Techno-Economic Transformation in Eastern Europe and the former Soviet Union – A Neo-Schumpeterian Perspective

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Abstract

This essay is an interpretative survey that explores the post-socialist transformation in Eastern Europe and the former Soviet Union (EE&fSU) from a neo-Schumpeterian perspective. It argues that we cannot understand the challenges of technological upgrading of the post-socialist region if we only adopt the lens of what can be termed transition economics. Instead, the post-socialist transformation is an open-ended process whose outcomes can be better understood as a disequilibriating evolutionary process involving the misalignment of different levels and parts of innovation systems. We develop a multi-level analytical framework and outline several major transformation processes involving dynamic interactive capabilities as the core precondition for technology catching up. Technology accumulation and innovation systems are hybrid systems whose dynamism rests on various governing principles. The swing from one pure mode of coordination (plan) to other (market) explains limited technological upgrading in both periods. Dynamic innovation systems are quintessentially hybrid systems. Crucial to this is an understanding of the role which the state plays, both as a contributor and as an obstacle to the transformation towards sustainable economic growth.

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1. Introduction

From the several concerns that particularly interested Chris Freeman, we have chosen to focus on two. First, his belief that technical change rests on governance regimes which are hybrid that is, simultaneously public and private. Second, his recognition that technological change is also a social and a political process.

Based on these two tenets of Freman's work, this essay explores and interprets socialist and post-socialist transformation in Eastern Europe and the former Soviet Union economies (EE&fSU), from a neo-Schumpeterian perspective.[1] The issue continues to be dominated by the economic theory of markets with institutional change measured using the EBRD's 'progress in transition' metrics. These metrics address progress in privatisation, price liberalisation, competition, the trade and foreign exchange regimes, banking reform, interest rate liberalisation and infrastructure deregulation. The ultimate benchmark is the 'open market economy', which, in 2017 was characterised as 'competitive, well-governed, green, inclusive, resilient, and integrated' (EBRD, 2017:7). Therefore, the 'economics of transition' is mainly about markets where organisations are passive players in a resource allocation game.[2] In contrast, we explore and interpret the collapse of socialism and its replacement by an 'open market economy' regime from a neo-Schumpeterian perspective.

Like Schumpeter, Freeman recognised the central role of technical change in economic growth and adopted an evolutionary perspective on economic development (Nelson and Winter, 1982). However, he departed from Schumpeter by embracing the crucial role of institutions, individual and political choices, and the historical context to explain the differential impacts of technological change internationally (Freeman and Louca, 2002).

We use a neo-Schumpeterian lens to explore four dimensions of EE&fSU transformation, based on the following arguments. First, whilst post-socialist transformation is a process of

[1] The former socialist world, which we describe as Eastern Europe and the former Soviet Union (EE&fSU), today is a multilayered Euro-Asian region of 29 economies that includes central European (Czechia, Croatia, Hungary, Poland, Slovakia, Slovenia), Baltic states (Estonia, Latvia, Lithuania) and south-eastern Europe (Albania, Bosnia and Herzegovina, Bulgaria, North Macedonia, Kosovo, Montenegro, Romania, Serbia), Eastern Europe (Belarus, Moldova, Russia, and Ukraine) and the Caucasus (Armenia, Azerbaijan, Georgia), and Central Asia (Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan). We also use the term Central-Eastern Europe (CEE) which refers to Central European, Baltic and south-eastern European economies.

[2] For a critique of this view see Moran and Ghoshal, 1999 and Simon, 1991

institutional change towards the dominant role of markets, it is also simultaneously a process requiring a major change in the role of the enterprises as carriers of capabilities and the source of innovation. Their transformation from production to business units not only involved a change in ownership, that is corporate governance, but also the transformation of their techno-economic profile. By contrast, from a transition economics perspective, this essential dimension of transformation was secondary to the primacy of ownership change.

Second, the key feature of dynamic innovation systems (IS) are 'interactive dynamic capabilities' emerging in the interaction of firms with their R&D networks and with foreign sources of technology and market access. In the post-socialist period, these interactions were weak. Their relationships were either with weak organisational capabilities (firms), unreformed (R&D organisations) or external actors (notable Foreign Direct investment, FDI). Improved efficiency in any one of these nodes which is not complemented by synergies and complementarities between nodes of the innovation ecosystems cannot deliver sustained income and economic growth.

Third, a dynamic national innovation system (NIS) rests on complementarities and synergies operating between different subsystems, notably (firms, universities, industrial institutes, infrastructure, financial systems, vocational training, etc). Before transition, EE&fSU systems were fragmented systems with significant gaps. Sudden confrontation with open markets led to a shift from 'domestic led' to dominantly 'foreign-led' technological modernisation. However, neither of these modes led to catch up, which occurs only if reliance on foreign sources of knowledge is complemented by local technology accumulation and the growth of interactive dynamic capabilities.

Finally, technology accumulation and innovation systems are hybrid systems. There is no 'one best way' and therefore the paths to sustained growth is contextual and cannot be preordained.

