoption of ADP technologies through FDI in the Visegrád countries and Slovenia are worth highlighting and widely applying in EU-CEE. At the same time, policies that address the digital divide between smaller and larger firms need to be adopted more widely. This can include IT-upskilling schemes for employees in SMEs, promoting lifelong learning, expanding e-commerce and remote work possibilities of SMEs, or helping smaller firms have a digital presence through marketing and communication channels.

5.4. ALIGN FDI ATTRACTION AND INCENTIVES TO MNES WITH NATIONAL INDUSTRIAL POLICY AND INNOVATION STRATEGIES

In the age of globalised production networks, MNEs represent not only the main agents of innovation, but also the core channels through which state-of-the-art managerial, organisational, as well as technological know-how is disseminated across borders. In this sense, there is a continued importance of facilitating valuable capacity-building through the FDI channel, especially as in the short-run, EU-CEE

economies will remain importers of knowledge. Therefore, FDI policy plays a pivotal role in the industrial policy of these countries. This is particularly apparent from the recent developments seen in the automotive industry, whereby incoming FDI in the area of e-vehicles and batteries is leading the way in greening the region. Yet, FDI policy, as it stands in its current state, is in need of refocusing. Naturally, there is a prisoners' dilemma associated with the present set-up, as the EU-CEE countries fiercely compete against one another for greenfield projects, and hence tend to resort to wide-spanning incentives. Still, rather than providing umbrella support based on crude metrics such as size or location, EU-CEE countries need to also consider the attractiveness of different sectors (e.g. green and digital) as well as business functions (i.e. beyond assembly) of the incoming greenfield FDI. In turn, the targeted support ought to be a part of a coherent industrial strategy, as illustrated on the example of East Asia.

At the same time, successful industrial policy that relies on FDI needs to go beyond the point when the investor commits to the given host economy. The major argument for incentivising FDI is for positive spillover effects to disperse widely across the economy and for domestic firms to acquire knowledge and skills. EU-CEE countries have particularly struggled in this aspect thus far, with the positive effects of FDI being relatively strictly confined to the boundaries of the MNE. Here, the role of the state is to influence the market structure to the advantage of the domestic firms. This entails giving opportunities to local companies to connect with MNEs and build a network of domestic suppliers and customers around the incoming investor. Such spillover-generating policies could be comparable in their form to export promotion policies, offered to firms looking to internationalise.

5.5. LOOK FOR PROMISING NICHES

As active industrial policy interventions are gaining momentum across the globe, it has also augmented the risk of overcapacity and inefficiency arising from the multiplicity of countries aggressively pursuing the same objectives. Semiconductors stand out as the most prominent example in the present age, which given the capacity constraints of EU-CEE countries, are unlikely to present a viable path for diversification and upgrading. In this sense, the EU-CEE policymakers are better off identifying promising sophisticated niche areas, and lift up and nurture these sectors. Comparable to the way in which Scandinavian countries have managed to become competitive in the manufacturing of high-end furniture, Italy in luxury garments, or Austria and Switzerland in mechanical engineering, the likelihood of success is naturally augmented if these niches build on existing traditions. In this sense, it is important to note that there are emerging industries where the EU-CEE countries do not appear to be taking on just simple fabrication roles, for instance in the case of pharmaceuticals or chemicals (Kordalska et al., 2022). Moreover, the success stories mapped in the green and digital sectors also indicate the presence of certain 'winners' around which clusters could potentially be nurtured.

5.6. INSTITUTIONAL IMPROVEMENTS AS A VITAL PRE-REQUISITE FOR TRANSFORMATIVE CHANGE

The fact that institutions matter, and that EU-CEE has deficiencies in this area, suggests that reinvigorating the process of institutional upgrading in the region is a key priority for EU industrial policy. The most prominent argument against state involvement in the market via active industrial policy is the risk of failed interventions, and understandably so. In recent years, some EU-CEE countries have seen backsliding in the quality of their institutions, and often suffer from ineffective policymaking and corrupt behaviour,

increasing the likelihood government failure. This represents a shared responsibility between individual EU-CEE countries and the EU itself. The EU can play a more active role in incentivising improvements in governance through the 'carrots' and 'sticks' it has at its disposal. Specifically, the EU should take a harsher stance toward the apparent deficiencies in the rule of law of numerous EU-CEE countries, not limited to the stricter application of the Conditionality Regulation. Measures could include closer monitoring, as well as a combination of incentives and sanctions (Landesmann and Stöllinger 2020).

The quality of institutions presents a particular challenge when talking about local authorities. Especially in lagging regions, institutions are very rarely equipped with the necessary technical capacities to oversee important structural changes in local economies, despite the reality that greater involvement of subnational authorities could be conducive to a more balanced industrial growth. In this sense, supporting the emergence of a few peripheral success stories can have an important demonstration effect for many comparable regions. Hence, making use of technical assistance from the EU, international institutions, as well as national governments, to set up such peripheral case studies would be highly recommended.

5.7. BE RESPONSIVE TO THE DISTRIBUTIONAL IMPLICATIONS OF STRUCTURAL CHANGE

The co-existence of growth and equality is an important facet of a successful development strategy, and was discussed to be one of the particularly well-managed aspects in the convergence experience of selected East Asian economies. The restructuring of EU-CEE economies in the light of the current megatrends holds the potential to boost productivity growth, but is likely to hit different economic agents differently. Therefore, making the transition work for the wider population is needed, which will require increased resources dedicated to extensive re-skilling programmes, as well as the provision of income support in the transition process. Firstly, this concerns workers in declining sectors, such as fossil-fuel extraction, whereby the resources from the Just Transition Fund can provide valuable support. In the case of the digital transition, age is likely to be another potential discriminating factor. Furthermore, as routine tasks become increasingly automated, the low-skilled workers will also require training and up-skilling. Moreover, in the case of a wider proliferation of business services in the EU-CEE economies, it is important to consider that generally, these tend to be concentrated around capital cities, which expands the issue of regional disparities and makes sub-national industrial policies as well as cohesion instruments especially relevant. Finally, as discussed, there is a digital divide present between SMEs and large enterprises, which justifies the need for greater support provided to smaller firms. In order to bridge the gap, a tailored strategy for increasing the digital competitiveness of SMEs is needed.

In this context, as highlighted in Grieveson et al. (2021), inspiration can be drawn from Scandinavia, whereby productivity-enhancing automation was coupled with the provision of a sound safety net that limited the risks of social fall-out (Sandbu, 2020). The Scandinavian approach entailed a multipronged strategy: in the first instance, minimum wages were set high to incentivise automation. At the same time, to ensure dynamic labour markets adjustments, labour market policies were set in a way that minimises exit and entry frictions. However, these growth-enhancing disruptive policies were coupled with extensive welfare provision to individual workers, including income support, tax reliefs, as well as welfare institutions that helped navigate these times of change.

5.8. ACKNOWLEDGING THE DIFFERENCES ACROSS EU-CEE COUNTRIES: EACH COUNTRY NEEDS ITS OWN NATIONAL INNOVATION AND INDUSTRIAL POLICY STRATEGY

Last but certainly not least, it is important to emphasise that our analysis also points to the great heterogeneity observable across EU-CEE. The standing of individual EU-CEE economies varies in terms of the level of economic development, the extent of industrialisation, presence of MNEs via FDI, competitiveness of domestic firms, technological capabilities, development of human capital, institutional capacities, just to name a few of the core distinguishing features relevant for industrial policy. On the one hand, this heterogeneity offers a chance for mutual learning from regional best practices, offering more relatable and replicable targets to strive for compared to benchmarking exercises carried out against the most advanced economies of the EU.

On the other hand, this makes one-size-fits-all conclusions quite unsuitable, as priorities differ across different clusters within EU-CEE. For the richest and/or most industrialised countries of the region, (Czechia, Slovenia, or Poland), the core focus ought to be on making the switch from imitation to innovation-driven growth. Here, the cultivation of a National Innovation System, wider participation in common EU projects, and human capital aspects stand out most prominently. Slovakia and Hungary lag somewhat behind the most advanced neighbours in multiple aspects. In these cases, building on the wide presence of MNEs and focusing on spillover generation and linkage creation with the domestic economy, as well as diversification of the sectoral and functional structure stand out as key challenges. Conversely, in the case of the countries falling most notably behind the technological frontier (Bulgaria, Croatia, Romania), the priority may be placed on importing of knowledge and capabilities in a strategic and targeted way. Moreover, for these countries, identifying opportunities to leapfrog proves especially relevant. We observed some promising developments to this end in Romania and Croatia, which ought to be supported to offset any development latecomer disadvantages as well as geographical disadvantages. Finally, for the Baltic countries (particularly Estonia and Lithuania), which tend to skew towards the pursuit of a services-oriented growth model, and are quite well-positioned for the digital transformation, the multi-faceted distributional implications discussed above stand out as a key challenge. Likewise, the stock of qualified human capital is already scarce, which limits the wider diffusion of these dynamic sectors, and will need to be managed.

PART B

COUNTRY BRIEFINGS

The notable differences observed across the EU-CEE with regards to industrial capabilities and megatrend preparedness, as highlighted in our report, make it useful to explore the country-specific opportunities and challenges associated with formulating a suitable industrial policy in the current global economy. Therefore, we provide here country-specific briefing notes for all of the 11 EU-CEE economies. In each of these briefings, we analyse the present standing and transition preparedness of a country, conduct a SWOT analysis to identify the main strengths, weaknesses, opportunities and threats to industrial competitiveness, and put forward key industrial policy priorities for the country to transition to a new growth model.

Bulgaria

COUNTRY OVERVIEW

Bulgaria is at the bottom of most EU rankings, including those on industrial competitiveness, innovation performance, digital performance and green transition. During the transition from plan to market the economy suffered deindustrialization of a massive scale and as a result all of the previous industrial giants were either liquidated or radically downsized. The share of the manufacturing sectors in GDP is much below the EU and EU-CEE averages. During the past three decades the country also suffered a setback in its global rankings on human capital development. Digital transition is one of the exceptions thanks to the preservation of the tradition of good quality IT education and a relatively well-developed IT sector.

Manufacturing employment is still dominated by low-value added sectors such as textiles and apparel (17.9% of total manufacturing employment), food products (17.7% of the total, basic metals (13.3%). None of the more sophisticated manufacturing sectors is present among the top 5 sectors by the number of employed. No global manufacturing brand is present in Bulgaria with a large-scale production facility. Moreover, large manufacturing facilities generating economies of scale and supporting efficient participation in global value chains are all but missing in Bulgaria. For example, only four manufacturing companies are present among the 20 largest business employers in Bulgaria.

While Bulgaria benefited from large FDI inflows after EU accession, most of this investment was directed to real estate, tourism and finance, offering limited scope for industrial upgrading. Manufacturing FDI in earlier periods was mostly directed to small and medium sized facilities in traditional sectors such as textiles and food processing. In the last decade or so, especially after the accession to the EU in 2007, FDI started to flow also to more sophisticated manufacturing sectors but also in small and medium sized facilities. One of the factors that contributed to the attraction of such FDI flows was the establishment of several industrial zones and the incentives they provided, initially under the general Investment Act and later under the Industrial Parks Act of 2021.The ICT sector and the provision of ICT services is one of the few success stories in Bulgaria's recent technological development. In 2021 the outsourcing industry accounted for 4.0% of the country's total employment and contributed 5.5% of the GDP. In recent years it has also been the fasted growing sector of the Bulgarian economy.

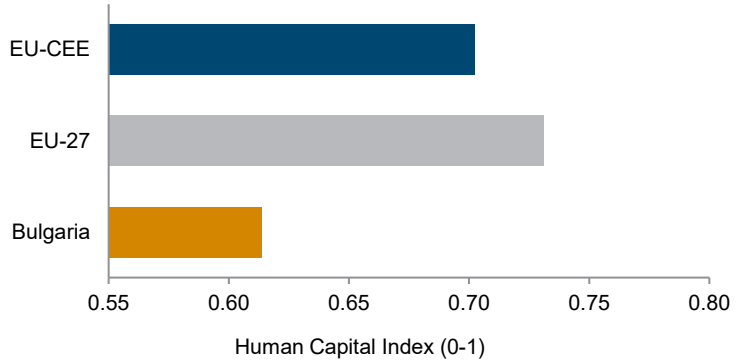
Targeted industrial policy actions have been all but missing dung the past three decades and were partly revived thanks to the participation in common EU policies and programmes. The recent Industrial Parks Act is probably the only homegrown industrial policy legislation. The National Development Programme Bulgaria 2030 specified five priority development areas including Innovative and Intelligent Bulgaria, Green and Sustainable Bulgaria, Connected and Integrated Bulgaria.

Industrial development – I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Bulgaria	0.05	12%	33%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Relatively diversified industrial and export structure which contributes to higher resilience of the economy to external shocks.

› Industrial zones have become drivers of industrial development attracting also new enterprises conforming with the green economy.

› The relatively large ICT sector with high quality IT specialists is among the few strong components of Bulgaria's economic structure.

Weaknesses

› Aging population marked by a trend shrinking of the workforce is a source of increasing labour and skills shortages.

› Manufacturing is still dominated by relatively unsophisticated industries. High-tech, high value-added products account for a small share of the country's exports.

› Very low aggregate energy efficiency.

› Very low levels of R&D investment by both the public and the private sector; poor innovation performance.

› Stagnation in the average quality of the workforce which acts as a hurdle for the technological upgrading of the industrial structure.

› Lack of a coherent long-term strategy for green transformation consistent with the European Green Deal.

Opportunities

› Relatively low dependence on fossil fuels for electricity generation.

› The ICT sector and the digital economy have a potential to grow in importance provided there will be targeted policy support for an increase of the pool of ICT specialists.

› The country is considered as an attractive destination for the outsourcing of IT services.

Threats

› Skill and labour shortages coupled with a continued exodus of skilled labour may create increasing bottlenecks both for economic growth and for the technological upgrading of the economy.

› Recurrent populist policy motions for postponing energy efficiency measures against the background of disruptions in energy supplies and rising energy costs.

› Lingering political instability and lack of long-term policy vision and strategy may delay further the digital and green transition.

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› Bulgaria's investment promotion mechanisms apply to both foreign and local investors.

› Large investment projects, which are deemed particularly important for the economy may be classified as priority projects and be granted additional incentives.

› There are no promotion mechanisms targeting specific sectors or industries or the entry to major global value chains

› Industrial zones (Industrial parks) are probably the only mechanism promoting FDI by providing certain incentives to resident investors. Most of the industrial zones are dominated by foreign companies and the predominant share of their production is exported.

New technologies, digitalization, innovation

› Bulgaria's draft Recovery and Resilience Plan (RRP) is built around education and skills, research and innovation, and the smart industry as primary targets for future investment.

› The Innovation Strategy for Smart Specialisation 2014-2020 (ISSS) had identified several priority thematic niches including Information and communication technology, Mechatronics and clean technologies, Industries for healthy life and biotechnology (including food), New technologies in creative and recreation industries.

› So far there has been no comprehensive assessment as to what extent the ISSS succeeded in pursuing its objectives. But it is already a fact that one of the key strategic goals, namely that by 2020 Bulgaria would move from the group of 'modest innovators' into the group of 'moderate innovators' was not achieved.

Green transformation of industry

› The RRP sets rather modest targets for green spending (27% of the total), well below the EU's 37% climate-spending benchmark

› The RRP mostly consists of long planned investment projects that had not been implemented due to the shortage of funding and lacks ambitious innovative green economy projects

› Little or no attention is assigned in the plan to RRF goals such as the reduction and utilization of waste, sustainable and intelligent mobility, construction of green infrastructure. The operationalization of such goals will be a challenge as work will have to start from scratch.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main report, we identify Bulgaria as one of the EU-CEE countries falling most behind the technological frontier. The priority should be to import knowledge and capabilities in a strategic and targeted way via targeted FDI policies and greater participation in EU research and innovation networks.

› **Focus policy efforts on a selected few priority areas and/or projects where industrial technological transformation can bring tangible results, including green transition.** Establish a coherent plan of action for pursuing the objectives in the priority areas including milestones and measurable performance indicators (see policy recommendation 5.1 in the main report). As part of this plan, develop and introduce targeted support instruments and mechanisms focused on entrepreneurial innovation seeking technological transformation in the priority areas. Allocate sufficient public funding to back these instruments in the context of medium- and long-term fiscal frameworks. Review and amend innovation governance and coordination mechanisms in order to ensure efficient policy implementation. Organize monitoring of progress in implementing the plan of action and introduce corrective mechanisms and measures if needed.

› **Develop new incentive mechanisms and instruments for attracting FDI in business activities contributing to technological transformation and aligned with the green transformation goals.** These should also include the above-mentioned priority areas and/or projects (see policy recommendation 5.4 in the main report). Build on the lessons of the successful development of industrial zones to design and implement more effective and efficient policy instruments for attracting FDI into the industrial zones. Plan to transform FDI-driven industrial zones into powerful clusters which can become drivers of economic growth and technological transformation. Seek innovative approaches to the management of projects with FDI participation including through public-private partnerships and the use of blended finance.