Underlying these issues is the range of countries and regional response patterns involved. The diversity of the shifts towards an open market economy, the degree to which technology accumulation is domestic or foreign-led and the different roles of the state in shaping IS have resulted in a rich mix of transition paths. They include neo-liberalism, the 'embedded liberalism' of Baltic states and central Europe respectively (Bohle & Greskovits,

2012) and different forms of 'super-presidential authoritarianisms' (Spechler, 2008) in the fSU. In one essay, it is not possible to go into the specificity of technology accumulation paths of each of 29 countries. Hence, our analysis will remain at the macro regional level distinguishing most often between CEE and the fSU but also sometimes pointing to differences within these groups. The option of focussing only on the part of the post-socialist world would undermine the generalisability of our arguments.

Section 2 presents the multi-level analytical framework underpinning our analysis. Sections 3, 4 and 5 explore firm-, network- and NIS- levels of the post-socialist transformation. Section 6 summarises the overall argument. We conclude with some general lessons based on the EE&fSU experience. Before we consider these issues, it is helpful to briefly define each of the major concepts which are used in the discussion:

In considering the NIS we follow Freeman (1987:1) which defined it as 'the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies'. We use the notion of systems of innovation in its meanings as both sectoral and technological systems as defined by Malerba (2002) and Carlsson, and Stankiewicz (1991) respectively. Malerba (2002) focuses on interactions among firms in the sector where products are developed and manufactured, generating and utilizing the technologies of that sector. Carlsson, and Stankiewicz (1991) focus on a network of interacting agents involved in the generation, diffusion, and utilisation of technology, and often not confined on specific sector.

Finally, we recognise the significant role of individual firms as network organisers and as coordinators but also as subordinate participants in innovation value chain activities. The notion of innovation ecosystem captures some of these meso level interdependencies though there is no consensus on its definition. For our purposes the recent definition of Grandstrand and Holgersson (2020) which define it as 'the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors' (p.1) meets the purpose. There are clearly overlaps among three definitions but also differences in the focus – sector, technology or firm in its network. This explains why we consider this meso level of analysis as one analytical layer.

Methodologically this essay should be considered an interpretative survey. It combines what in research methodology is defined as integrative and argumentative reviews[3]. The integrative review aims to summarise past literature to provide a more comprehensive understanding of a particular phenomenon. In contrast, argumentative reviews selectively examine literature to support or refute an argument in the literature. In this essay, we aim to provide a comprehensive understanding of the post-socialist transformation from a specific - neo-Schumpeterian – perspective and develop a framework and argument that differs from the mainstream economics of transition perspective on the post-socialist transformation.

2. Innovation systems as an indispensable ingredient of alternative growth theory: a conceptual perspective

Technical change and the institutions that promote it play a central role in the forging ahead and catching-up process. Thus, an IS approach can be considered an indispensable ingredient of alternative growth theory (Freeman, 2002; Gilpin, 2001:132). Our analysis of the EE&fSU techno-economic transformation rests on the three components depicted in Table 1 which also indicates where these issues are considered in subsequent sections of this essay.

Table 1: Analytical framework

Level	**Focus**	**Processes**
Firm	Capabilities and Corporate Governance	Reconstitution of enterprises from production to business units (Section 2)
Systems of innovation and innovation ecosystems	Dynamic Interactive Capabilities	Erosion and restructuring of R&D systems (Section 3.1)

[3] https://research-methodology.net/research-methodology/types-literature-review/

		Internationalisation of innovation systems (Section 3.2)
National Innovation System	(Mis)alignment of subsystems	Fragmented (dual) national innovation systems: processes (Section 4.1) State control of technological modernisation process (Section 4.2.)

Note: Numbers in brackets refer to sections of the essay

First, the framework's micro base comprises firms that are both carriers of organisational capabilities and governance arenas (Aistleitner et al , 2020; Dosi et al., 2000). From this perspective, corporate governance is closely linked to capability accumulation, and through the legal and broader institutional system, firms are inextricably linked to their broader environment (Deakin et al, 2017; Lazonick, 2002, 2003). They represent 'the original, most important point of permeable contact between state and society' (Seleny, 2006: 130). In the context of the EE&fSU this is an essential point. The pattern of privatisation and the overall institutional transformation have strongly shaped the nature of firms in the post-socialist period (see Section 2).

Second**,** the notion that connects micro with macro levels of our analytical framework is the concept of 'interactive dynamic capabilities' (von Tunzelmann and Wang, 2003; 2007). The notion is centred on the idea that capabilities are never isolated to individual firms but are generated in interactive and dynamic processes in sectoral (Malerba, 1992) and regional innovation systems (Cooke et al, 1997), including interactions with foreign actors. We follow von Tunzelmann and Wang (2007: 127) who define the dynamic interactive capabilities of firms as 'the extent to which the changes in their capabilities influence or are influenced by the changes in the capabilities of consumers and/or suppliers, all in real time'.

A system that is conducive to various learning mechanisms is likely to generate more technology upgrading activities and is more likely to generate long-term growth. As Chandler (1990, 1993) shows, central to dynamic interactive capabilities are firms' organisational capabilities which are inseparable from external networks and the social conditions in which the enterprise operates (Lazonick, 2002,2003). In the context of the EE&fSU, links between firms and external source of R&D in the NIS as well as links between firms and foreign technology markets are the two most relevant aspects of dynamic interactive capabilities. We explore this in Sections 4.1 and 4.2.

Third, a successful national IS (or NIS) emerges through the interactions among different subsystems (Freeman, 2002). What matters for growth are the complementarities between the business sector, education and skills formation, science, finance, corporate governance, foreign trade systems, culture, etc. How these subsystems have evolved and whether they are aligned are essential for understanding growth from an IS perspective. The central tendency is not towards an equilibrium but the disequilibriating (mis)match among different subsystems.

In the context of the EE&fSU, we point to different aspects of fragmentation of the NIS, which lay behind mismatches. We also address the State, an actor which is rarely treated in the NIS literature.[4] Yet, in the context of the EE&fSU, the State is a crucial actor shaping modes of technological modernisation strongly. We explore these issues in Sections 4.1 and 4.2.

The three levels of our analytical framework do not operate in isolation from each other. Our approach is inspired by the philosophical framework of systemism, which sees a role for both agency and structure (Bunge, 2000). Actors in innovation systems are always relationally embedded, and different analytical levels are mutually interconnected through various bridging mechanisms (Gräbner & Kapeller, 2015; Aistleitner et al., 2020). Given the scale and scope of our analysis which aims to generalise based on the long period and many countries, we cannot present country-specific details of bridging mechanisms between different levels.

[4] We agree with Vertova (2014) that the State in the NIS literature enters only indirectly as an 'institution' whose task is to supply the key elements of dynamic innovation system and is rarely explicitly discussed. State policies are frequently considered but the literature on innovation systems does not engage with different theories of the State.

Nevertheless, we do present some of these mechanisms as they are discernible in increased differentiation of paths of technological modernisation between CEE and the fSU countries.

3. Reconstitution of enterprises and production networks

The socialist enterprise (in its different variants) can be described as a production unit with 'dislocated' business functions. In its orthodox (Soviet) form, foreign trade organisations were responsible for marketing, finance ministries for finance, planning ministries for strategy, R&D was distributed in branch institutes. Thus, the Soviet enterprise comprised units operating within a country-wide superstructure (Yudanov, 1997); its open-ended nature is well captured by the label 'USSR Inc.' (Hanson, 2003). The degree to which socialist enterprises were production rather than business units differed across the CEE vs fSU economies as well as over time.[5] However, in all cases the dispersed 'business' functions across a hierarchy resulted in weak firm-specific organisational capabilities. Attempts to enhance these capabilities, through horizontal associations and different forms of *kombinats*, were important micro institutional innovations but were not enough to overcome the disadvantages of the centrally planned system (Chandler, 1993). Understanding the critical challenge of post-socialist transformation – the reconstitution of enterprises from production to business units – requires recognition of this legacy of weak firm-level organisational capabilities.

The new owners of these enterprises had to construct and manage new links, both within and outside their enterprises. The enormity of this task differed, depending on the extent to which enterprises in different EE&fSU countries were production or business units, and how much the uncertainties and modes of privatisation in the institutional environment favoured the formation of organisational capabilities. For example, Kutlaca and Radosevic (1998, 1999) show significant differences between the socialist and early post-socialist periods in the extent to which enterprises were involved in knowledge generation (measured by the patenting in the US). The more orthodox the system, the lower the share of enterprises and

[5] For further details see Radosevic (1999b)

the higher the share of industrial institutes, government (ministries) or academies of sciences involved in patenting (ibid 1999).

Large scale privatisations and the sudden exposure of enterprises to international competition led to privatisation of the most viable firms (Mergele et al., 2020) and at the same time resulted in the destruction of firms that, had they had time to adjust, would have been viable (Kogut and Zander, 2000). Large socialist conglomerates were dismantled and transformed into unrelated small and medium-sized enterprises (SMEs) with no technical or market infrastructure to rely on.[6]

This situation was aggravated by privatisations and the character of corporatisation which operated at the lowest industrial hierarchy level, the production unit (for example in Russia). Since these units could not function as self-contained business units in the new market-oriented environment, this led to the rise of business groups. The business group gathered under one administrative structure business functions such as financing, marketing, materials procurement and R&D, which, formerly, had been spread across the country-wide economic hierarchy (see Adachi, 2010 for a study of several such groups). An exceptional case was the Russian Gazprom; the whole administrative structure of the gas industry was consolidated into one enterprise, which ensured the stability of supply of this critical resource. In Poland, among 40 socialist era foreign trade organisations, seven became conglomerates, based on control of several individual enterprises. This enabled the enhancement of organisational capabilities, including links to foreign markets (Jaworski and Radosevic, 2006).

By the end of the early transition period (1995 onwards), many institutional factors that had driven conglomeration in central Europe (though not elsewhere) no longer existed.[7] The advantages enjoyed by large business groups, such as easier access to financial capital, had disappeared. However, in the fSU, business groups (financial-industrial groups) continued to play an important role, similar to other emerging economies (Guriev and Rachinsky, 2005; Peck, 2004; Morck et al., 2005; Khanna and Yishay Yafeh, 2007).

[6] For evidence on electronics conglomerates, see Radosevic (2004b;2004c)
[7] For a difference in views see Stark, 1996 and Hanley et al, 2002)

Despite these differences in the role of business groups, the common legacy of weak firm-level organisational capabilities has remained. As a result, EE&fSU firms are weak in the production of complex products (i.e., requiring complex networks of suppliers). The dismantling of socialist production networks was especially devastating for the fSU economies where what was formerly a supra-national system was broken into country-specific subsectors. This led to the abrupt dismantling of linkages among very distant parts of what had become independent states that could not be re-established.