› **Develop a coherent strategy for prioritizing the future development of the ICT sector.** Develop a programme for expanding the scope of IT education and skill building with a view to increasing the pool of IT professionals as a future niche for the country (see policy recommendation 5.5 in the main

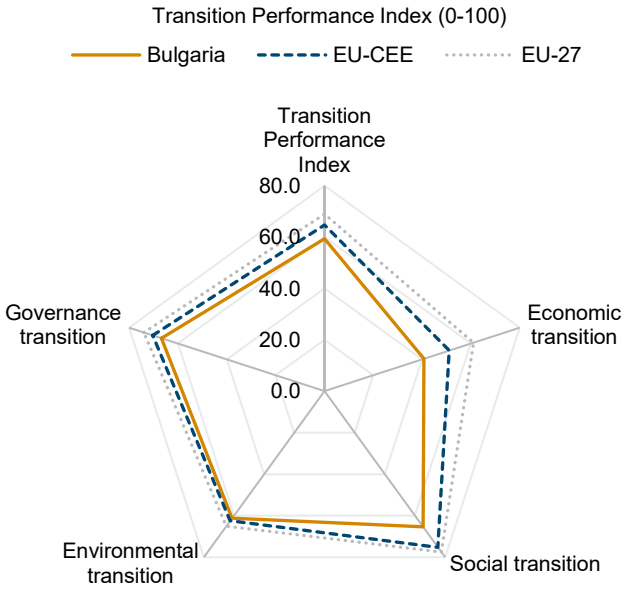
report). Broaden IT awareness raising among adolescents and young people on the prospects of an IT professional career. Widen and deepen the IT curricula in secondary and especially tertiary education in close cooperation with the business sector so that to match their current and future needs. Introduce targeted support schemes for ICT entrepreneurs, startups and SMEs. Develop and introduce measures for speeding up the prevalent introduction of e-Government. Consider introducing incentives for attracting FDI in the ICT sector and the digital economy.

Industrial development – II

Sector	% of manufacturing employment
Textiles, apparel, leather and related products	17.9
Food products, beverages and tobacco products	17.7
Basic metals and fabricated metal products, except machinery	13.3
Rubber, plastics, and other non-metallic mineral products	10.5
Other manufacturing, installation of machinery and equipment	9.1

Note: 2020 values.
Source: National Statistical Institute

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Croatia

COUNTRY PROFILE

With its EU membership, Croatia further integrated its economy into Western and Central Europe since 2013. However, its industrial competitiveness and labour productivity still lags behind economically advanced countries in the EU-CEE region. The share of employment and value added claimed by manufacturing in Croatia is below the EU average. Human capital quality is slightly higher than the EU-CEE average, but below the EU average. Croatia has also showed promising signs of improvement in its innovation performance, as seen by the growing share of R&D expenditures relative to GDP over the past decade.

Tourism is one of the main pillars of the Croatian economy, comprising 20% of the country's GDP. Presently, manufacturing in Croatia is largely based on food and beverage production, which account for some 24% of the total manufacturing revenue in the country. The most represented industrial branches in exports include processing of petroleum products (11.8%), motor vehicles (11.2%), chemical products (8.3%), food products (8.1%) and electrical equipment (7.8%). Agriculture in Croatia is carried out in less than 25% of the country's land area, accounting for less than 10% of the country's GDP.

The automotive industry within the country employs some 10,000 people in over 130 companies This may be a small number in absolute terms, but offers growth opportunities for the Croatian economy to industrially upgrade: The Croatian Rimac producer of electric hyper cars can be regarded as a prime example of a major innovator in the country's automotive sector. However, on the macro level electromobility in Croatia is limited: Eurostat data from 2018 showed that the share of energy from renewable sources in transport was less than 4%.

Croatia is currently in transition to an energy powerhouse and power hub in the Western Balkan region, with its floating liquefied natural gas (LNG) regasification terminal on the island of Krk and with investments in green energy, including wind, solar and geothermal energy. The Krk terminal provides an additional source of natural gas for the Croatian market, which relies on natural gas for 48% of its energy needs. The terminal will also be a natural gas distribution point for surrounding markets, including Italy, Austria, Hungary, Romania and Slovenia.

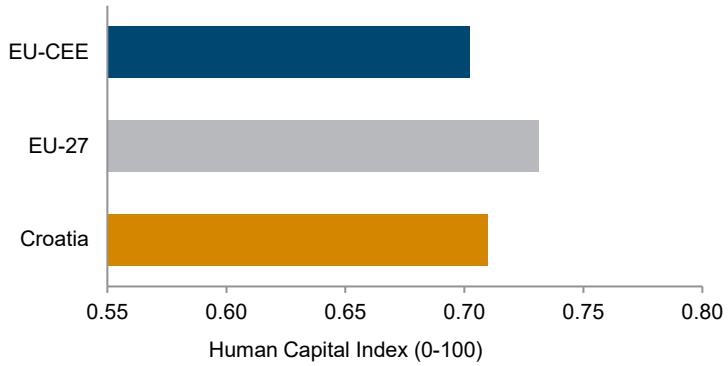
Croatia lacks a foreign investment screening mechanism and does not differentiate between foreign and domestic investors. Nevertheless, foreign investors face challenges in the investment climate, due to administrative barriers and corruption. Given the megatrends, the economy's main shortcomings lie in inefficient bureaucracy, heavy reliance on tourism, low competitive industrial performance, and in negative demographic development.

Industrial development – I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Croatia	0.05	13%	31%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Attractive destination for investors despite being one of the less economically developed EU-CEE countries, due to the country's geostrategic location

› Well educated workforce - above average information and communications technology (ICT) skills of young people, in comparison to other EU countries

› Well maintained traffic and transport infrastructure network; functional comparative advantage in logistics

› High public spending potential: the government facilitated investments in the amount of some 5.6% of the country's GDP in 2020 (the third-highest share in the EU); despite COVID-19 related recession, Croatia's absolute figure dedicated to R&D expenditure surged to EUR626mn in 2020.

Weaknesses

› Poor vertical policy coordination between the government and ministries (including national and local public administration) as well as inefficient bureaucracy prone to corruption and weak judiciary

› Large regional disparities - rural regions bordering Serbia and BiH have a larger proportion of citizens at risk of poverty and social exclusion; high rural/urban divide in terms of internet access

› Negative demographic development, causing labour shortages

› High economic reliance on tourism sector and relatively low level of industrialisation compared to other EU-CEE economies

Opportunities

› Croatia is one of the biggest beneficiaries of the EU's Multiannual Financial Framework (MFF) scheme (EUR14bn) in the 2021-2027 period

› Growing share of investments aimed at facilitating the digitalization of Croatia's administration, industry, agriculture, transport, courts, hospitals, and schools

› Changes in immigration policy implemented to alleviate the scarcity of skilled workers within the country, as of 2021, no more quotas for foreign workers exist

Threats

› Shortage of a specialised workforce due to brain drain, adversely affecting innovation potential as well as the integration of green/digital technologies

› Slow reform progress of Croatia's administrative sector

› Complex legislative framework, non-responsive public administration and contradictory and complex legislative framework inhibit green transition - over 60% of local businesses do not perceive the green transition agenda as an opportunity, according to the Croatian Chamber of Commerce

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› The government passed in 2015 an 'Investment Promotion Act' and amended it several times since to increase FDI through various promotional instruments. With this bill, newly created companies registered within Croatia can claim a reduced corporate tax rate. In addition, the government pledged to subsidise the costs of jobs created through foreign investment projects. The government also allocated additional grants for capital-intensive projects with an investment volume of EUR5mn.

› A bill on strategic investment projects was introduced in 2018 to provide accelerated approval mechanisms and to facilitate the removal of administrative hurdles for investment projects in the country's mining, energy, tourism, transport, or infrastructure sectors, with a minimum value of EUR10mn.

› Despite those bills, Croatia still lacks a tailored FDI promotion policy tasked with abolishing Croatia's reliance on its tourism sector.

New technologies and digitalisation

› Croatia is to receive EUR1.7bn from the European Regional Development Fund to support the country's innovative and smart economic transformation and to increase the competitiveness and internationalisation of local SMEs.

› Croatia earmarked some 20.4% of the country's Recovery and Resilience Facility (RRF) to invest into the digital transformation of the country's economy and to increase the efficiency of public sector bodies. To achieve this, the government established management and coordination structures to plan and implement digital transformation projects, financed by the RRF.

› In 2022, Croatia received the first tranche from the Next Generation EU (NGEU) instrument in the amount of EUR700mn to boost the country's innovation and digitalization agenda.

› In 2018, the government introduced Croatia's National Development Strategy, tasked with launching initiatives aimed at developing digital competencies and promoting the availability of digital jobs for citizens in the 2018 – 2030 period.

Green transformation of industry

› Croatia's 2018-2030 National Development Strategy aims to support the country's green transition by facilitating energy self-sufficiency and transition to clean energy by 2030. Next to green and digital transition, Croatia's National Strategy also focuses on the protection of natural resources and the fight against climate change

› Croatia earmarked 39% of EU Cohesion Policy funds to facilitate the country's green energy efficiency by increasing the share of renewables in energy production to 60% by 2030. In addition, some EUR179mn from the EU's Just Transition Fund (JTF) was earmarked to mitigate the economic and employment effects of Croatia's green transformation. The government also earmarked some EUR500mn in EU Cohesion Policy funds to facilitate the industrial transition of Croatian regions, as a measure to mitigate regional disparities within the country.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main report, we identify Croatia as one of the EU-CEE countries falling most behind the technological frontier. However, we see positive signs that the country is starting to move in a more innovative direction, and policymakers should use all possible levers to capitalise on these trends. The priority should be to import knowledge and capabilities in a strategic and targeted way via targeted FDI policies and greater participation in EU research and innovation networks.

› **Implement a tailored FDI promotion policy to import innovation and drive the expansion of promising niche sectors apart from tourism.** The country's tourism sector is likely to remain the focus of foreign investors, nevertheless, the government's future economic and investment support should focus on industrialisation and a greater diversification of Croatia's economy. As part of this, the government should aim to attract more investment to Croatia's poorer regions, to help them to catch up with the country's more economically and socially developed counties, such as the capital Zagreb or the Zagreb County. Two elements of policy will be key to achieve these goals. First, identifying niches within the economy where promising innovation is already occurring on a micro level, and which can be expanded, such as the ICT sector (see policy recommendation 5.5 in the main report). Second, the government should tailor FDI attraction policy to incentivise foreign capital flows into these potential niche areas, and to attract investment that will also generate domestic spillovers (see policy recommendation 5.4 in the main report).

› **Upgrade institutions to enable them to support innovation, including at the local level, and the maximise participation in EU programmes.** As we highlighted in the main report (see section 4), less-than-perfect institutions are not, per se, a barrier to effective industrial policy and the development of smart specialisation strategies. Nevertheless, Croatia's relative institutional weakness, despite improvements in recent years, is a barrier to these goals. Both the national government and the EU should continue to prioritise improving the capacity of institutions, including by tackling ineffective public administration. Upgrading of institutions, including at the local level, could unlock significant growth potential in the economy (see policy recommendation 5.6 of the main report), allowing for both the expansion of more successful smart specialisation strategies to boost innovation (see policy section 5.1 of the main report), and also helped to improve the absorption capacity of EU funds. Meanwhile, Croatia's inefficient public sector have a negative impact on the overall attractiveness of the country's economy for domestic and foreign investors, and the rigid business environment limits entrepreneurial activity and fuels the country's brain drain.

› **Address skills shortages and increase labour market participation.** Like most of EU-CEE, Croatia faces severe demographic challenges, and these will become an ever more binding constraint on the economy's growth potential in the future. A shortage of labour in general, and particular skills shortages in key sectors, are already an issue. The shortage of specialists is significantly affecting the integration of digital and green technologies into local businesses and prevent local enterprises from tapping the full potential offered by Croatia's digital and green transformation. Part of the reason for this is that the country suffers from low labour force participation rates. The government introduced reforms to tackle rigidities in employment protection legislation and abolished the quota for foreign workers in 2021. Nevertheless, active labour market policies (including those listed in Croatia's 2018-2030 National Development Strategy) remain insufficient. To address the issue and to improve Croatia's industrial outlook, additional upskilling and reskilling programmes - in line with long-term industrial policies (such as digitalization and green transition) - should be implemented as soon as possible (see policy recommendation 5.7 of the main report).

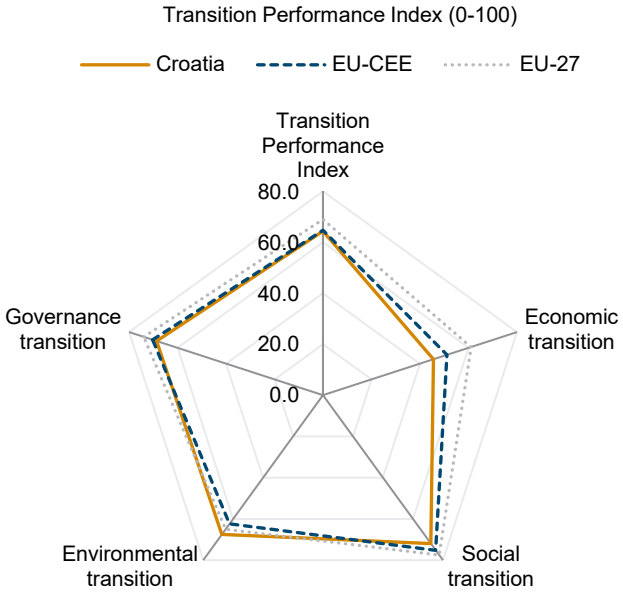
› **Introduce a minimum wage at a higher share of Croatia's median wage.** Eurostat data from 2020 showed that over 20% of Croatian workers earn less than two-thirds of the median wage. Introducing higher minimum wages will incentivise the automation of low productivity jobs, and create additional labour supply for more productive parts of the economy. Nevertheless, this process will require direct policy interventions to both ensure its success and to minimise the negative social fallout. The government should pursue an active labour market policy to ensure retraining of workers for the needs of a more digital and green economy, while also providing an adequate social safety net for the transition period (see policy recommendation 5.7 of the main report). Frictions on job entry and exit should also be minimised to speed up the transition.

Industrial development – II

Sector	% of manufacturing employment
Food products	19.2
Fabricated metal products, except machinery and equipment	13.0
Wood and of products of wood and cork (excl. furniture)	6.7
Wearing apparel	5.3
Rubber and plastic products	4.7
Machinery and equipment n.e.c.	4.7

Note: 2018 values.
Source: Eurostat Structural Business Statistics

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Czechia

COUNTRY OVERVIEW

Czechia is the most industrialised country in the EU-CEE, and the most developed. This is reflected by the various indicators of industrial competitiveness, whereby the country not only outperforms other economies in the region, but also scores quite high above the EU average. The relatively high share claimed by sophisticated manufacturing in total manufacturing value added is particularly encouraging—an outcome of deep global value chain integration through FDI. The human capital dimension echoes the relative strength of Czechia, though it does not catch up to regional leaders Slovenia and Estonia.

Similar to Hungary and Slovakia, the metal production and automotive sectors form the core of economic activity in Czechia, representing 14.8% and 13.7% of manufacturing employment, respectively. The Czech automaker Škoda Auto, now owned by Volkswagen Group, is one of the largest employers in the country , though other original equipment manufacturers also contribute to the size of the sector (including Toyota/Groupe PSA, and Hyundai Motors). Building on its long-standing tradition in engineering and mobility, there are emerging efforts related to green technologies in the automotive industry, including participation in the IPCEI related to the development of hydrogen-powered buses. In addition, Czechia has a relatively strong foothold in the chemicals and pharmaceuticals industry, and a growing presence in the medical equipment industry, including the production of nanofibers. There is also a solid ecosystem of high growth start-ups and established players in the digital sector, including 'unicorn' and 'big exit' firms such as Avast, Kiwi.com, Rohlik group, or JetBrains.

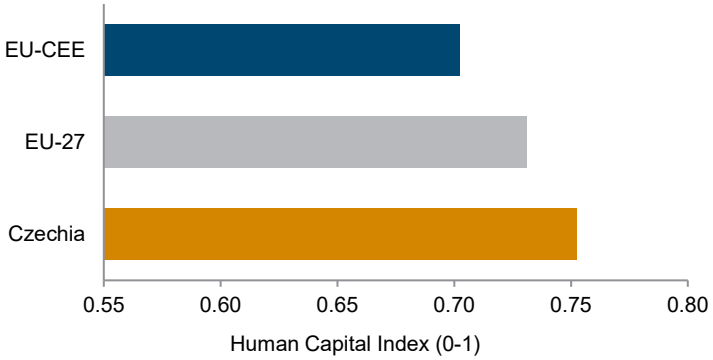
The economy's main shortcoming given the megatrends lies in the environmental transition: here, Czechia lags behind even its less economically advanced EU-CEE peers, unlike the other four dimensions of the transition performance index, where Czechia lies above or in line with the overall EU performance. At the same time, given its landlocked position and high dependence on Russian energy imports, the issue of energy security represents a particular challenge for industrial competitiveness going forward.

Industrial development – I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Czechia	0.19	25%	52%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Deep embeddedness in global value chains, especially in the automotive sector, eases access to state-of-the-art technologies and know-how

› Second highest government spending in R&D relative to GDP among all EU countries , points to the state's commitment to boost innovation

› Institutional quality is among the highest in the EU-CEE, offering solid pre-conditions for state entrepreneurship

Weaknesses

› A laggard in the green agenda by EU standards: over-reliance and continued subsidization of coal and other fossil fuels, combined with energy efficiency much below EU levels and high dependence on Russian imports.

› There are numerous obstacles to greater digitalisation, including the relatively low IT adoption by public authorities, and high mobile data prices due to the market oligopoly

› Scarcity of financing options for new enterprises due to an underdeveloped venture capital and private equity market

Opportunities

› Strategic emphasis on hydrogen technology value chains offers promising areas for leapfrogging

› An emerging entrepreneurial ecosystem, as evidenced by the recent rise of domestic high growth firms specialised in digital products and solutions

› Continuous experience with labour shortages incentivises productivity-enhancing automation

Threats

› Scepticism of policymakers towards green policies, lower social support of environmental protection compared to the core-EU countries and a relatively strong carbon related industrial lobby

› Shortage of scientific and ICT specialists in the labour market hinders the potential of a more digital economy

› Lagging productivity growth rates in recent years compared to other Visegrád countries

› Lack of cooperation and coordination among government ministries and agencies responsible for industrial policies

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› Act on Investment Incentives revised in 2019 to focus on higher value-added projects. Umbrella support continues to be provided to manufacturing with different conditionalities based on firm size. Greater assistance offered to SMEs is intended to extend support to domestic firms. In addition, technological centres and business service centres are strategically favoured for financial assistance and fiscal benefits. Still, there is a general lack of ex-post evaluation of the effectiveness of implemented promotion policies, and the bulk of supported projects remain in the manufacturing industry, offering little room for sectoral diversification.

› Special tax allowances for R&D expenditures are in place, which allow for a deduction of up to 100%. However, these are used relatively sparsely, and have been subject to organisational challenges over eligible expenditures in the past that caused conflicts between businesses and tax authorities.

New technologies, digitalisation, innovation

› The National Research and Innovation Strategy (RIS3) approved in 2021, vertically focuses on nine core domains, including areas in which Czechia already has a relatively strong presence (e.g. advanced materials, transport, electronics), as well as new areas identified for upgrading and diversification (e.g. bioeconomy, pharmaceuticals).

› About 22% of the Recovery and Resilience Facility (RRF) is allocated to the digital transformation, including direct businesses support. Czechia is presently in the process of meeting the necessary milestones for the disbursement of these funds.

Green transformation of industry

› The investments and reforms covered by the RRF do not primarily target the nurturing of green technologies and industries, focusing more heavily on the provision of sustainable public solutions. This aspect can be partially linked to the RIS3 strategy, however, where green technologies for agriculture, food production and forestry make up one of the nine specialisation domains.

› There is an emphasis on hydrogen technologies, with the adoption of the Hydrogen Strategy of the Czech Republic and participation in the IPCEI ‘Hy2Tech’, as well as the establishment of the Czech hydrogen technology platform (Hytep) by the Ministry of Industry and Trade.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of the study, we identify Czechia as the wealthiest and most industrialised country of the region, where the core focus should be on making the switch from imitation to innovation-driven growth. Policymakers should target the cultivation of a National Innovation System, wider participation in common EU projects, and investment in human capital. Specifically, we propose the following policy priorities:

› **Implement a tailored FDI promotion policy which would complement the national industrial strategy.** Recent reforms in the investment incentives scheme lay out the intention to upgrade the position of Czechia in global value chains. However, the support provided remains broadly defined and is not harmonised with an overall industrial strategy, missing a clear directional overlap with other strategic policy documents (as outlined in policy recommendation 5.4 of the main report). Moreover, as discussed in Box 4 of the main report, a regular and evidence-based evaluation of investment promotion policies is largely absent in the country. At the same time, the creation of linkages with domestic firms ought to feature more prominently in the country's FDI strategy. Leveraging the regional offices of the Czechinvest agency, that have the know-how on local firms and their needs can play a valuable role.

› **Speed-up digitalisation of the public sector and overall implementation of the strategy Digital Czechia.** So far, digitalization of public services has been proceeding rather slowly, and presents an opportunity for Czechia. Inspiration can be drawn from the EU-CEE's digital frontrunners like Estonia, which is a leader in the quality of public e-services (see recommendation 5.3 of the main report). The country should take advantage of the fact that for the first time since 2007, digitalization of public services falls under the responsibility of a government minister. The utmost issue has been the so-called supplier lock-in, i.e. a situation when a government agency is dependent on a single long-term supplier, reducing the efficiency of the digital ecosystem, interconnectedness of the digital public services and providing room for corruption. To this end, the transformation and synchronization of the internal processes and IT tender coordination would present a step in the right direction.

› **Take a more proactive approach to the green transformation.** The policy stance taken by Czechia in the green transition thus far has been relatively hesitant and avoidant. This limits the potential to cultivate an ecosystem where green technologies and industries, which are inevitably rising in importance, would be able to flourish. Implementing direct support to innovative businesses and research in this area presents an opportunity to leapfrog from a coal-oriented economy to a rising player in clean technologies. Still, given the large share of Czechia's workforce being potentially adversely exposed to the changes brought on by the green transition, policies advancing the green transformation need to be complemented by the provision of a robust safety net (in line with the policy recommendation 5.7 of the main report).

› **Introduce the upskilling and reskilling programs, that enable employees to acquire competences demanded by the labour market.** Again related to the distributional implications of structural change (as emphasised in policy recommendation 5.7 in the main report), it is important to note that Czechia is among countries with the lowest share of population continuously participating in lifelong learning programs. In the near future, combined with population ageing, this exacerbates the risk of deepening skill mismatches in the labour market, and hinders the prospects of further

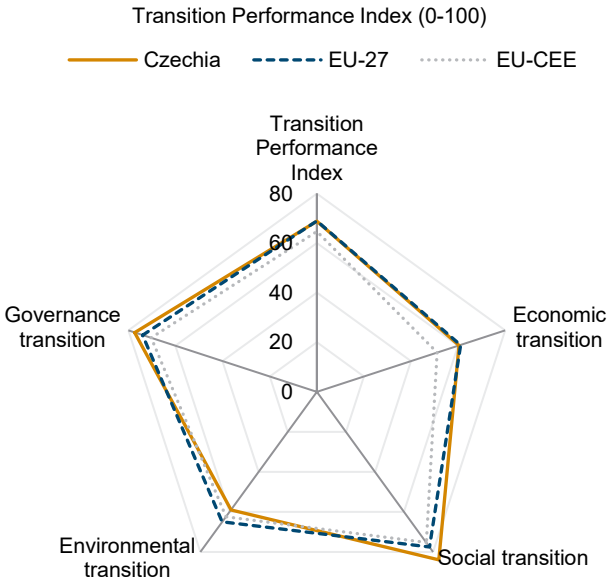
development. A central programme for upskilling and reskilling which is in line with the long-term priorities of the industrial policy ought to be implemented under the coordination of the responsible government ministries.

Industrial development - II

Sector	% of manufacturing employment
Fabricated metal products, excl. machinery and equipment	14.8%
Motor vehicles, trailers and semi-trailers	13.7%
Machinery and equipment	10.0%
Electrical equipment	8.2%
Food products	7.5%
Rubber and plastic products	7.2%

Note: 2018 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Estonia

COUNTRY OVERVIEW

Estonia is one of the world's most enabled digital nations and a pioneer in digital transformation in EU-CEE. Technological advancements and very high quality of human capital enable Estonia's strong service-based model, largely based on exports of digital know-how and ICT services. Strong record in development and implementation of innovative technologies has been attracting large-scale FDI in high-tech sectors – the cornerstone of economic growth over the last decade. Governance and social transition also top the levels of EU-CEE and EU27, largely due to advanced digitalization of public services and social innovation. Economic transition performance ranges above other EU-CEE due to steadily growing income level, flexible job market and strong public finance.

The largest sector of economic activity in Estonia, similarly to other Baltic states, is manufacturing, especially wood and wood products, which altogether accounted for 15% of GDP in 2021. Estonia's industry, however, is uncompetitive both compared with EU-CEE and the overall EU average (see table below). In 2020, medium- and high-tech manufacturing value added according for just 30% of the total, also below the EU-CEE and EU averages.

However, the IT sector is the heart of Estonian economy and, in the last decades, has largely driven overall economic growth. This success is based on high levels of capacity and knowledge, strong domestic and foreign demand for cutting-edge technological solutions, strong competitiveness on international markets, and a high level of trust from both customers and investors domestically and internationally. Estonia has the highest number of start-ups and 'unicorns' per capita in Europe, with a notable percentage of those operating in high-tech sectors. Examples include the ride-hailing company Bolt, the fin-tech company Wise (now headquartered in the UK), or the most recent 'unicorn', a digital customer service provider Glia. Despite the deteriorating geopolitical situation and resulting negative economic fallout, Estonia remained highly attractive among foreign investors last year, as overall venture capital investment activity was the highest in per capita terms of all EU countries .

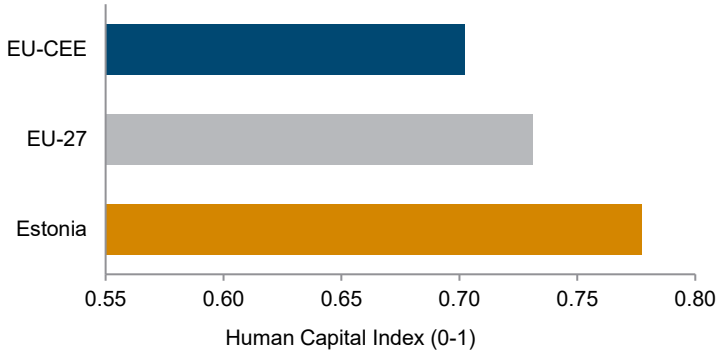
However, Estonia still lags behind in the environmental transition, as oil shale and natural gas remain core energy sources. Nevertheless, like for the rest of EU-CEE, the Russian invasion of Ukraine and fallout will likely shift country's energy profile to more green and sustainable sources.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Estonia	0.06	13%	30%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Estonia is a leader in digital transition and IT sector developments, both in EU-CEE and the EU27. As a result, the country posts a remarkably high level of digitalization and well-established digital infrastructure (DESI above EU average), as well as ensures strong cyber security.

› An exceptional record of unicorn start-ups and major capacity in IT R&D.

› High labour productivity relative to other EU-CEE countries and high quality of workforce, with high PISA test scores in mathematics and science rankings compared with EU and global peers.

Weaknesses

› Uneven digitalisation across the sectors, with the manufacturing sector lagging far behind services.

› Oil shale remains one of the major energy sources and the on-going energy crisis gave it a new spin.

› Low quality of transport infrastructure and shortcomings in terms of connectivity and sustainability of transport.

› Shrinking working age population, which is still fuelled by an outflow of young professionals following the Global Financial Crisis, and major reliance on immigrant workers, especially in manufacturing, construction, service and trade, as well as highly-technological sectors.

Opportunities

› Increasing investment attractiveness of Estonia, reflected in the steadily growing FDI flow, relies on a good combination of skills (especially in ICT and natural sciences), environment, geographic location, and innovation capacity, complemented by minimal bureaucratization and stability of institutions.

› Two-decade experience of developing and establishing cutting-age digital solutions and IT technologies allow to accelerate further R&D in most demanded sectors, including cleantec and automation.

› Good potential to utilize existing R&D infrastructure for future research and proof of concept in eco-innovation, which is largely based in academia, accelerators and competence centres.

Threats

› A lack of a formal policy to ensure project selection and assessment of performance, which led to some EU-funded infrastructural projects being designed too large and delivered inefficiently.

› Persistent labour shortages, with demand for both low and high skilled workers (especially in ICT) being very high. Very strict immigration laws are often an obstacle in hiring both high and low-skilled workers of foreign origin.

› Very high economic divergence across the North-Eastern regions and the rest of the country. It results in digital and environmental transition being very slow and requiring major alterations of economic activities in the former region.

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› Foreign investors are treated on an equal footing with local investors. Hence all investment incentives and benefits, such as no corporate income tax on retained and reinvested profits, reduction of tax rate for distributed profits from 20% to 14% (as of January 2018), access to various grants and support programs, are equally available for local and foreign investors.

› Investment Promotion Agency published a number of grants to support investments (including FDI) in sectors and regions most affected by transition to a climate-neutral economy (e.g. mining, manufacturing and other sectors in North-Eastern regions) and investments focused on clean and efficient production and use of energy, and on sustainable transport.

New technologies, digitalisation, innovation

› Around 24% of Recovery and Resilience Facility (RRF) funds allocated to Estonia will be streamed into (i) digital transformation of public services – increasing accessibility of public services and internet coverage (c.a. 12% of funds); (ii) digital transition of enterprises, with a focus on improving digital skills of workers and developing digital technologies for enterprises (c.a. 12% of funds).

› Action plan ‘Estonia 2035’, as a part of Estonian Research, Development, Innovation and Entrepreneurship (RDIE) Strategy for 2021-2035 prioritizes research in highly technological fields, including artificial intelligence and robotics, as well as development of green and sustainable technologies.

Green transformation of industry

› In Estonia’s Recovery and Resilience Plan, 22% will be allocated to the green transition of enterprises, which includes development of a broad range of green technologies (green hydrogen, low-carbon and climate-neutral capabilities), as well as building green skills. Another 12% will be invested in sustainable transport and 9% in sustainable energy and energy efficiency, with a major focus on decarbonizing economic operations, including transportation.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of this study, we identified Estonia as the most digitally advanced country in the region, and therefore very well prepared for this half of the 'twin' transition. The core focus for policymakers should therefore be to maximise advantages in the digital sphere, address the distributional implications of this type of growth, take steps to maximise the growth potential of the green transition (where Estonia is much less advanced), and address the extremely challenging issue of labour supply.

› **Digitalisation of enterprises, particularly in the manufacturing sector, via the development of an entrepreneurial state, and smart specialisation strategies.** Although the services sector is an EU leader in terms of digitalisation, this is much less the case for manufacturing, where Estonia is a relative laggard. Further automation, including robotisation, and digitalisation of enterprises could lead to significant productivity improvements and increase the economy's growth potential. Part of the solution here is to incentivise the automation of routine tasks via higher minimum wages (see policy recommendation 5.7 in the main report). However, this alone will not be enough. Policymakers must seek to transition towards a more entrepreneurial state, by pushing closer collaboration between research institutions and enterprises, both private and public (see policy recommendation 5.1). Estonia's strong institutions by EU-CEE standards (see main report) make this a more realistic aspiration than in most countries of the region. In line with this, smart specialisation strategies also seem to be a potentially fruitful path for Estonia, with a continuous feedback loop between key actors from research institutions, the private sector and ministries to identify appropriate new technologies and processes, develop them, and incorporate them into business operations.

› **Further push the digitalisation of industry, address labour shortages more generally, and boost productivity and growth potential via automation and active labour market policy.** The demographic challenges of the Baltic states, including Estonia, are well known, with aging population and extreme labour shortages across all sectors and all skill levels. There is no silver bullet. Yet the apparently weak competitiveness and lagging digitalisation of the manufacturing sector outlined above suggest the potential for labour-saving improvements. Along with strategies to increase the absorption of digital technologies in industry, policymakers should seek to nudge automation of the economy more generally, by setting minimum wages at a level that encourages automation and an active labour market policy that ensures workers get to the parts of the economy where they are most needed, and with the appropriate training, as quickly as possible. We propose combining a strong welfare state and extensive retraining programmes with minimal entry and exit frictions for employment (see policy recommendation 5.7 in the main report). These policies will need to take into account that education and skill attainments are very heterogeneous by ethnic groups.

› **The green transition of large parts of the economy has some way to go, and appropriate policy interventions would unlock significant growth potential here.** As we identified above, Estonia has a long way to go in transitioning from oil shale to renewable sources in electricity production, in reducing the use of fossil fuels in the transport sector, and in increasing the heating efficiency of dwellings across the country. These can be achieved by combining carbon pricing, public investments in new infrastructure, fostering private investments especially when households and small businesses are concerned, with adequate subsidies to the latter. FDI attraction policy must be adapted to take this needs into account: Estonia should seek to incentivise in particular foreign capital that will help to make significant strides in the greening of the economy (see policy recommendation 5.4 in the main

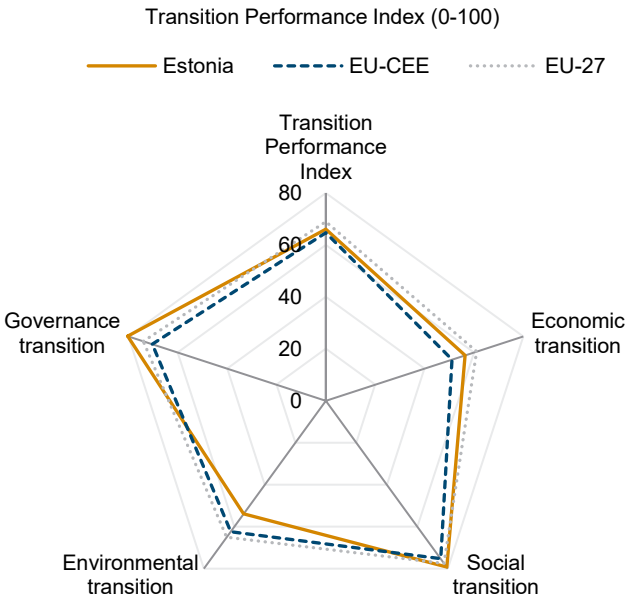
report). With the EU support towards green transition being very strong, it is a primary duty of local governments to identify the most vulnerable groups and tailor targeted support.