Domestic firms in central Europe, which received significant FDI inflows, continued to operate as production units but under a Multinational Corporation (MNC) umbrella. Rozeik (2011: 249) shows that, in the automotive industry, 'although there has been much restructuring, companies' mandates have not actually changed since 1989 and … there was little functional upgrading. Companies have moved from being truncated production units to captive subsidiaries under MNC control'. (ibid: 249)

In a nutshell, the central transformation process at a micro level was the reconstitution of enterprises. The extent to which enterprises were production or business units and differences in their corporate governance strongly determined whether they became agents of the innovation process. Organisational learning was limited, with no opportunity to strategically integrate the various enterprise functions and activities. During the early transition period, the advantages provided by educated populations were not exploited; lack of organisational capabilities hampered the profitable employment of skilled people.

4. Building static isolated or dynamic interactive capabilities

Dynamic interactive capabilities are the crucial property of a dynamic IS. In this Section, we explore the extent to which socialist and post-socialist IS developed this feature of dynamic IS. We consider two major networking issues: domestic R&D networks (4.1.) and internationalisation of innovation systems (4.2).

4.1. Erosion and restructuring of the R&D system

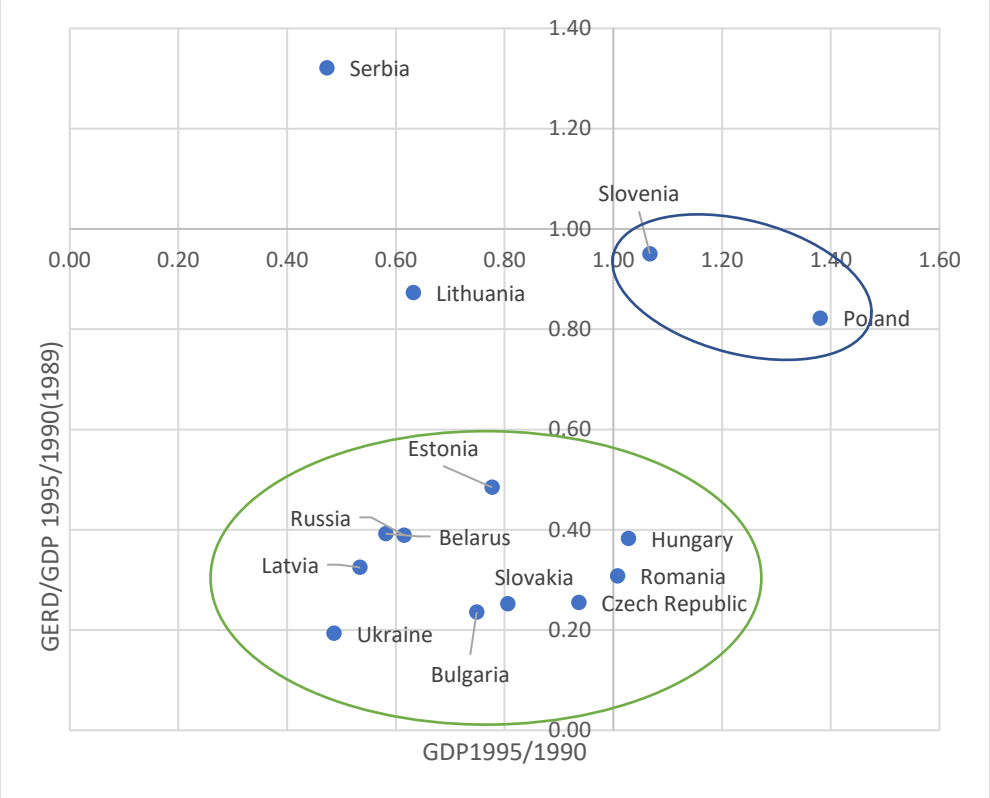
The crucial weakness of the socialist economy IS was the failure to develop R&D at the enterprise level (Freeman, 2004; Hanson and Pavitt, 1987; Amman and Cooper, 1982). Innovation processes and technological activities were spread across industrial institutes, academies of sciences, enterprises and to a very limited extent in MNCs. Equally, in the post-socialist period, enterprise growth cannot be understood only as a management and intra-firm problem. It is also linked to the features of the national and local environments.

The collapse of the IS, driven by a sharp fall in GDP resulted in the collapse of the R&D system, both within and outside enterprises. It was a consequence of a sharp decline in demand for local R&D from the domestic business sector and the collapse of public funding for R&D. In none of the economies for which comparable data are available, was there simultaneous GDP and GERD/GDP recovery (upper right quadrant, Figure 1) while the majority experienced simultaneous decline (lower left quadrant, Figure 1). GDP fell by an average of 21%, while the share of Gross Expenditures on R&D (GERD) in GDP, fell from 2.1% to 0.8%, or by 40% (Figure 1). By 1995, central Europe GDP had recovered, but the decline in the GERD/GDP ratio ranged from 75% (Czech R and Slovakia) to 18% (Poland). The worst-hit areas were the fSU republics. For example, in the Ukraine GDP fell by 51% and GERD/GDP by 81%. In real terms, this meant that the R&D system was dysfunctional and had entered 'survival mode' and was submerged in a range of survival strategies.