Industrial development – II

Sector	% of manufacturing employment
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	16.9%
Manufacture of fabricated metal products, except machinery and equipment	12.4%
Manufacture of food products	11.6%
Manufacture of furniture	7.2%
Manufacture of electrical equipment	5.5%
Repair and installation of machinery and equipment	5.5%
Manufacture of computer, electronic and optical products	5.3%

Note: 2021 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Hungary

COUNTRY PROFILE

Hungary is a high-income country with medium-high level of industrialisation. The share of manufacturing is about to shrink below 17% of GDP on account of expanding services and construction activities. The country's industrial competitiveness is about the EU average. Hungary specialises on industrial activities with relatively high sophistication which is the result of deep integration in international value chains generated by FDI. Thanks to the modernization efforts of established companies and the addition of new highly productive manufacturing lines, Hungary is ranked 18th in the EU as regards labour productivity (gross value added per worker employed) in the manufacturing sector, ahead of Czechia and Poland. The best labour productivity ranks have been achieved in the chemical, the pharmaceutical and the automotive industries.

The automotive industry is the largest industry by size. It includes both assembly plants such as Suzuki and Mercedes Benz and component suppliers e.g. the engine factory of Audi. A BMW plant to produce electric cars is under construction in Debrecen with an investment volume of EUR 2 bn. The electronics industry is to large extent integrated with the car industry. The subsidiaries of Robert Bosch GmbH produce various electronic car components and operate R&D facilities. CATL from China has started an EUR 7bn investment for producing batteries for cars. The plant will have capacity of 100 gigawatt hours, enough to power more than 1 million cars. The pharma industry has long tradition in Hungary and together with other areas of the life science industry and universities in the field they are leading in R&D among the industries in Hungary. EGIS and Gedeon Richter Plc. are renown for developing new pharmaceutics and biotechnological products.

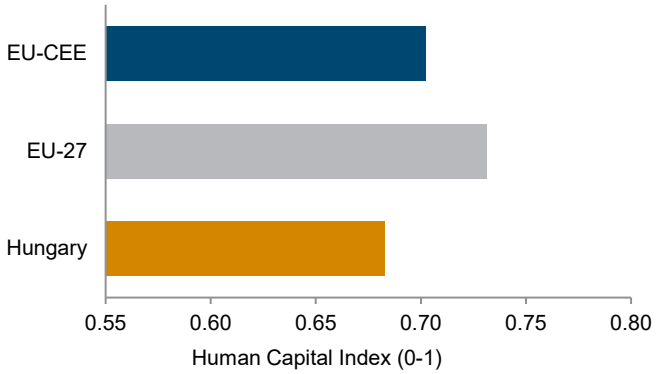
The modern industrial base contributes to better than average quality of the environment. Given its landlocked position and high dependence on Russian energy imports, the issue of energy security represents a particular challenge for future industrial competitiveness. Human capital is a weak point of the country; especially poor health conditions stand out. The HCI value for Hungary decreased from 0.69 to 0.68 between 2010 and 2020 due primarily to worsening quality of education. Hungary stands out with very poor performance in governance transition by which it is the last among the EU members. Transparency, corruption and rule of law have major shortcomings. In this context, the government passed legislative improvements to unblock the Multiannual Financial Framework 2021-2027 and the Next Generation EU funds at the end of 2022, but future disbursement will depend on making commitments work and on fulfilling additional conditions.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Hungary	0.13	18%	53%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› With tax revenues amounting to 37% of GDP and eligible EU funding of 4-6% of GDP annually, the government has substantial potential resources to spend on R&D, green transition and industrial modernisation in the coming years.

› Attractive conditions including state subsidies to manufacturing FDI and embeddedness in global value chains enable the access to state-of-the-art technologies and know-how. The relatively modern industrial base limits carbon emission.

› Progress has been made in digital economy; the DESI score is 44 against the EU average of 52. The internet infrastructure is advanced allowing the use of digital services across the country.

Weaknesses

› Inadequate economic policy measures, increasing controversy with EU partners and slow adaptation to the new international environment has manoeuvred the country into a situation where fiscal consolidation and energy security overrules long-term development goals. Currency instability, high current account and fiscal deficits prompt ad-hoc economic policy measures which reduced transparency and accountability; increasing instability of profit expectations hinder investments.

› Innovation expenditures have increased in recent years; however, the efficiency of the innovation system is still low, only 57% of the EU average.

› Big discrepancy exists between large companies and SMEs in digital technology integration. Business R&D capacities are mostly concentrated in foreign-owned companies while government R&D spending stagnates.

› General shortage of ICT specialists and engineers hinder the utilisation of advanced technologies. The current education system is unprepared, its financial means are inadequate to increase ICT literacy and provide high quality workforce.

› Public investments do not prioritize industrial modernization and green transition. Sports infrastructure investments have enjoyed priority over other public investments including energy saving.

Opportunities

› Advanced clustering in the automotive, electronics and pharmaceutical industries can attract more capital, technology and R&D.

› Centralised state ownership in utilities allow the government, at least in theory, to implement large-scale, coordinated investment programmes to improve energy efficiency and waste management.

› More green energy could be generated by supporting the utilization of wind energy resources.

› Improving ICT literacy is in demand and could be developed with adequate training. The country participates in related EU programmes which give access to knowledge and financial support.

Threats

› If EU funding is not arriving on time due the government's reluctance to meet necessary conditionalities, the funding of development programmes gets in danger.

› The recently imposed extra taxes drain the windfall profits not only of energy companies and banks but also of the pharma industry and cement manufacturing which will block their modernisation.

› Green transition suffers delay if the current short-term measures remain in effect for a longer period. Currently the government supports energy intensive industries suffering from high energy prices instead of energy saving programmes. Tight government control and low regulated tariffs in waste management and other utilities discourage investments and energy saving.

› Digital education, business support and R&D programmes cover all necessary areas but may remain on paper if they do get priority in the curricula of the education system and in government policy.

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› Economic and FDI policy aim, since 2017, to change Hungary from a 'manufacturing hub' to an 'advanced manufacturing & innovation centre'. New forms of cash incentives and tax grants were introduced to enhance corporate R&D activities and technology-intensive investments. Investors in new production capacities are eligible for cash grants to cover half of the training costs for employees. Individual 'VIP support packages' were introduced for the most significant projects which gives priority treatment by government offices. Contractual research services have also become eligible for cash grants benefiting R&D projects and the country attracted several digital service centres. The government's aim is to maintain the car industry in the electric car age by attracting battery manufacturers. Foreign policy has targeted Asian investors, mainly from China and South Korea.

› The government initiates and promotes national ownership in all other economic sectors than manufacturing. Support is provided to national investors to overtake foreign owned businesses in banking, retail, telecommunication, etc. Companies in these sectors, still to large extent foreign owned, are subject to surtaxes which drain their profits and may prompt them to leave. National investors concentrate in those sectors which serve the domestic market and can benefit from public

procurement. The FDI screening mechanism is stricter than the EU recommendations and enables the government to hinder foreign takeovers of assets put up for sale and initiate national take-over.

› The most recently identified priority of industrial policy is military industry. New production facilities involve FDI or other forms of international cooperation.

New technologies, digitalisation, innovation

› The 2014-2020 industrial policy (Irinyi-plan) set the target to expand the share of industry in the Hungarian economy. Re-industrialisation could not be realised because the progress of industry depended more on its service content than on new production capacities. But the broader aim of increasing the employment rate and attracting FDI could be attained. Efficiency and competitiveness overtook as main priorities more recently, but the overall political and institutional adjustment is missing. It is not the government but the National Bank which came forward with a comprehensive competitiveness programme.

› Longer-term government programmes are financed mainly from EU funds. The Economic Development and Innovation Operational Programme (EDIOP) is Hungary's biggest programme focussing on investments in SMEs with a total allocation of EUR 8.8 billion over seven years. Its scope was expanded in 2020 to fight the negative impacts of Covid.

› The Digital Workforce Program aims to digitally prepare current employees throughout sectors and occupations and increase the number of professionals engaged in the ICT sector in Hungary. The Digital Success Programme 2030 is an integrated programme to increase the level of digitalisation across industries, public services and education.

› Many of the objectives of a new industrial policy enjoying EU support have been put into brackets by the recent protectionist policies which aim at maintaining the current level of economic performance of SMEs with preferential credits and government grants.

Green transformation of industry

› The volume of greenhouse gas emissions in Hungary per employed person stood at 11 tonnes in 2020, below the European Union average of 13.6 tonnes. The country reduced emissions since 2010 by 34%, thus the government sees no problem in reaching the 55% target by 2030 in accordance with EU law. The greening target faces problems mainly in transportation and households, not in the industry. On the European Eco-innovation scoreboard Hungary ranked 27th in 2019. Investments in green transformation are inadequate. Environmental resource management activities achieve low results in an over centralized management system applying lower than cost covering tariffs.

› The share of renewables in total energy consumption stagnates at around 14% since 2010. Progress in energy generation greening has been achieved mainly on account of solar energy. The government considers nuclear power the most important source of electricity and expands capacities relying on Russian investments with risky outcome.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of the study, we identify Hungary as one of the most industrialised countries of the region, but as one falling behind the most developed EU-CEE peers in multiple aspects. Therefore, we suggested that the core focus ought to be on leveraging the wide presence of MNEs to create deeper

linkages with the domestic economy, as well as on diversifying the sectoral and functional structure. Specifically, we propose the following policy priorities:

› **Re-define goals and means of an entrepreneurial state in a broad social and economic dialogue.** The party in power for twelve years controls all resources and decision-making power to run a developmental state it has failed to support functional upgrading and technological progress. This approach contrasts itself with the policy recommendation 5.1 of the main report, whereby we emphasise that an entrepreneurial state needs to take a collaborative approach to policymaking. This entails involving a plethora of stakeholders and building an effective feedback loop for new ideas and markets to be financed, tested, assessed and adjusted to be developed further. In this sense, following the mainstream European policy trajectory would increase efficiency and support modernisation. Normative rules should take priority over discretionary interventions.

› **Support more competitive markets, and faster adoption of new technologies, to accelerate technological upgrading and the digital transformation of the economy.** Suppress rent-seeking, encourage the flow of domestic capital from local monopolies into internationally competitive activities. The institutional backsliding witnessed over recent years augments the risk of costly failed policy interventions. In this sense, policy recommendation 5.6 of the main report, which stresses institutional improvement as a vital pre-requisite for a successful national industrial policy and a National Innovation System, proves particularly relevant in the case of Hungary. Furthermore, given relatively large disparities within the country, improving institutional capacities at the sub-national level also proves key for increasing the effectiveness of Smart Specialisation Strategies.

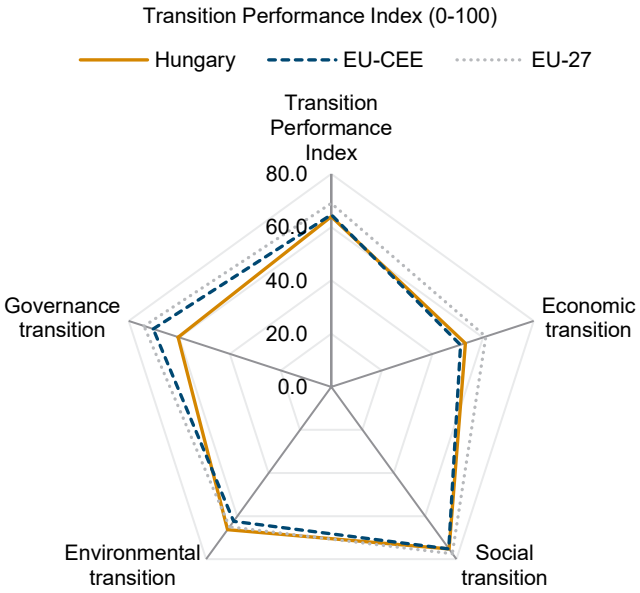
› **Increase the budget for education and healthcare to improve the availability, skills and mobility of human capital.** In education, the curricula need modernisation to match digital age requirements. To this end, Hungary would benefit largely from unlocking and effectively utilising EU financial inflows. At the same time, the linkages and synergies between higher education, research institutions and corporate R&D must strengthen. The integration process in life sciences and pharmacology may give the example.

Industrial development - II

Sector	% of manufacturing employment
Motor vehicles, trailers and semi-trailers	12,8
Food products	12,3
Fabricated metal products, exc. machinery and equipment	10,8
Rubber and plastic products	7,4
Machinery and equipment n.e.c.	7,2
Electrical equipment	7,1
Computer, electronic and optical products	6,5

Note: 2018 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Latvia

COUNTRY OVERVIEW

Latvia is the least industrialised country in the EU-CEE, and also one of the least developed. This is reflected by the various indicators of industrial competitiveness. The country has got one of the highest shares of low-tech industry within manufacturing value added in the EU. This is also an outcome of very low FDI in the manufacturing sector (while most inward FDI went to the service industries).

Building upon the natural resources of the country, one core activity in the economy is the processing of wood (together with forestry upstream and furniture production downstream), which accounts for 20.9% of total employment in manufacturing. In general, companies are small to medium in size; Lavijas Finieris and Kronospan Riga are the largest two, producing wood-based panels. Given the advanced tertiarisation of the economy, the fabrication of metal-based products declined in importance in the past (to 10.1% of employment in manufacturing) and only one enterprise in this sector (Severstal distribution) as well as one in the electronics industry (Mikrotils) are of medium to large size. Thus, food production amounting to 17.3% of total employment, became the second largest manufacturing subsector. Two of the three largest Latvian employers in manufacturing however are pharmaceutical enterprises (Olainfarm and Grindeks) since larger facilities are required for efficient production in this sector.

The human capital situation can be described as middle-rate in comparison to the EU-CEE. In terms of tertiary educated workforce, the country is a front runner in the EU-CEE region, and while in terms of digital skills Latvia ranks below the EU average, the share of ICT graduates surpasses EU levels.

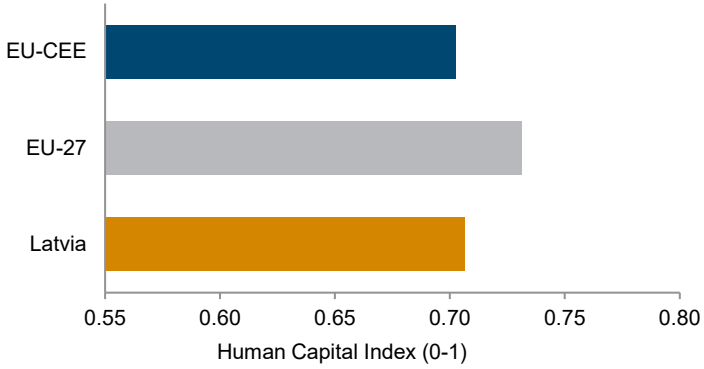
The economy is on a good track concerning environmental transition, however in the case of material use and energy efficiency Latvia lags behind. In addition, in the past two decades greenhouse emissions were, contrary to the EU average and the national reduction target, on the rise. Upon lately dependence on Russian energy imports had been high. The reorientation towards Northern and Western Europe took place or is ongoing but results in higher energy prices. Thus, the issue of energy security and costs represents a challenge for industrial competitiveness going forward.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Latvia	0.05	12%	21%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Latvia has a high share of population with tertiary education and one of the highest shares of ICT graduates among students in comparison to other EU-CEE countries, which allows to use the opportunities of digitalisation in all industries

› Institutional quality is among the highest in the EU-CEE, behind the leader Estonia but in line with Czechia, Slovenia and Lithuania, offering solid pre-conditions for state entrepreneurship

Weaknesses

› Latvia has a low innovative capacity and progress in this field is lower than for the EU average. Government support and finance for R&D business expenditure is lacking. Thus, also patent applications are among the lowest in the EU.

› Environmental expenditure is relatively low and the R&D investment rates is one of the lowest in the EU

Opportunities

› Latvia has one of the highest broad-band penetration rates in the EU, which points to a relatively well-developed digital infrastructure in the country. Moreover, in the area of digital public services, Latvia (along with the other Baltic countries) outperforms the EU average.

› The ongoing experience with skill shortages incentivises productivity-enhancing automation

Threats

› Integration of digital technology in enterprises, particularly in SME's is developing slowly, although the RRP foresees public investments in this area.

› The lowest share of new doctorate graduates within the EU impedes the development and application of innovation in Latvia and hinders the potential of a more high-technology based economy.

› The working age population is about to shrink strongly in Latvia. Skill shortage is already for a longer time a serious issue for the manufacturing sector.

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› FDI policies have been rather passive in Latvia. Not recently, but in the past the country has established five free trade areas, which offer companies apart from other benefits a substantial reduction in corporate income taxes and real estate taxes.

New technologies, digitalisation, innovation

› The National Industrial Policy Guidelines 2021-2027 approved in 2021, focus on the development of human capital, i.e. particularly ICT and vocational skills of the incoming as well as the existing workforce. In addition, innovation and export capacities of firms should be fostered. The government identified five Smart Specialisation areas in their RIS3 strategy: Knowledge-intensive bioeconomy; biomedicine, medical technologies and biotechnology; smart materials, technology and engineering; as well as advanced ICT and smart energy as horizontal enablers of structural transformation across all economic sectors.