The shock was not only cyclical (collapse of R&D demand due to collapse of GDP). It was also structural. The collapse was compounded by the sudden opening of the economy in which demand for import-substitution-types of technological activities disappeared. The closed nature of socialist economies before 1989 - not confined only to military R&D expenditure - explains their very high share of R&D expenditure. The abrupt opening of these economies undermined the need for 'behind the border' technology activity. This was the case for most CEE economies and much less for the fSU economies, many of which continued with import substitution regimes. For example, this explains the increase in Serbia's GERD/GDP ratio despite a GDP collapse of 53% after it was subject to international sanctions between 1992-1995. A ban on importing equipment resulted in increased expenditure on 'reinventing the

wheel' technological efforts (see Radosevic, 1999a; Kutlaca, 1999). It is notable that Slovenia, the most open economy in the sample during the socialist period, experienced the smallest (5%) fall in its GERD/GDP ratio.

Figure 1: Collapse of the R&D system and changes in GDP 1995-1990(1989) in EE&fSU (1990=1)



Source: Data on R&D from Meske (2004, Table 19.1). GDP from the EBRD database

Note: A comparable data for the period until 1996 are not available for the remaining fSU and the ex-Yugoslav republics

The most significant changes occurred in industrial institutes, which were extramural organisations serving industry enterprises. In the market economy, these 'industry commons' organisations require a combination of public-private funding and joint involvement of enterprises and public stakeholders. However, under the radical marketisation of the economy, these organisations came under enormous threat for several reasons. First, in the

dire market conditions of the early transition, enterprises as the major stakeholders in these institutes, could not sustain or integrate their costs. Second, public funding prioritised those parts of the R&D system suffering market failure (basic research organisations) but did not support organisations with links to the industrial policy arena. As a result, they were treated like other enterprises and were subject to privatisation (Czech Republic), or were closed (Baltics), or were gradually eroded and converted into commercial R&D organisations depending on policy willingness to support their survival (Romania, fSU). In fSU economies, they have nominally been preserved but given the significant decline in external demand for RTD services and deprived of resources for restructuring, they have undergone substantial erosion.

The networks of Academy of Sciences institutes with the Academy as its manager have remained in the downsized form in the majority of the EE&fSU. However, their autonomy and role as the 'quasi Ministry' for science has been significantly reduced. In several Baltic states, Academies have been transformed into learned societies, and their institutes have been merged into the university research system or transformed into public research organisations.

The only sector where all EE&fSU countries experienced gradual growth was university R&D. During the socialist era, with the exception of a few countries, this sector was focused mainly on teaching. However, teaching income and gradual internationalisation of the R&D system led to improved scientific excellence in several CEE economies. The differences in that respect, between the CEE EU members and the fSU countries have become significant.[8]

Common to the overall transformation of public R&D systems in the EE&fSU is that through increased competition (peer review) they have become more internally open and, to varying degrees, improved in scientific excellence (Dyker and Radosevic, 2000). However, this led to an increased trade-off between improved scientific excellence and reduced local industry relevance (Radosevic and Lepori, 2009).

[8] See for example the rankings at https://www.webometrics.info/en/Ranking_Europe/Central_Eastern_Europe

Table 2 presents R&D system institutional models in EE&fSU, based on dominant sectors, performers and funders measured by the number of years over 1996-2018 period when a particular institutional model was dominant. In only two cases (Slovenia and Czechia) does the business sector dominate both financing and performance. In all other economies, the government is the most important funder and R&D is performed by business enterprises, universities or government (public research organisations). We observe that countries, where non-business sectors dominate (models C-E), tend to have lower income and lower GERD/GDP ratios on average.

These data show that the institutional structure has remained relatively unchanged despite 23 years of transformation, economic growth and recovery. This remarkable structural inertia shows that demand for R&D does not emerge automatically with economic recovery and growth. Demand for R&D is 'derived demand' and not a simple reflection of product demand (von Tunzelmann, 1995). It primarily reflects weak in-house business sector R&D capabilities. As a result of weak Business Economic Sector R&D, EE&fSU R&D systems continue to be externalised; enterprises have not integrated previous external R&D capacities (Radosevic, 1999b, c). The only notable change has been the increasing role of foreign (notably EU) funding, which, in several CEE countries has been used to substitute rather than to complement domestic funding.

Table 2: Institutional models of R&D in 1996-2018 period based on the dominance of R&D performing and funding sectors

(Percentages correspond to the proportion of number of years when the institutional mode is dominant)