› About 21% of the Recovery and Resilience Facility (RRF) is allocated to the digital transformation, supporting particularly digitalisation of businesses, a digital upskilling of the workforce and a fast development of the 5G infrastructure in Latvia.

Green transformation of industry

› Only a small share of the funds foreseen in the RRF for green transition is directed towards industry, while most towards public transport and energy saving measures. Nevertheless, the investment in the green and digital transformation of electricity grids as well as the renovation initiative to increase the energy efficiency of building are horizontal measures that also raise the resource productivity of Latvia's industry.

COUNTRY-SPECIFIC RECOMMENDATIONS

As for the other Baltic countries, the core focus for policymakers in Latvia should be to maximise advantages in the digital sphere, address the distributional implications of this type of growth, take steps to maximise the growth potential of the green transition, and address the extremely challenging issue of labour supply.

› **Take advantage of strong human capital and address demographic decline with a stronger push towards automation and active labour market policy.** Latvia has a reasonable level of human capital by EU-CEE standards, but has been experiencing, and will continue to experience, very negative demographic trends. These are visible in skills and general labour shortages in the economy, and present a major break on future growth potential. Policymakers must prioritise making the most of the available human capital with targeted policy interventions, focused on education, training, the retention and attraction of human capital, and improving labour productivity. The government should

invest more in the upskilling of the existing workforce and increase spending on active labour market policies including training and foster the development of digital and vocational skills in education. By targeting a higher minimum wage, the government can incentivise the automation of more routine tasks, and combined with the formulation of retraining policies, a stronger social safety net, and minimal entry and exit restrictions for employment, ease and speed-up the transition of workers towards higher value added tasks (see policy recommendation 5.7 in the main report). Moreover, immigration policy could be adapted in order to attract much-needed skilled workers in particular sectors.

› **Take a more proactive approach to foster innovation capacity of the economy by taking steps towards the establishment of an entrepreneurial state with a national innovation strategy.** The low performance in research and innovation in Latvia highlights the need for a substantial increase in direct public support to R&D and more incentives for business to invest in R&D. A greater proportion of research funding should be devoted to ICT-related projects, which are currently underfunded. Although we do not identify Latvia as one of the EU-CEE countries fully at the state of being able to build an entrepreneurial state, steps should be taken in this direction. The state should seek to build up more networks of exchange between key ministries, academia and the private sector in order to exchange information with the aim of building a feedback loop to develop ideas (see policy recommendation 5.1 in the main report).

› **Implement incentives to attract proactively FDI in industrial sectors relevant for the digital and green transformation of the economy, and consistent with a national innovation strategy.** Following on from the previous point, foreign investment will remain a central channel by which the Latvia economy receives and implements innovation, and in this sense FDI policy should be increasingly steered towards attracting investment that will bring innovation in line with the economy's needs. The government should seek to build on existing niches, aiming to attract FDI to these niches, and incentivizing foreign investors to operate in a way that will generate spillovers for the domestic economy (see policy recommendation 5.4 in the main report). A more active approach in FDI attraction could foster the development of the areas targeted at in the RIS3 strategy mentioned above as well as other relevant business services. In addition, FDI could facilitate a swift restructuring in energy and transport towards smart and green technologies, which Latvia anyway needs due to the breakdown of the economic ties with Russia and Belarus.

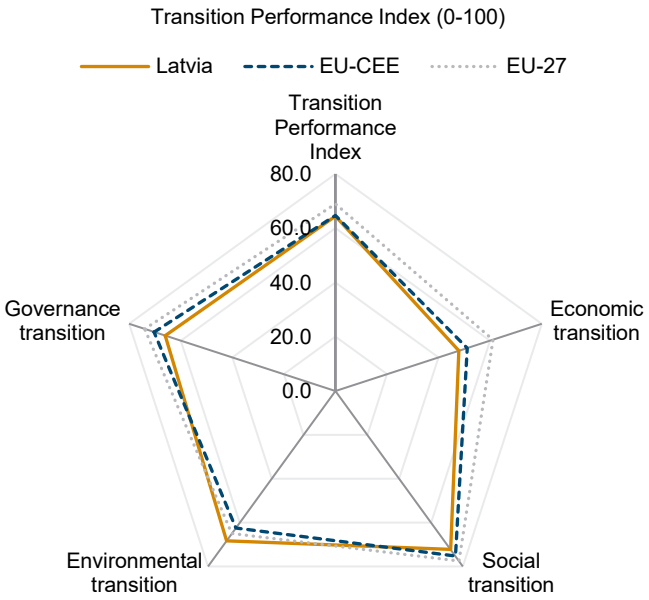
› **Make green transition a key element of the economic development strategy. Latvia was until recently heavily dependent on Russian gas and oil.** It has to invest in further energy interconnection capacities with neighbouring countries. It should further promote renewable energy generation in particular by removing administrative barriers to the development of (on- and off-shore) wind energy projects. Green transition (raising material use rate, resource productivity, etc.) should also be fostered by improving access to finance for small and medium-sized enterprises through public lending and guarantee schemes.

Industrial development - II

Sector	% of manufacturing employment
Wood and products of wood, cork, straw, etc. except furniture	20.9%
Food products	17.3%
Fabricated metal products, excl. machinery and equipment	10.1%
Wearing apparel	6.2%
Furniture	6.1%
Other non-metallic mineral products	5.1%

Note: 2021 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Lithuania

COUNTRY OVERVIEW

Lithuania is one of the less industrialised countries in the EU-CEE, though one of the most developed socio-economically. The country's service-orientation is reflected by the various indicators of industrial competitiveness. The country has got the highest share of low-tech industry within manufacturing value added in the EU and the lowest share of high-tech industry. This is also an outcome of the lowest ratio of FDI in the manufacturing sector in comparison to GDP within the EU-CEE, as most inward FDI went to the service industries.

Similar to the other Baltic states, one core activity in the economy is the processing of wood, which accounts for 9.2% of total employment in manufacturing, while downstream production of furniture is even more important with 14.7% of total employment. In general, small- to medium-sized companies prevail in most industrial sectors. Freda is the only large-size company producing furniture. Given its strong export-orientation, food production is the largest single sector employing 16.8% of the industrial workforce. Rokiskio Suris is with about 1,500 workers the second largest industrial enterprise in Latvia, producing cheese and dairy products. Some of the largest manufacturing companies cluster around petroleum and gas processing. Orlen Lietuva, which is polish-owned is the only petroleum refinery in the Baltic states. Achema is producing nitrogen fertilizers as well as chemicals like Thermo Fisher Sientific. SCT Lubricants is producing engine oils and Lietpak, Neo Group and Orion Global PET all produce plastics of different kind. For all those companies, the issue of high dependence on Russian energy and inputs in general is obviously a particular challenge for industrial competitiveness currently and in the coming years.

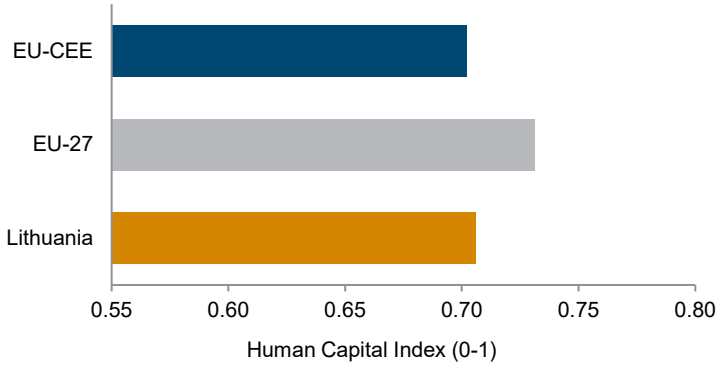
The human capital situation can be described as middle-rate in comparison to the EU-CEE, however in term of tertiary educated workforce the country is a front runner in the region. The economy's main shortcoming given the megatrends lies in the environmental transition: material use, resource productivity and circular material use are areas that need more attention.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Lithuania	0.08	18%	29%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Lithuania has a rather high share of population with tertiary education in general and with basic digital skills in particular as well as a high share of ICT graduates among students in comparison to other EU-CEE countries

› The highest share of SME's with at least basic level of integration of digital technology within the EU-CEE (57%) (also above EU average) shows the adaptability of the economy in the course of technological transformation

› Lithuania's innovation performance increased quite strongly, more than the EU average, in the past 7 years. The share of innovators is rising as well as enterprises investing in non-R&D innovation expenditure as well as the availability of venture capital

› Institutional quality is among the highest in the EU-CEE, behind the leader Estonia but in line with Czechia, Slovenia and Latvia, offering solid pre-conditions for state entrepreneurship

Weaknesses

› Lithuania shows one of the lowest levels of industrial competitiveness within the EU due to the relatively small country's impact on the global market

› Public support for business R&D is low, which results in a limited innovative capacity of enterprises.

› In terms of material use Lithuania is the least country in the EU except for Finland in 2020 and showed a decline in performance in the past decade

Opportunities

› Venture capital expenditures are relatively high and among the fastest growing in EU-CEE, offering opportunities for innovative start-ups. In terms of startups per capita, Lithuania is second in the EU, only falling behind Estonia.

› Similar to the other Baltic states also Lithuania ranks above the EU average in digital public services for businesses and particularly in services for citizens

› The share of renewables in total energy consumption increased strongly in the past decade. However, more has to be invested to reduce the dependence on oil and gas, which offers opportunities in the area of green transformation.

Threats

› The low and recently declining share of new doctorate graduates compared to the EU average is likely to hamper the development of the research and innovation capacity of the Lithuanian economy

› Lithuania is among the EU Member States that have assigned the least spectrum for 5G – only 5%, compared to the EU average of 56%, which is critical to foster 5G development

› Greenhouse gas emissions per capita are still below the EU average but increased over the past decade. Lithuania has to step up efforts to achieve the climate goals.

› The working age population is about to shrink in the coming years. Skill shortage is already for a longer time a serious issue for the manufacturing sector

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› FDI policies have been rather passive in Lithuania. Not recently, but in the past, the country has established seven Free Economic Zones, which offer companies six years of exemption from corporate income tax, 50 percent reduction during exemption from real estate tax and no tax on foreign company dividends.

New technologies, digitalisation, innovation

› A high share of 31% of the Recovery and Resilience Facility (RRF) is allocated to digital transformation, supporting particularly science-business cooperation for innovative technologies, investment in broadband infrastructure to reduce the urban-rural digital divide, a digital upskilling of the workforce to reduce the shortage in IT specialists and a faster development of the 5G infrastructure in Lithuania.

› The Smart Specialisation Strategy (S3) updated in 2019 by the Lithuanian government, focuses on seven priority domains, which consider areas with existing or potential competitive advantage. These are e.g.: energy and sustainable environment, health technologies and biotechnology, agro-innovation and food technologies or smart, green and integrated transport.

Green transformation of industry

› A high share of the RRF is allocated to green transition, however the measures are not directed towards industry but horizontal. Most important are the development of offshore wind infrastructure and of onshore plants for renewable energy sources, the creation of energy storage facilities and the support for phasing out the most polluting road transport vehicles.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of this study, we identified Lithuania as a fairly digitally advanced country by EU-CEE standards, and therefore well prepared for this half of the 'twin' transition. The core focus for policymakers should therefore be to maximise advantages in the digital sphere, address the distributional implications of this type of growth, take steps to maximise the growth potential of the green transition, and address the extremely challenging issue of labour supply.

› **Take a more proactive approach to foster innovation capacity of the economy via the establishment of a national innovation strategy and development of an entrepreneurial state.** As a relatively advanced country by EU-CEE standards in per capita GDP terms, and with a fairly high level of institutional development in the regional context, Lithuania is in a position to target the development of an entrepreneurial state. Lithuania has among the highest scores in EU-CEE for government effectiveness and regulatory quality according to the World Bank Worldwide Governance Indicators. Strengthening business-research collaboration on innovation is the main priority, by creating networks involving key ministries, academic and the private sector (see policy recommendation 5.1 in the main report). The government should also increase further the innovation capacity of firms by making R&D tax incentives more effective.

› **Invest more in reaping the benefits of digital transformation.** Lithuania has a good standing concerning digital skills of its population. However, it has still room to improve towards its Nordic peers and even Estonia. Since ICT seems to be a good niche for smart specialisation (see policy recommendation 5.5 in the main report), the government should invest more in the reskilling and upskilling of its workforce including training of unemployed and people out of the labour force. Where relevant, the example of Estonia should be followed, in order to ensure further digitalization of industry and the public sector (see policy recommendation 5.3 in the main report).

› **Preserve the strengths of having a skilled workforce by fostering education, training and attracting human capital.** Like its Baltic neighbours and much of the rest of EU-CEE, Lithuania faces negative demographic trends and this will be an ever-greater constraint on the economy's growth potential. Although there is no solution to solve the issue entirely, there are various measures that the government could take. A key priority should be active labour market policy, to ease the transition of workers from more routine tasks to more productive jobs (see policy recommendation 5.7 in the main report). The government should invest more in the upskilling of the existing workforce and foster vocational education and training. In order the speed the transition, exit and entry restrictions for employment should be minimized, while a higher minimum wage would push the private sector to automate routine tasks more quickly. The government should also ensure an adequate social safety net to cover the period of transition between jobs. Moreover, immigration policy should attract much needed skilled workers in particular sectors.

› **Implement a tailored FDI promotion policy which would complement the national innovation strategy. Lithuania could do more to attract FDI actively, and this remain a key channel by which the economy absorbs innovation.** FDI policy should be aligned with strategies for national innovation and economic development in general, with incentives for foreign investors tweaked to encourage capital to enter priority sectors, and to attract the kind of investment that will also generate more domestic spillovers (see policy recommendation 5.4 in the main report). This could also help to

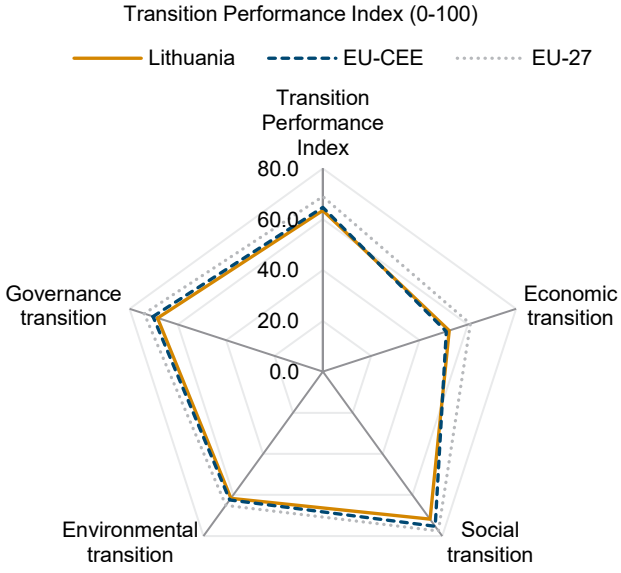
development the areas of the country's smart specialisation (S3) strategy, in particular agro-innovation and food technologies, transport, logistics and information and communication technologies (ICT).

Industrial development - II

Sector	% of manufacturing employment
Food products	16.8%
Furniture	14.7%
Wood and products of wood, cork, straw, etc. except furniture	9.2%
Fabricated metal products, excl. machinery and equipment	8.1%
Wearing apparel	6.6%
Repair and installation of machinery and equipment	4.7%

Note: 2021 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Poland

COUNTRY OVERVIEW

Poland is a moderately industrialized country, with the role of manufacturing in employment and value added above the EU average, yet below some of its CEE peers. It is an export-oriented economy, deeply embedded in global value chains through the channels of both FDI and subcontracting. In recent years, Polish economy, and the manufacturing sector itself has been catching up in terms of labour productivity (although still at high productivity gaps), and it has been quite resilient when it came to employment and output dynamics. Its comparative advantages lie mostly in the availability of skilled, and still relatively cheap workers, as well as its geographical proximity to the German headquarters. It is, also, the largest economy of the region, which is reflected in its diversified industrial structure, and a relatively (on the CEE background) big role of domestic demand and domestic ownership in manufacturing sector.

Industrial structure in Poland is dominated by low- and middle-low tech industries, with very small shares of high-tech activities in employment and value added. The technology content is weak also in services, with relatively small shares of ICT and knowledge-intensive activities. Poland manufacturing production and exports is specialised in food, metals and minerals manufacturing, production of furniture. It is also present in most globalized value chains of automotives (though to a lower extent than other Visegrád countries), machinery and equipment, as well as pharmaceuticals. In recent years, exports of services have been growing dynamically, due to new FDI in logistics, transport, and various business services (shared-services centres). Most of export-oriented industries in Poland are dominated by multinational corporations, while Polish capital is organized mostly in small and medium enterprises, which perform functions of suppliers and subcontractors. Notable exceptions are visible in: food production (Maspex, diary cooperatives), clothing and footwear (LPP, CCC), pharmaceuticals (Polpharma, Adamed), chemistry (Synthos, Azoty), and ICT (CD Projekt, Asseco). After 2015 there were industrial policy attempts to stimulate the development of domestically owned exporters, and a broad innovation ecosystem. They have been, however, mostly futile, and inconsequent, and the dependence on foreign capital and value chains has actually even increased.