	Model A	Model B	Model C	Model D	Model E	Model F	Model G	Model H	Model I	
				Central and eastern Europe						
		Business enterprise sector driven in performing and funding								Number of years for which data are available
Slovenia	**100%**									22
Czechia	**78%**	22%								23
		Business enterprise sector focused and government funded								
Slovakia	**48%**	**48%**			4%					23
Hungary	**45%**	**55%**								22
Croatia	21%	**79%**								19
Romania	27%	**50%**		23%						22
		Government funded and university/business sector/government focused								
Estonia	20%	**40%**	**40%**							20
Poland	9%	**43%**	13%	**30%**		4%				23
Latvia	9%	14%	**41%**	9%	23%				5%	22
Serbia		25%	**75%**							12
Lithuania		6%	**72%**	11%	11%					18
		Government driven in performing and funding								
Bulgaria	14%	**5%**		**59%**		23%				22
				Former USSR						
		Business enterprise sector focused and government funded								
Russia		**100%**								23
Ukraine	6%	**94%**								17
Belarus	18%	**77%**		5%						17
Kazakhstan	26%	21%	5%	26%			21%			19
Kyrgyzstan	14%	21%		**64%**						14
		Government driven in performing and funding								
Armenia				**100%**						19
Azerbijan				**100%**						18
Tajikistan				**100%**						17
Uzbekistan				**100%**						7
		University focused and government/university funded								
Georgia			**50%**					**50%**		2

Source: Calculated based on UNESCO UIS database

Note: Highlighted boxes indicate the dominant model proxied by the proportion of years

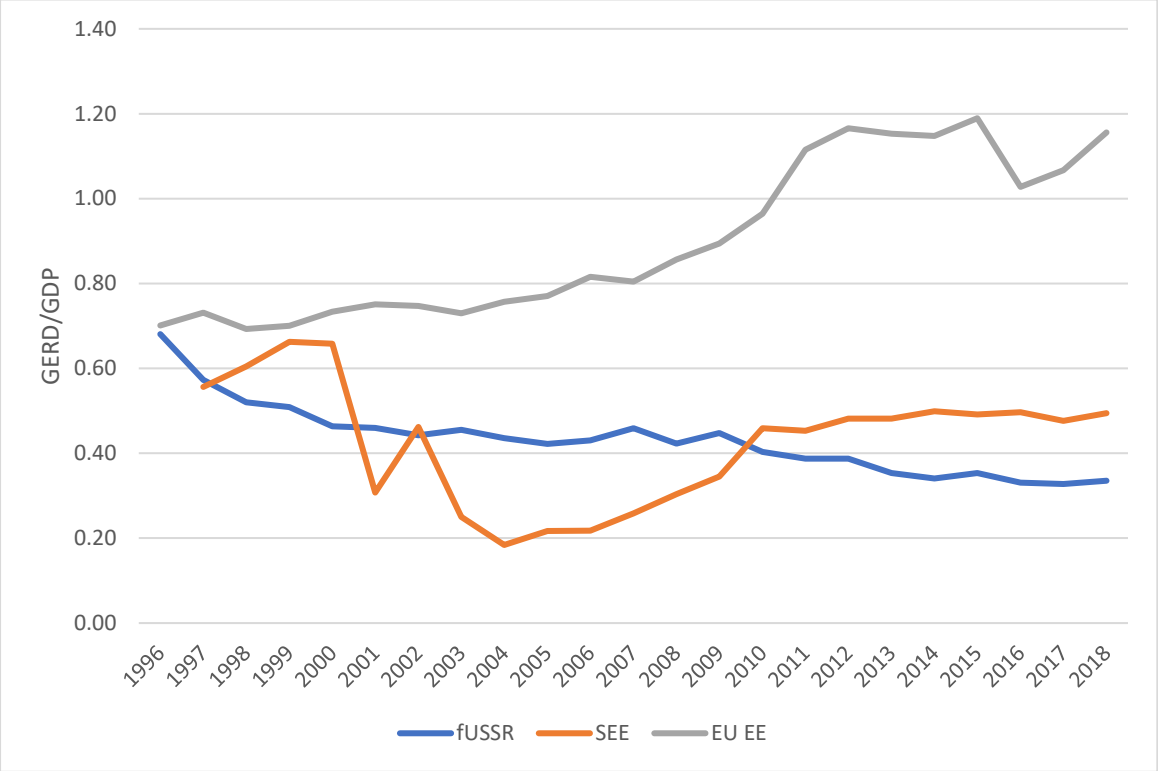
Explanations:

Model	Dominant performing and dominant funding sectors
A	Business enterprise sector dominates in performing and funding R&D
B	Business Enterprise sector dominates in performing and government sector in funding R&D
C	Higher education sector dominates in performing and government sector in funding R&D
D	Government sector dominates in performing and funding R&D
E	Higher education sector dominates in performing and foreign source in funding R&D
F	Business enterprise sector dominates in performing and foreign sources in funding
G	Government sector dominates in performing and business enterprise sector in funding R&D
H	Higher education sector dominates in performing and funding R&D
I	Higher education sector dominates in performing and business enterprise sector in funding R&D

There seems to be a growing divergence between the increasingly Europeanized R&D systems being established in the new CEE member states, and the post-Soviet R&D systems. This difference is driven by the funding boost provided by the EU Structural Funds and the greater opportunities for internationalisation of EU members' R&D systems (Figure 2). By contrast,

R&D investments in the fSU economies have declined due to R&D policy, their resource-based nature and sizeable 'de-manufacturing'.

Figure 2: GERD in GDP for the E.U. countries from Eastern Europe, countries of sSU and South-East Europe, 1995-2018 (simple average)



Source: UNESCO UIS database

Note: South-Eastern Europe countries here are Serbia, N. Macedonia, and Bosnia & Herzegovina

4.2. Internationalisation of innovation systems

Building dynamic interactive capabilities in socialist economies was hindered not only by the external (extramural) sources of their R&D but also by the limited access to advanced technologies. This latter factor led to excessive imitative technology development. The high levels of domestic (residents) patenting in all socialist economies were indicative of the dominance of behind-the-technology frontier activities, which declined significantly after

1990 as countries opened up to foreign technology inflows (Lacasa et al, 2017, figure 2). Patenting activity (except in Slovenia) has been reduced further despite rapid economic growth between 1999 and 2008 (ibid).