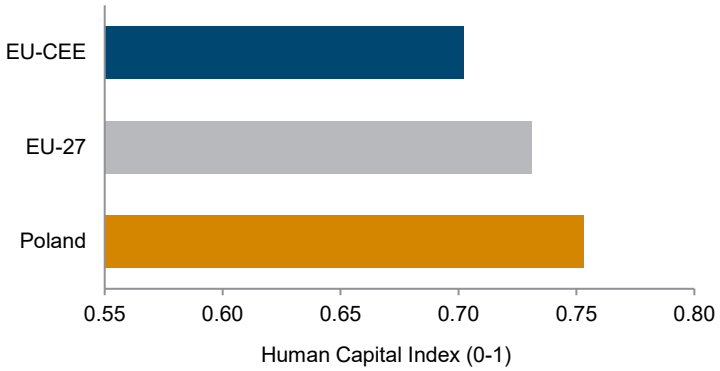
Polish manufacturing has considerable weaknesses, and it will face profound challenges to reduce its substantial productivity gap with respect to West European economies. Its competitiveness resides still mostly in low labour costs (further assured by currency undervaluation), and the availability of skilled workers. Functionally, it is specialised in production stages of manufacturing in most industries. Internal sources of non-cost competitiveness and innovativeness are restricted to few industries. R&D expenditure lies both below the EU average, and behind Czechia and Hungary. What is more, there is a significant gap between large firms and SMEs in important aspects such as R&D and productivity of employees.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Poland	0.14	17%	33%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Deep integration in global value chains, which facilitates productivity growth, technological spillovers and access to export markets. In recent years, it has moved beyond manufacturing towards business services

› Diversified industrial structure, and a strong domestic market, making it more resilient to global business cycle and diverse shocks

› Policy makers' awareness of the role of industrial policy, as reflected in the systemically growing government financed R&D spending, and the development of innovation ecosystem around the Polish Development Fund

Weaknesses

› High reliance on fossil fuels in energy supply, with import dependency and coal being of particular importance. By 2030 the share of coal-fired power generation will still be estimated to be around 37.5%.

› Low innovativeness of the business sector, with low R&D expenditures, small high-tech manufacturing and knowledge-intensive services.

› Digital and productivity gap between large (mostly foreign) companies, and domestically owned SME sector, which translates into the barriers for investment and competitive exports.

› Underfinanced public services, including education, science and health care systems

Opportunities

› Strategic focus on some future-oriented activities and technologies, like batteries for electric vehicles, drones, cloud computing and hydrogen utilization, might enable leapfrogging

› Upgrading towards high value-added, profitable niches in some of the already developed low-tech industries, e.g. food production, furniture, or chemicals.

› Development of innovation and entrepreneurial ecosystem in segments of ICT (gaming, big data, e-commerce, fin-techs).

› Automation and functional upgrading in business services sector, driven by accumulated skills and experience of Polish workers as well as the continuous wage pressures, in the condition of labour shortages

Threats

› Functional lock-in in labour-intensive, low-wage activities, facilitated by poor application of labour regulations and systemically weak trade unions

› On-going blockade on the inflow of strategically important RRF funds, due to political conflicts between the ruling party and the European Commission

› Carbon lock-in, slow energy transition and weak development of green industry, due to policymakers' scepticism of policymakers and the pressures of a strong carbon related industrial lobby

› Shortage of scientific and ICT specialists in the labour market hinders the potential of a more digital economy

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› Polish Investment Zone created in 2018 makes certain tax exemptions now available in the entire country and not restricted to regional special economic zones as before. This was undertaken to introduce more selective and strategic approach to incoming FDI, as well as to level-off the field for both foreign and domestic investors. In a similar way, the Act on Supporting New Investments of 10 May 2018 granted extra-support for greenfield investments in R&D centres in Poland. Despite some signs of this new strategic approach to foreign capital (perhaps best exemplified with the forward-looking invitation for LG batteries factory), the overall policy is still lenient and many investments in manufacturing reproduce low-tech, labour-intensive mode of production.

› Diverse agencies of the Polish Development Fund Group provide institutional support also for outgoing FDI and exports. Consolidation and reform of the Group, as a part of the Strategy for Responsible Development (SOR) after 2017, increased the scope and availability of instruments for foreign expansion, which span: export insurance schemes, export promotion and diplomacy, and direct subsidies to outgoing FDIs.

New technologies, digitalisation, innovation

› The SOR Strategy included profound reform of the National Innovation System, and its consolidation around the National Centre for Research and Development and the Polish Development Fund Group. In subsequent years institutional and financial support for innovations increased substantially, and it covers diverse stages of technology maturity, as well as companies of various sizes. SOR also prescribed a strategic focus on a number of key industries, either with already strong comparative advantage (e.g. food, furniture, trains, games), or promising ones (drones, small ships, medical instruments). However, only some of them can be perceived as policy success. Most were discontinued due to a lack of political or business support, while the whole industrial strategy evolved after 2020 towards more horizontal and liberal one.

› About 21% of the Recovery and Resilience Facility (RRF) is allocated to the digital transformation, including direct businesses support. However, Polish government remains (as of early 2023) in conflict with the European Commission, which means that necessary milestones for the disbursement of these funds remain unmet.

› Broad financial support for robotisation through tax deductions, grants, and subsidies. Most of these funds are, however, scattered, unstable or depend on the acceptance of the national Recovery and Resilience Facility plan. Now, the most important instrument is the Act on relief for robotization, which grants tax deductions for 50% of robotization-related costs.

Green transformation of industry

› Polish Hydrogen Strategy was prepared in 2021 to mobilize and integrate actions towards development of diverse hydrogen-based technologies and to introduce them in utilities, transportation, and industry. Industrial Development Agency has coordinated since then opening of 5 so-called hydrogen valleys, i.e. regional clusters that shall specialise in particular technologies, and integrate academic, business and political actors. Also, Poland participates in IPCEIs on hydrogen utilization.

› Support of electromobility has been of the priorities in Polish industrial policy since 2017. Its flag project is to develop a Polish commercial brand of electric vehicles (within a state-owned company Electromobility Poland). This faces, however, multiples obstacles and lags behind the schedule, while other initiatives have been more successful. It involves building a battery cluster around the LG factory, and a strong export sector of electric buses.

› Polish Development Fund runs a Green Hub, as a platform dedicated to support investment and innovation in renewable energy technologies. This is however a small exception, and energy transition is rarely perceived by the policy makers as vital for industrial competitiveness as well (beyond mere costs, and accessibility of energy). For instance, Polish plan for Recovery and Resilience Facility covers mostly funds for transition of energy infrastructure, and electric public transport, with marginal role for development of technologies themselves.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of the study, we identify Poland as one of the wealthier and more industrialised parts of the region, where the core focus should be on making the switch from imitation to innovation-driven growth. Policymakers should target the cultivation of a National Innovation System, wider participation in common EU projects, and investment in human capital. Specifically, we propose the following policy priorities:

› **Take a more assertive and strategic stance towards foreign direct investments.** Incoming FDIs have been a transformative force for Polish manufacturing, in its both positive and negative aspects. In most industries, it is foreign capital that drives production, technical change and exports, with domestically owned companies and labour force at peripheral and dependent positions. Arguably, some policies and institutions favour such mode of development. This could be changed by, most importantly, much more selective application of tax deduction and subsidies to incoming FDIs, to make sure that Poland is attracting investment from abroad that aligns with its specific needs and own industrial strategy (see policy recommendation 5.4 in the main report). Development of clusters and balanced linkages with Polish suppliers should be a precondition of such financial support. Also, strict application of labour regulations and protection of competition would facilitate wage growth, profit reinvestments (instead of remitting) and functional upgrading.

› **Push the SME sector beyond routine tasks, and towards higher positions in value chains.** Productivity and digital gap between SMEs and large companies is a major barrier on the way to a new growth model in Poland. The SME sector is relatively large and important for employment, yet it is far from technology frontier and is unable to sustain high rates of investment and innovation. Public policies should push the companies to build up on existing advantages, yet to abandon the dominant labour-intensive mode of production. In already strong low- and middle-tech sectors (food, furniture, chemicals), Poland could develop local, resilient value chains, which could be new leaders in niches of respective industries. The process should involve local authorities, academia, as well as IT sector to integrate digital technologies, following the guidelines of an entrepreneurial state (see policy recommendation 5.1 in the main report). On the other hand, current ITC ecosystem (in gaming, fintech, e-commerce, e-health or e-education) should be scaled-up and networked, with the funds of RRF.

› **Commit to an ambitious and broad energy transition.** So far energy transition in Poland has faced multiple obstacles and has been narrowed down to slow changes in energy infrastructures. In turn, Poland not only remains a major polluter in terms of CO_2 emissions, but also has ongoing problems with availability and costs of energy, while its sector of green technologies is underdeveloped. The greening of power generation and the parallel coal phase-out should be sped up, with regulatory and financial priority given to renewables. The Just Transition Fund should be utilized to build up on the human and economic potential of coal regions. New modes of production and technology development (including cooperatives) should be promoted for instance in thermal modernization, ecological construction, and electric public transport. The PFR Green Hub should be expanded towards further technology areas, based on the lessons learnt in hydrogen and batteries.

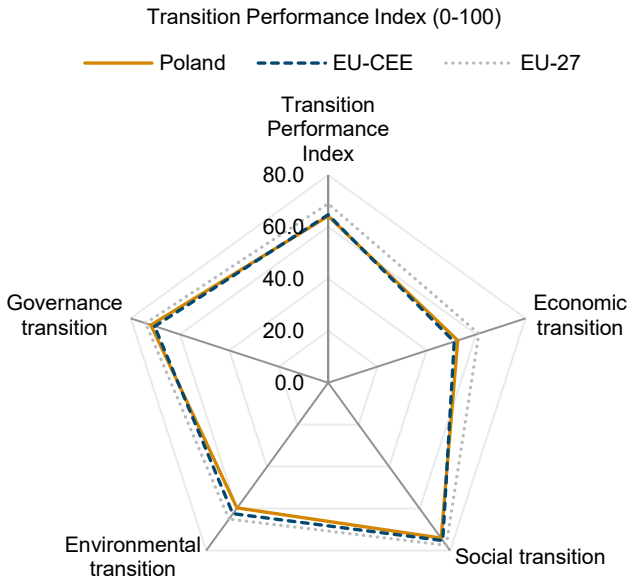
› **Invest in education, skills and science.** Human capital remains a major competitive advantage of Polish economy. However, this advantage may evaporate quickly, due to demographic decline and weaknesses of education sector. Labour shortages have been present already in recent years, and many investors, as well as public sector organizations, complain about the decreasing availability of highly skilled workers. Large public investments in education and science is a precondition towards sustained upgrading, in terms of industrial complexity, functions and tasks. Education and (re)training policies should be aligned with the current and future needs of the labour market, and address especially workers in industries and/or regions that will be negatively affected by the twin transitions, to prepare them for the needs of a greener, more digital economy (see policy recommendation 5.7 in the main report). Priority should be given towards education and life-long learning in engineering, IT and other competences, in line with long-term social and industrial goals.

Industrial development - II

Sector	% of manufacturing employment
Food products	15.2%
Fabricated metal products, excl. machinery and equipment	13.1%
Rubber and plastic products	7.9%
Motor vehicles, trailers and semi-trailers	7.5%
Furniture	7.2%
Machinery and equipment	5.2%
Other non-metallic mineral products	5.2%

Note: 2018 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Romania

COUNTRY PROFILE

Romania is the second poorest country in the EU, only ahead of Bulgaria, in terms of GDP per capita, but strong purchasing power puts it in a row with Slovakia and Hungary. Following a decade of fast economic growth, Romania was classified as a high-income country in 2020 by the World Bank and entered negotiations to join OECD in 2022.

The country has medium-high level of industrialisation with higher-than-average structural sophistication. The share of manufacturing has fallen below 16% of GDP in recent years on account of a fast expansion in wholesale and retail trade. Romania has joined the central European car industry hub by attracting FDI. Dacia, a subsidiary of Renault largely relies on domestic components and has been successful internationally among the low-cost brands. Several international car component producers are present with a wide range of products. The most important are the Mercedes-Benz subsidiaries Star Assembly and Star Transmission in Sebes, where the construction of a factory for electric engines is about to start. Romania has retained a number of traditional labour-intensive industries such as the production of apparel and furniture. The country has good potential for expanding food production and a tradition in the chemical industry. Labour productivity (gross value added per persons employed) in manufacturing is second lowest in the EU; there is no single manufacturing activity with a significantly better position.

Romania's main economic success story is the ICT sector. Despite the country's poor DESI index, high readiness for digital transition and increasing skills make Romania a growing digital outsourcing destination. A handful of start-ups have achieved international reputation with own products. The robotic process automation company UiPath is the first Romanian unicorn listed on the New York Stock Exchange after reaching a valuation of USD 1 bn.

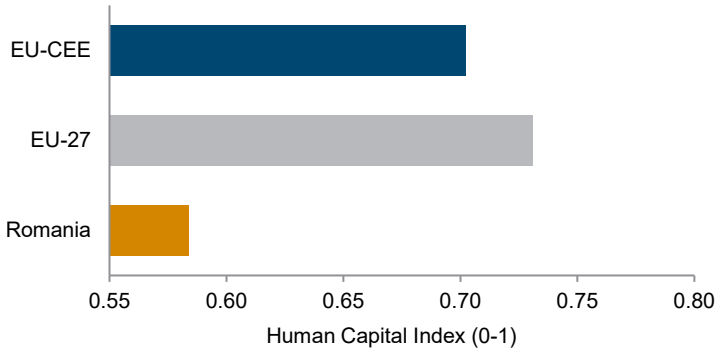
Large income and educational polarisation hinder industrial development. Romania has the lowest share of income held by the poorest quintile and one of the lowest employment rates and HCI index in the EU. An educated and digitally skilled urban middle class coexists with a traditional rural population not fit for matching modern industry's labour demand. The country is lagging most EU-CEE peers in terms of competitiveness, transition performance, especially as regards economic and social transition. But it is 10th best in the EU in terms of environmental transition following the shut-down of many of the polluting heavy industry plants built under communist rule. The governance indicator rank is close to average only because public finances are in relatively good shape. But the country has one of the highest corruption perception rates and is second worst in terms of voice and accountability in the EU.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Romania	0.09	18%	44%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› The diversified industrial base allows for producing a wide variety of products limiting dependence on volatile international supply chains.

› Energy security is provided by domestic oil and gas resources as well as abundant though irregular supply of hydro-energy which provides 36% of the generated electricity. Government grants based on EU funds have attracted large private investments in green transition including photovoltaic parks.

› There are numerous SMEs in the software industry, many of them internationally based. Low taxes attract specialists and reduce brain drain in the ICT sector.

Weaknesses

› Backward transport infrastructure is a bottleneck for just-on-time deliveries. The construction of the motorway network is behind schedule.

› Labour intensive and energy intensive industries have relatively high share in the manufacturing production. A large part of the labour force is tied in low value-added industries, has limited skills and gets inadequate training. The country has a relatively small share of digitally educated population.

› Romania has the lowest R&D expenditures in % of GDP in the EU. It has also the worst innovation index and DESI. Many of the past government development programmes were either ill-prepared or only partly implemented failing to bring improvement.

Opportunities

› Access to large EU funds in the amount of 5-7% of GDP annually helps to improve infrastructure and provides solid funding to digital and green transition. The country participates in related EU programmes which can spread knowledge and give financial support.

› Large number of internationally successful software firms can have spill-over effects to manufacturing companies. The ICT industry could grow faster if qualified labour would be more abundant.

› Climatic conditions are favourable for the further development of photovoltaic and wind parks.

› State ownership in a large part of the industry could enhance structural change and generate islands of modernisation.

Threats

› Shrinking population mainly on account of emigration combined with low participation rate limit the access to new labour force.

› Large social inequality and the backwardness of rural areas hinder the spread of digital and industrial skills and the education of a wider labour force.

› Administrative and institutional bottlenecks can hinder the access to EU funds. The tendering process is slow and cumbersome.

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› A liberal economic environment, low taxes and educated urban workforce have attracted export oriented FDI in manufacturing and services. The government sees its main reform task in enhancing competition and managing the access to EU funds.

› FDI and general investment policy priorities support technological change and R&D by tax allowances. Two state aid schemes are in place to support FDI with a total budget of EUR 1.5bn for the 2014-2023 period which is a rather small amount in comparison to the expected investment volumes. Aid is available to all investments in all sectors above a certain size of investment. Industrial parks offer ready-made infrastructure and locate most of the modern manufacturing projects.

› The Romanian state has one of the smallest budgets in % of GDP in the EU, thus it has limited own resources to finance industrial policy programmes. The role of the state is large in industry as the main energy sector companies and mines are state-owned. State ownership may enhance modernisation programmes, but the government is mainly engaged in inefficient cross-subsidisation.

New technologies, digitalization, innovation

› Romania is a policy taker of EU priorities to attract the available funding. Institutional capacities are overstrained by external requirements; no room remains for autonomous setting of goals. Nevertheless, EU programmes are adequate in size and content to raise competitiveness and improve living conditions. The country benefitted from EUR 35bn development financing under the 2014-2020 financial framework in which environmental protection and low carbon economy projects were supported with EUR 6bn. It will receive EU 31.5bn from the Cohesion Fund in 2021-2027.The country can also benefit EUR 29bn in grants and loans from the RRF over three years, of which 41% will support green transition and 20% the digital transition.