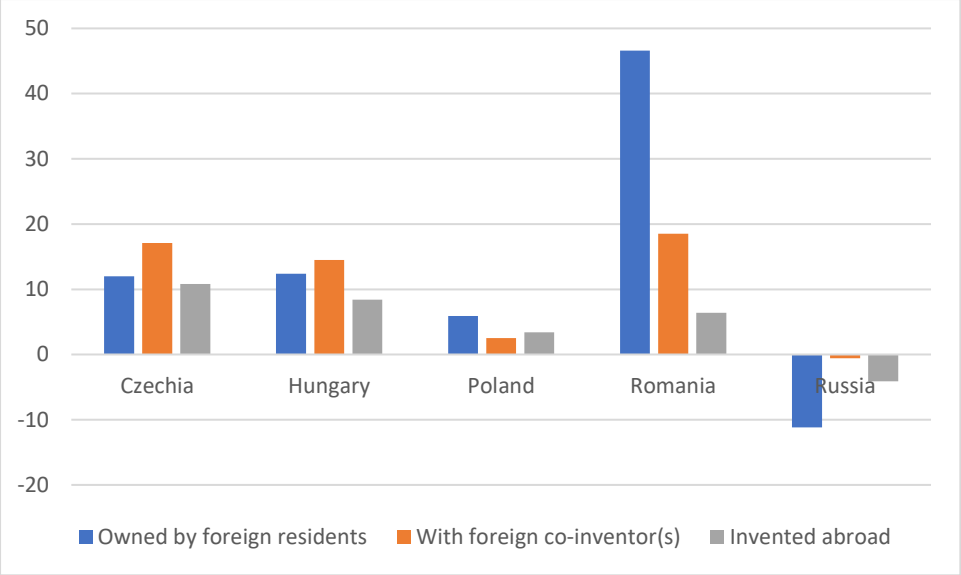
There is an increasing gap between central Europe and Baltics, where local innovation activity has declined, and Russia where increased patenting activity reflects domestic-led technological modernisation and behind-the-technology frontier inventive activities. The persistent lack of recovery of patenting in central Europe is based on the greater openness of these economies to foreign knowledge and technology and high FDI dependence.

By contrast, substantially increased patenting per GDP in Russia reflects its extensive behind technological frontier patenting activities. However, Russian frontier inventions (proxied by the US patents) are being commercialised increasingly by foreigners rather than Russian firms. In the socialist period, just 1% of Russian inventions were patented by foreigners; between 2000 and 2004, this reached 83% (Porter and Ketels, 2008). These figures suggest weak organisational capabilities in domestic firms to commercialise the results of domestic inventive activity.

Overall, the technological activities of the CEE countries have become highly internationalised and more dominated by foreign residents. Figure 3 shows the shift in the four biggest patentor countries from the CEE towards foreign ownership or co-inventions with foreign applicants.[9] A strong shift towards applications of patents invented abroad reflects their low relative share. The internationalisation of patenting in CEE is accompanied by intense integration of their science systems through increased co-authored publications (Makkonen and Mitze, 2016). In that context, again, the pattern is strikingly different for Russia, which shows a relative decline in all three types of 'knowledge exchange' (see Figure 3).

Figure 3: Changes in the share of patents (2018-1999) (in % points)

[9] Patterns are similar in other small economies which we do not report for space reason