› The RRF Digital Transformation pillar provides about EUR 2bn for the development and improvement of e-government, governmental cloud and electronic ID cards. The National Strategy on Digital Agenda targets the development of ICT skills for citizens, labour force and digital experts. These programmes are expected to increase the efficiency of public administration.

› Multinational companies, especially in the automotive cluster are well integrated in national and international value chains. Development programmes can rely to a great extent on local suppliers and international suppliers from the neighbourhood.

› A recent industrial policy priority is military industry. New production facilities involve FDI or other forms of international cooperation to increase the capacity and modernize the production of weapons.

Green transformation of industry

› The greenhouse gas emission per capita is second lowest in the EU; it is in the mid-field in relation to GDP. EUR 6.75bn EU funds will be available for green transition under the 2021-2027 financial framework, for developing green energy, reduction of carbon emissions, environmental infrastructure, biodiversity conservation, green spaces, risk management and sustainable urban mobility measures. Companies will be invited to tenders to improve their processes and to supply inputs to public investment projects.

› Investments from the same funds is planned to improve the energy performance of residential and public buildings and to develop renewable energy sources and smart energy systems. Projects will reduce energy consumption, support the decarbonisation of the energy sector and generate demand for a wide range of products which domestic suppliers could deliver.

› The government’s recent short-term initiatives go partly against mid-term priorities. In response to the current energy crisis, they have declared to reactivate coal-fired power plants, earmarked substantial funds for gas infrastructure and gas-fired power plants and a law was passed to promote the production of fossil gas and crude oil.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of the study, we identify Romania as one of the least developed parts of EU-CEE, falling most notably behind the technological frontier. Therefore, policymakers should make it a priority to import knowledge and capabilities in a strategic and targeted way, and to identify promising areas for leapfrogging opportunities. Specifically, we propose the following policy priorities.

› **Increase institutional capacity and build government-industry-research-university linkages to coordinate industrial policy.** Cooperation and synergy effects could increase funding, improve targeting and coordination of R&D activities and the use of available knowledge (see policy recommendation 5.1 of the main report). Horizontal and vertical cooperation could increase the efficiency of public institutions, enable state entrepreneurship, and generate strategic programmes for economic modernisation.

› **Increase fiscal space to be able to finance a pro-active industrial policy, R&D activities and improve the efficiency of public spending.** Although low taxation is a competitive edge attracting FDI, investors need better infrastructure, higher qualified workforce and digital public services to bring more sophisticated technology into the country which can only be attained by public investments. This echoes the point we raised in the main report, that FDI policy ought to be a part of an overall industrial policy mix, and aligned with a national Innovation strategy (see policy recommendation 5.4).

› **Efficiency of spending should also be enhanced by increasing administrative capacity, improving decision-making processes and streamlining public administration.** Faster tendering and implementation of required reforms should accelerate the access EU funds. As the second poorest country of the EU-CEE, making use of all the available EU financial instruments is particularly vital (see policy recommendation 5.2 in the main report). Corporate governance of state-owned enterprises should improve to increase efficiency and meet long-term modernization goals.

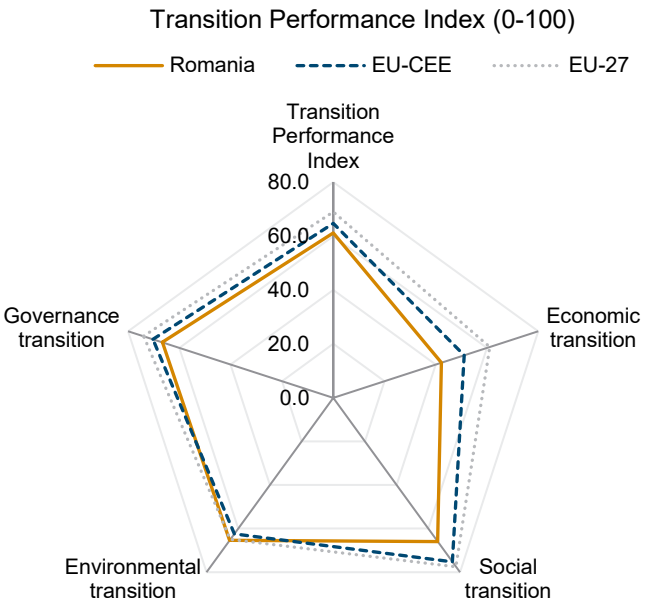
› **Improve education and skills on all levels of the education system to improve labour qualification and participation.** As emphasised in the main report, successful industrial policymaking considers distributional implications and balances growth with equality. In this sense, social equity should increase the mobility of rural labour force to mitigate urban labour shortages. Increasing labour market participation should be supported which, in turn, would mitigate poverty.

Industrial development - II

Sector	% of manufacturing employment
Motor vehicles, trailers and semi-trailers	15.7
Food products	13.3
Wearing apparel	10.4
Fabricated metal products, exc. machinery and equipment	7.4
Rubber and plastic products	5.5
Furniture	5.1

Note: 2018 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Slovakia

COUNTRY OVERVIEW

Slovakia is one of the most industrialized countries within the EU, with a manufacturing value added share of 18% of GDP. It's share of medium and high-tech sectors is also high above the EU-average, driven by foreign-owned production plants. However, Slovakia ranks below the EU-average in terms of the competitive industrial performance index, hinting at quality shortcomings and echoing the country's position in production networks as primarily an assembly hub.

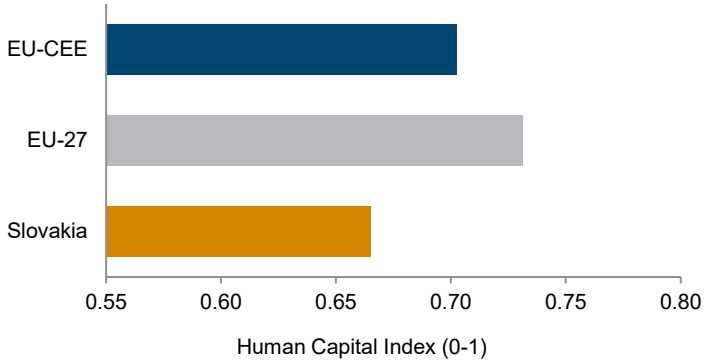
Similar to Czechia and Hungary, Slovakia has a highly undiversified industrial base, with the automotive and metal production sectors forming the core of economic activity in Slovakia: each accounting for 16% of manufacturing employment. Volkswagen Slovakia is the largest employer in the country, with a staff of 11500 persons in 2021 and together with other original equipment manufacturers (KIA Motors, Stellantis, Jaguar Land Rover) and car part suppliers (Mobis, Faurecia, SAS Automotive) it forms the core of automotive employment. US. Steel Košice is the second largest company with a staff of 8500 persons. Inward FDI is also advancing the green transition, and Slovakia recently attracted numerous foreign investments related to electric vehicle production. Nonetheless, large productivity gaps remain between MNEs and domestic firms, pointing to the fact that spillover generation represents a major challenge for Slovakia. Still, building on its comparative advantage in the automotive sector, there are some domestic efforts to upgrade into related green technologies: three Slovak companies participate in the IPCEI European Battery Innovation, and one in the IPCEI hydrogen value chain (IPCEI HY2Use). A project by the RONA company aims to apply hydrogen in industry. The Slovak battery firm InoBat Auto is setting up an EV battery R&D centre with a pilot production line in Voderady The Slovak Battery Alliance was modelled after the European Battery Alliance and formed in October 2018. It aims to foster closer cooperation between universities, industrial and public sectors. In June 2021, the government adopted the National Hydrogen Strategy, also modelled after the European Hydrogen Strategy. The action plan included investment opportunities and will include all stages, from transport, distribution and storage to use in industrial and transport technologies (e.g, hydrogen bus and sports car presented at Expo 2020 in Dubai). Another promising sector in Slovakia is the IT sector, with clusters in Bratislava, Košice and Žilina. There are numerous innovative companies that emerged from Slovakia, including the domestic success story Eset, a global IT security provider, or Sensoneo, a smart waste-management firm. However, many promising start-ups end up being transferred to foreign ownership at a relatively early stage, including Slido (acquired by Cisco), or Minit, a leader in data mining (acquired by Microsoft), pointing to issues in the availability of financing to expand and maintain high-growth firms.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Slovakia	0.12	18%	53%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Deep integration in global value chains and a well-developed industrial base represents the main strength of the country, which continues to attract foreign investors into the country. Soon, there will be five automakers with an extensive network of suppliers, making Slovakia the largest per-capita passenger car producer in the world.

› Emerging IT clusters in parts of the country, augmented by FDI in business services, are opening up a promising diversification route for the economy, and attracting highly educated workers from home and abroad.

Weaknesses

› Slovakia lags behind its Visegrád peers in the area of innovation. This is repeatedly visible from various EU-wide rankings and comparisons: it has one of the lowest BERD per GDP in general, and scores badly in the ECO-Innovation Scoreboard in particular. The lagging human capital quality further limits innovation potential. Slovakia also ranks on the lower end of the DESI-Indicator in (23rd out of 27 countries). In terms of the share of SMEs reaching at least basic levels of digital intensity, the country scores especially badly, hinting at a large digital divide between large enterprises and SMEs.

› There are wide regional disparities within the country, which require a targeted and distinct industrial strategy. However, the lagging regions often lack the technical and institutional capacities to effectively identify and formulate suitable Smart Specialisation Strategies, and struggle to absorb available EU financing.

Opportunities

› About 43% of the Recovery and Resilience Fund (RRF) are allocated to green transition in Slovakia, which is much higher than in other EU-CEEs and might pose an opportunity for faster transition. The so-far smooth progress with the RRF milestones and disbursements contributes positively to the opportunities tied to this source of financing.

› While R&D is typically located at headquarters of large automakers, some car part suppliers have established R&D centres in Slovakia. For example, in August 2021, the German Hella company, producing automotive lighting, opened a new development centre in Slovakia. It cited putting production and research under one roof as an advantage for minimizing time for transportation and miscommunication. Such functional upgrading ought to be incentivized more widely to move from production to more sophisticated activities of the value chain.

Threats

› The large and undiversified industrial sector poses a large challenge in the green transition, given the high greenhouse gas intensity and high energy intensity of the economy. Combined with the very high dependence on Russian energy imports, the availability of cost-competitive and clean energy can become a limiting factor in the country's industrial competitiveness going forward.

› Battery production is an important step of transition towards electric vehicle production. However, no battery gigafactory is currently located in the country, thus Slovakia lags behind Hungary and Poland in this respect.

› There is a large brain drain to the more developed neighbouring countries, especially to Austria and Czechia. This is exacerbated by the lagging quality of higher educational institutions, leading to outward migration of talent at a young age. This reality not only exacerbates existing labour shortages, but also limits the possibility to upgrade into an innovation-based economic model.

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› Investment aid is primarily aimed at reducing regional disparities (aid intensities depend on the GDP per capita of the respective region), though in reality, attracting FDI into the least developed regions presents a major challenge. A tax allowance is the preferred from of investment aid. Supported areas include industrial production, technology centres, shared service centres, combined project of industrial production and technology centre.

› There are also some efforts to target higher-value added activities, including the Research and Development Super deduction, whereby companies located in Slovakia can deduct additional 100% of their R&D costs from their corporate income tax base; or the Patent box, a special tax regime for intellectual property rights-related income. The effectiveness of incentivising such investments is not clear as it tends to lack evaluation, and production-oriented projects continue to dominate greenfield FDI.

New technologies, digitalisation, innovation

› About 21% of the Recovery and Resilience Fund (RRF) are allocated to the digital transition, including direct support to firms and the adoption of a 'voucher' system to boost innovation. An investment of around €102 million plans to help address the digital divide by aiding firms digitalise their business processes and providing trainings through a network of digital innovation hubs. In addition, investments intend to support domestic development of a supercomputer, as well as encourage participation in other cross-border EU projects, whereby Slovakia is presently underrepresented.

› A new 'Action Plan for the Digital Transformation of Slovakia for the years 2023-2026' was approved at the end of 2022. The action plan (which is a part of the RRF milestones) presents measures to

improve Slovakia's digital performance, building on the 2030 digital transformation strategy for Slovakia, as well as on the current 2019-2022 action plan. These overlapping documents intend to support the integration of innovative technologies in enterprises, including cloud and edge computing, HPC, blockchain and AI.

› The Implementation Plan of the Research and Innovation Strategy for Smart Specialisation of the Slovak Republic adopted in 2017 focuses on five smart specialisation areas: vehicles for the 21st century, industry for the 21st century, digital Slovakia and creative industry, population health and medical technology, and healthy food and environment.

Green transformation of industry

› About 43% of the Recovery and Resilience Fund (RRF) are allocated to green transition, which represents a high share by EU standards. Investment of around €368 million go into the decarbonisation of industry and will spur energy efficiency improvements and deployment of innovative technologies. Part of financing into sustainable transport will support the roll-out of around 3000 charging stations for alternative fuels.

› Following the European Battery Alliance, the Slovak Battery Alliance was created in October 2019, with the aim to be more active in European battery value chains. The alliance is a platform for deepening cooperation across different stakeholders, which has been traditionally absent in Slovakia.

› In October 2019, the Circular Slovakia platform supporting responsible entrepreneurship based on the principles of a circular economy was launched. Likewise, Envirostretégia 2030, Strategy of the Environmental Policy of the Slovak Republic 2030 approved in 2019 has the underlying vision is to achieve a sustainable and circular economy, paired with rigorous environmental protection, minimal use of non-renewable resources and hazardous substances.

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of the study, we identify Slovakia as one of the most industrialised countries of the region, but as one falling somewhat behind the most developed EU-CEE peers in its innovation potential. Therefore, we suggested that the core focus ought to be on leveraging the wide presence of MNEs to create deeper linkages with the domestic economy, as well as on diversifying the sectoral and functional structure. Specifically, we propose the following policy priorities.

› **Cultivate a 'network state' by improving the efficiency of governmental institutions and facilitating the collaboration between public institutions and the academia and private sector.** Better coordination across different ministerial units will ensure the alignment of individual industrial policies with overall socio-economic objectives, and remove the inefficiency arising from often overlapping strategic priorities and documents (see policy recommendation 5.1 in the main report). Likewise, better developed networks and collaboration channels with major stakeholders will allow policies to be closely aligned to the specific needs of the market and increase the potential for domestic firms to receive the support they need.

› **Given major regional disparities across the country, recognising and addressing the starkly different industrial policy needs across regions is crucial.** While the most developed parts of the country may be facing the challenge of making the transition from imitation to innovation, lagging regions are first and foremost in need of upgrading their basic infrastructure, improving human capital quality and attracting FDI to link up to GVCs. The setup of regional investment promotion agencies, as seen in Czechia (see Box 4 of the main report) presents a useful example of a tailored subnational industrial policy. Overall, a national industrial strategy needs to be sensitive to these differences and ensure responsiveness to the distributional implications of adopted policies (see policy recommendation 5.7 of the main report).

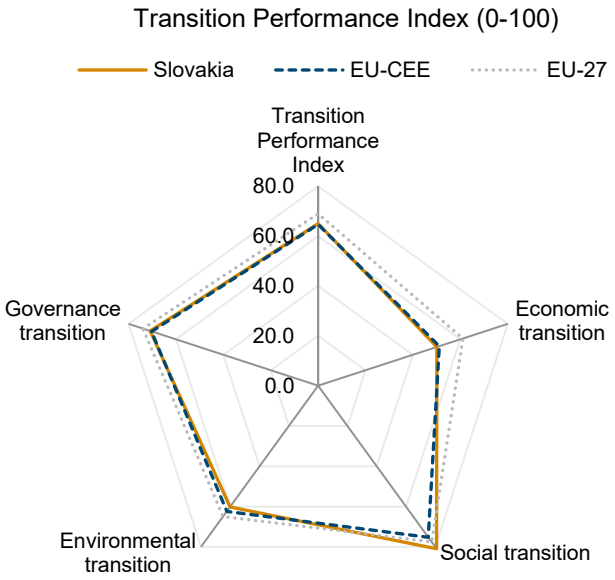
› **Improve the provision of public services, especially in the area of education to close the quality gap in human capital, mitigate brain drain, and acquire talent from abroad.** As emphasised in policy recommendation 5.3 of the main report, learning from regional leaders is crucial. In this sense, identifying the major gaps between Slovakia and the most developed countries of the EU-CEE provides a road map of the priority areas that the country needs to improve upon. With students and workers often moving for better education and working conditions to neighbouring Czechia (and other parts of Europe), poor quality of public services is a major 'push' factor for many who choose to emigrate. The shortcomings in the human capital dimension are also reflected in the low position of Slovakia in various rankings. The RRF funds will provide a valuable opportunity to tackle this challenge, as they also focus on the availability, modernisation and quality of inclusive education, and the improvement of universities' performance.

Industrial development - II

Sector	% of manufacturing employment
Motor vehicles, trailers and semi-trailers	15.7%
Fabricated metal products, excl. machinery and equipment	15.7%
Machinery and equipment	9.0%
Food products	7.4%
Rubber and plastic products	7.1%
Electrical equipment	7.0%

Note: 2018 values of Persons employed.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

Slovenia

COUNTRY PROFILE

Slovenia's transition to an export-oriented market economy is widely seen as a success, accompanied by solid institutional development and a solid industrial base, which have led to a level of economic development on par, and in some categories exceeding, that of Czechia. Slovenia's manufacturing industry plays a prominent role in the national GDP, surpassing the average share of manufacturing as % of GDP of EU-CEE countries by 5 p.p. Industrial production is also comparatively more diversified, with only basic metals and pharmaceuticals exceeding 10% of value added in the total share of manufacturing, and the production of metals and electrical equipment accounting for the largest share of the workforce. Along with the business conglomerate Mercator, Slovenian pharmaceutical firms Krka and Lek (owned by Sandoz, Novartis) are the are the largest employers in the country .

Slovenia is merely average in terms of industrial competitiveness and the total share of high-tech products in manufacturing's value added when compared to the EU-CEE average. Other EU-CEE countries have been catching-up in terms of purchasing power (although most are still well behind), which can be interpreted as a sign that Slovenia has largely maximised its existing industrial base and has been slow to respond to the opportunities brought by the green and digital transformation. Underinvestment in the private sector, low levels of inward FDI compared to other EU-CEE countries and lingering government ownership in non-strategic sectors, such as tourism, hinder industrial upgrading.

A feature with progressive importance to Slovenia's prospect of overcoming the functional specialisation trap are specialised SMEs, well integrated in global value chains, producing products, such as a car parts, machinery or tools that reach high value added due to innovation, quality and engineering expertise. There are also emerging initiatives to reorient the automotive sector towards electric vehicles (produced in the largest automotive employer, Revoz, owned by Renault) and hydrogen, though larger initiatives to decarbonise the industry are so far absent– a fact supported by zero IPCEIs granted to Slovenia. Slovenia's key strength is its quality of human capital, which even exceeds the EU-average.

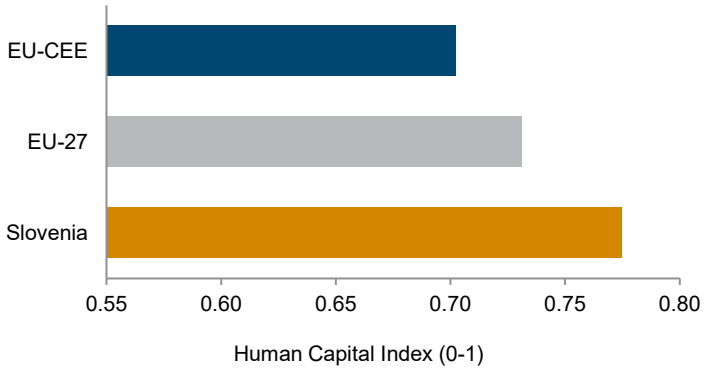
Due to relatively higher wages, Slovenia can no longer compete against other EU-CEE countries in labour costs, thus, Slovenia must focus on innovation, high-tech industries and build on positive signals, such as the growing public investment in R&D as a share of GDP, a solid share of enterprises that have undergone the first step digitalisation and build a supportive business environment for successful SMEs with potential to upgrade their positions in global value chains, and gradually turn from suppliers to outward investors.

Industrial development - I

	Competitive industrial performance index	Manufacturing value added (MVA) (% of GDP)	Medium- and high-tech MVA (% of total MVA)
Slovenia	0.11	22%	37%
EU27	0.14	15%	41%
EU-CEE	0.10	17%	38%

Note: 2020 values. The CIP index assesses the strength and complexity of an economy's industry, with Germany claiming the maximum score in 2020 at 0.42.
Source: UNIDO

Human capital quality



Note: A Human Capital Index of 0.75 means a child born today will be expected to be 75 percent as productive at the age of 18 as they would against a scenario of having enjoyed complete education and full health.
Source: World Bank

INDUSTRIAL COMPETITIVENESS – SWOT

Strengths

› Quality of human capital is the highest among EU-CEE and the labour force is characterized by good knowledge of foreign languages

› Solid engineering base in diverse industries, marked by well-performing manufacturers specialised in high-value added niche products, for example in the automotive industry (Kolektor), space technology (Dewesoft), aeronautics (Pipistrel)

› After years of falling behind, Slovenia has since 2019 increased its share of public investment in R&D above 2% of GDP (currently leading EU-CEE), gained spots in the European Innovation Index (EIS) and has improved its digitalisation performance, especially in the public sector

Weaknesses

› Political divisions and the only recently reversed trend of democratic backsliding lead to mistrust in the government's ability to carry out ambitious development programs, while small size of the country equals in over-representation of particular interests, thus hindering the opportunity to promote state entrepreneurship

› Low share of FDI as % of GDP in comparison to other EU-CEE countries driven by the relative difficulty in attracting FDI, due to higher wages and an overall less accommodating business environment

› Undeveloped venture capital market leaves start-ups with few option for financing, which can prompt emerging start-ups to move abroad after the initial growth phase

Opportunities

› High indicators of life quality (including safety, education and healthcare) and proximity of nature make Slovenia an attractive destination for skilled labour force

› The largest car factory Revoz has already partially oriented production towards small EVs, the existing know-how can be leveraged in the green transition

› Embeddedness in global value chains can act as a push factor for greening manufacturing since partners and headquarter companies are often the first to demand ESG strategies, disclosure of non-financial information, etc.; this can already be observed among automotive suppliers

› Large volumes of available biomass and a slowly emerging wood industry represent a major opportunity to develop niche applications for biomass in energy, construction, etc.

Threats

› No consensus on future energy production which may lead to prolonged use of coal in the high-emitting thermoelectric plant Šoštanj, increased energy imports dependency and higher prices for the industry compared to other EU-CEE countries

› Ageing domestic workforce and lack of lower-skilled workers, showcased by the high share of surveyed Slovenian companies who see labour shortage as a critical issue (70%) – this share is highest in Europe. Solving the situation will require more inward migration, however, the current migration policy is restrictive

› A small number of energy intensive companies that produce 2,5% of GDP uses one sixth of all energy needs of Slovenia; the energy transition could hamper their competitiveness further and could lead to job losses

› The pharmaceutical industry is partially tied to the Russian market where pharmaceutical company Krka owns a manufacturing subsidiary; the full effect of sanctions and deteriorating relationships is yet unclear

INDUSTRIAL POLICIES AND STRUCTURAL REFORM DEVELOPMENTS

FDI promotion and value chain upgrading

› Law on promoting investments, implemented in 2018, allows for smaller subsidies (via public calls) and case-based larger public participation in projects featuring foreign capital. Public support is meant to incentivize digital and green development and research and innovation and may not be given to certain low-tech sectors (such as steel, mining, energy, etc.). No distinction is made between domestic and foreign investments.

› The national Smart Specialisation Strategy (S4, and in draft version, S5) promotes value chain upgrading through developing R&I networks based on thematic areas, promoted within the Strategic Development and Innovation Partnerships (SRIP), including partnerships for developing ‘Smart factories’ and ‘Smart materials’., which have been introduced with varying levels of success.

New technologies and digitalisation

› The Strategy of Digital Transformation and the national Industrial Policy 2021-2030 set KPIs and outline key strategic directions for the digitalisation of the industry, namely the support for digital transformation of companies (products, processes and sales) and introduction of Industry 4.0 concepts and technologies, such as AI, robotics and the internet of things

› The Recovery and Resilience Plan (RPP) outlines reforms for the digitalisation of the economy based on the above-mentioned tenets of the national Industrial Policy and allocates funding for a public call for supporting the digital transformation of companies (EUR 44 m) and co-financing RRI projects related to digitalisation (EUR 20 m); however, both programs are small compared to total of available grant funds in the RPP (EUR 1.800 m)

Green transformation of industry

› Green development is described as one of the primary strategic directions of the Slovenian Industrial Policy 2021-2030 and connected to national energy and climate goals by accelerating the transformation of industry, with few concrete steps outlined in the document

› The Recovery and Resilience Plan allocates 30% of funds for the green transition, mainly to energy efficiency and circular economy, however, the total extent of direct support for the industry is small, only EUR 5 m allocated for energy efficiency projects for companies and EUR 5 m allocated to projects for accelerating the transition to the circular economy (which will only partially fund companies)

› The national Climate Change Fund, fully funded by the income from the ETS is currently not transparent, inefficient and does not enable the funding of transformational projects to green the economy; changes to the programme are expected in 2023

COUNTRY-SPECIFIC RECOMMENDATIONS

In the main part of the study, we identify Slovenia as one of the wealthiest and more industrialised parts of the region, where the core focus should be on making the switch from imitation to innovation-driven growth. Policymakers should target the cultivation of a National Innovation System, wider participation in common EU projects, and investment in human capital. Specifically, we propose the following policy priorities.

› **Upgrade the support ecosystem for innovative SMEs with high potential for growth and upgraded positions in global value chains.** Focus on fast-growing companies that operate in high-tech sectors or manufacture complex and innovative products. Accelerate their potential for scaling-up of production and R&D activities by improving the business environment, lowering the tax burden on skilled workforce and leverage the state’s potential to provide funding. There are multiple promising niches emerging in Slovenia as shown in this briefing, and the expansion from SMEs to large companies ought to be

enabled through better access to funding (see policy recommendation 5.5 of the main report, where we highlight the importance of identifying successful niches). Explore the options for strategic entrepreneurship of the state in fast-growing companies to reduce risk for private investors.

› **Reorient FDI policy towards attracting investments that allow for ascension in global value chains.** Build on stories of successful cooperation for the promotion of greenfield investments (such as the robot manufacturer Yaskawa) and offer incentives conditional on the establishment of business functions with higher levels of added-value global value chains (such as R&D centres). Build on a solid reputation of institutional quality, quality of life and healthy living environment, proximity to large population centres to attract the establishment of various higher-level functions, such as R&D, design or regional headquarters. Such actions shall require better coordination between ministries responsible topics, such as investment policy and labour policy, as laid out in the policy recommendation 5.4 of the main report.

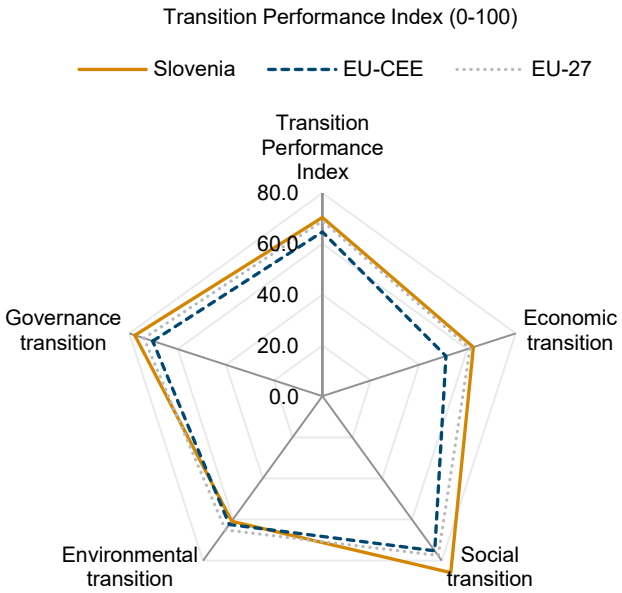
› **Capitalise on the green transition. Slovenia's economy is small enough to allow for dealing with specific issues on a case-by-case basis.** Certain companies, such as steel producer SIJ are already using best-in-class technologies and are introducing circular economy principles to production. Active industrial policy should promote deeper engagement with companies in order to design roadmaps that will allow energy-intensive industries to fully decarbonise without succumbing to various transition risks. This goes in line with the entrepreneurial approach we defined in the main report, whereby the state forms a collaborative network with key ministries, academia, business agencies and the private sector. Furthermore, the national climate change fund should be used to fund support schemes, such as Carbon Contracts for Difference and technical assistance for developing complex projects that can compete for funding from programs, such as the EU Innovation Fund. In parallel, build on Slovenia's solid performance in the Eco-Innovation index (best among EU-CEE) to support niche companies offering green products or various higher-end applications developed from biomass.

Industrial development - II

Sector	% of manufacturing employment
Fabricated metal products, except machinery and equipment	16.3
Electrical equipment	10.7
Rubber and plastic products	7.8
Food products	7.7
Motor vehicles, trailers and semi-trailers	7.4
Machinery and equipment n.e.c.	7.2

Note: 2018 values.
Source: Eurostat Structural Business Statistics.

Transition performance scorecard



Note: 2020 values. The TPI scores countries based on 4 pillars of a transition to a more sustainable, inclusive and resilient economy.
Source: European Commission

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Appendix

Appendix Table 1 / European Innovation Scoreboard for EU-CEE countries in 2022

	Moderate				Emerging						
	EE	SI	CZ	LT	HU	HR	SK	PL	LV	BG	RO
0 Summary Innovation Index	**110**	**103**	**102**	**92**	**77**	**73**	**71**	**66**	**56**	**50**	**36**
1.1 Human resources	**111**	**127**	**69**	**101**	**41**	**49**	**65**	**49**	**68**	**30**	**17**
1.1.1 New doctorate graduates	66	77	89	43	31	43	66	20	20	31	20
1.1.2 Population with tertiary education	112	141	61	200	49	66	90	96	126	54	0
1.1.3 Population involved in lifelong learning	184	190	44	74	46	37	33	40	76	0	34
1.2 Attractive research systems	**139**	**121**	**92**	**59**	**88**	**55**	**61**	**47**	**48**	**31**	**40**
1.2.1 International scientific co-publications	243	227	155	108	80	111	105	60	87	42	36
1.2.2 Scientific publications among the top 10% most cited	83	73	43	50	58	34	38	43	22	18	49
1.2.3 Foreign doctorate students as a % of all doctorate students	163	126	140	36	162	46	69	45	70	49	22
1.3 Digitalisation	**95**	**95**	**83**	**114**	**79**	**82**	**75**	**92**	**85**	**52**	**95**
1.3.1 Broadband penetration	82	115	76	139	76	45	73	106	79	82	161
1.3.2 Individuals with above basic overall digital skills	109	73	91	86	82	123	77	77	91	18	23
2.1 Finance and support	**113**	**79**	**105**	**92**	**97**	**82**	**47**	**73**	**46**	**28**	**36**
2.1.1 R&D expenditure in the public sector	106	71	105	77	40	85	48	65	58	24	11
2.1.2 Venture capital expenditures	201	31	125	182	116	149	64	72	68	54	94
2.1.3 Direct and indirect government support of business R&D	30	140	83	21	153	7	28	84	6	5	9
2.2 Firm investments	**109**	**70**	**109**	**92**	**79**	**47**	**65**	**66**	**29**	**41**	**14**
2.2.1 R&D expenditure in the business sector	72	118	90	39	91	43	34	64	13	41	18
2.2.2 Non-R&D innovation expenditures	143	27	161	174	90	64	101	84	58	64	14
2.2.3 Innovation expenditures per person employed	109	66	75	62	57	33	57	50	16	17	11
2.3 Use of information technologies	**127**	**126**	**118**	**65**	**74**	**90**	**83**	**72**	**75**	**36**	**13**
2.3.1 Enterprises providing ICT training	81	138	131	63	75	119	75	88	81	19	13
2.3.2 Employed ICT specialists	177	114	105	68	73	59	91	55	68	55	14
3.1 Innovators	**133**	**162**	**193**	**159**	**69**	**177**	**59**	**58**	**55**	**78**	**6**
3.1.1 SMEs introducing product innovations	117	171	173	146	87	169	54	55	52	100	13
3.1.2 SMEs introducing business process innovations	151	154	215	172	50	186	64	61	58	55	0
3.2 Linkages	**221**	**192**	**124**	**191**	**130**	**150**	**68**	**100**	**102**	**47**	**10**
3.2.1 Innovative SMEs collaborating with others	196	145	162	160	105	135	75	65	58	72	0
3.2.2 Public-private co-publications	273	370	180	98	159	195	113	74	139	48	53
3.2.3 Job-to-job mobility of HRST	221	156	68	259	138	144	41	141	124	24	0
3.3 Intellectual assets	**114**	**73**	**59**	**65**	**49**	**41**	**50**	**79**	**64**	**70**	**31**
3.3.1 PCT patent applications	58	63	41	35	61	37	36	36	46	34	21
3.3.2 Trademark applications	211	128	95	142	76	73	89	101	115	128	65
3.3.3 Design applications	105	45	55	44	16	20	37	115	48	68	16
4.1 Employment impacts	**157**	**116**	**115**	**109**	**64**	**82**	**59**	**53**	**51**	**60**	**9**
4.1.1 Employment in knowledge-intensive activities	113	135	96	83	92	53	66	56	68	62	18
4.1.2 Employment in innovative enterprises	196	99	132	133	38	108	52	51	37	57	0
4.2 Sales impacts	**74**	**91**	**108**	**57**	**94**	**63**	**108**	**73**	**59**	**67**	**77**
4.2.1 Exports of medium and high technology products	59	116	128	63	130	55	134	87	44	57	103
4.2.2 Knowledge-intensive services exports	94	55	75	17	82	33	63	69	83	86	80
4.2.3 Sales of new-to-market and new-to-firm innovations	72	101	120	95	62	107	125	59	50	59	40
4.3 Environmental sustainability	**34**	**80**	**101**	**82**	**72**	**58**	**96**	**46**	**28**	**55**	**47**
4.3.1 Resource productivity	20	108	97	52	71	91	88	56	60	14	9
4.3.2 Air emissions by fine particulates	37	88	122	120	100	75	111	54	0	54	67
4.3.3 Environment-related technologies	40	52	80	59	40	17	83	29	40	84	48

Source: European Commission, Eurostat.

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