Source: OECD REGPat Database https://stats.oecd.org/#

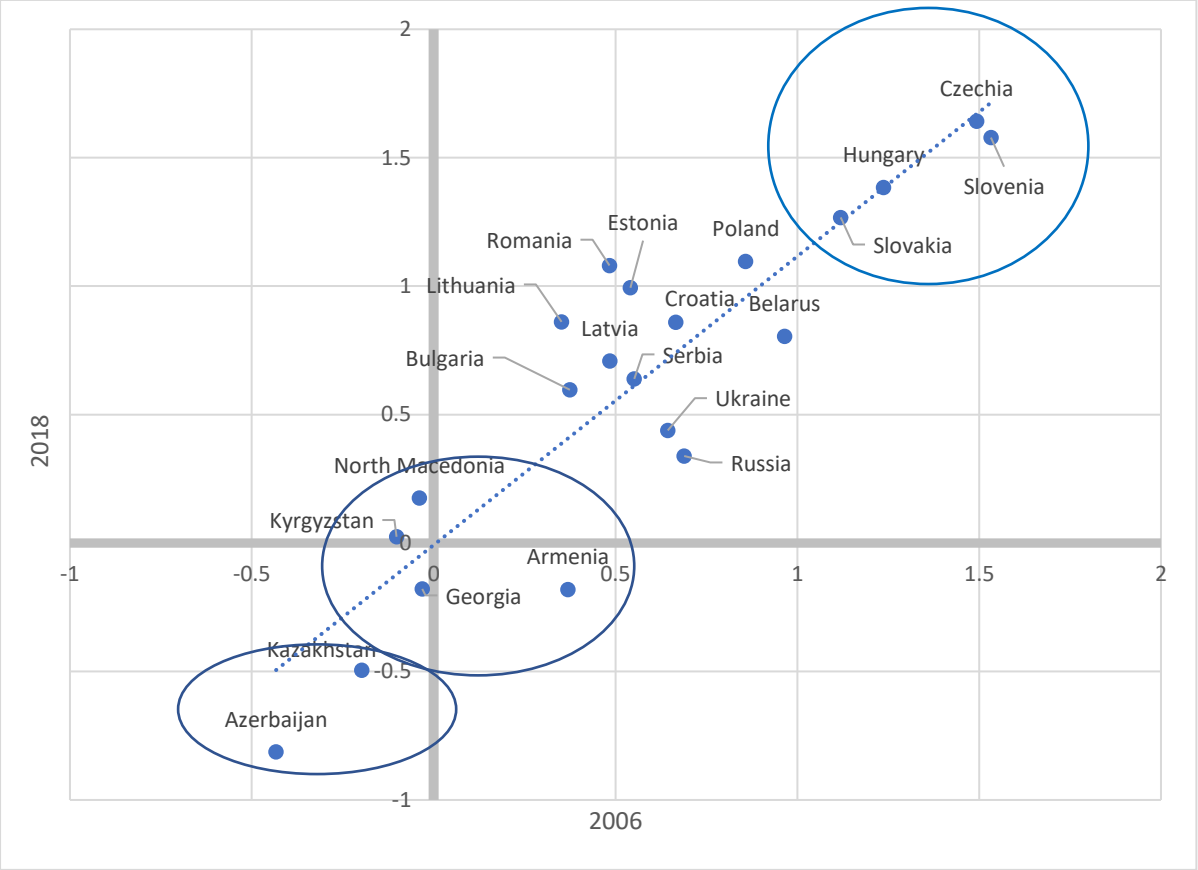
The internationalisation of innovation systems was equally intensive on the 'downstream' side, especially in the CEE economies. On the downstream side, FDI and trade are channels of tangible and intangible knowledge transfer but related more to the use of knowledge. A large stream of econometric research on the effects of FDI, though mainly in the CEE, examines the direct and indirect (spillovers) impact and shows that direct effects dominate (for example, Damijan et al., 2013). Spillovers are limited and context-dependent (Hanousek et al., 2011,; Bruno and Cipolina, 2017; Iwasaki and Tokunaga, 2014, 2016). These meta-analyses have confirmed Holland et al.'s (2000: 209) conclusion from 20 years ago: 'FDI inflows have improved the overall growth potential of the recipient economies, but primarily through productivity improvements within the foreign affiliates themselves, rather than through increased capital investment, or technology spillovers to domestic firms'. Sectoral evidence suggests that the lack of positive spillovers may be due to a lack of alignment or complementarity between domestic and foreign technological activities (McGowan et al., 2004). From the perspective of dynamic interactive capabilities, FDI has been essential in generating export and employment. Still, the lack of complementary endogenous technological capabilities has limited the transformative potential that characterises dynamic catching up economies.

On the positive side, FDI and insertion into Global Value Chains (GVCs) have been essential restructuring mechanisms for the electronics and automotive sectors. Their impact has been particularly relevant for central European countries, which, together with Germany and Austria, from what has come to be termed the central European manufacturing cluster (IMF, 2013, Comotti et al., 2020). This has led to a 'win-win' situation where the relocation of jobs to the East has not led to losses in Germany or Austria (Marin, 2011). However, this story of successful industrial integration of Central Europe has led to the de-industrialisation of other CEE economies that are not part of the German supply chain (Stollinger, 2016). Also, the successful industrial integration of Central Europe contrast sharply with very patchy integration of the fSU economies which is concentrated in resource based industries (gas, oil, gold, diamonds, etc) and some buyer driven production chains (clothing) (World Bank, 2005b).

The contentious issue is to what extent the internationalisation of CEE economies and attraction of FDI have been matched by a domestic upgrading process (Comotti et al., 2020; Stollinger, 2016; Darvas, 2020). Export product complexity is a new indicator, which provides information on this dimension of technological transformation. Figure 4 compares EE&fSU economies based on export product complexity, between 2006 and 2018. We can identify three clusters: core central European (Czech, Slovenia, Hungary and Slovakia); natural resources-poor (North Macedonia, Georgia, Armenia, Kyrgyzstan); and natural resources-rich (Kazakhstan, Azerbaijan). The remaining CEE economies (Poland, Baltics and south-east Europe) and the European fSU countries (Russia, Ukraine, Belarus) export products of different, but intermediate levels of complexity.

Between 2006 and 2018, the Central European cluster (except Poland) recorded no upgrading in complexity, while the fSU economies (except Kyrgyzstan) experienced a downgrading of complexity. The only 'upgraders' were Poland, Baltics and south-east Europe. This suggests slight convergence within CEE and divergence with respect to the fSU economies. This is in line with the above-cited evidence on export-led growth through GVCs, which points to differentiation within EE&fSU (World Bank, 2005b).

Figure 4: Levels of export product complexity in Eastern Europe 2006 and 2018



Note: Armenia 2007, Kyrgyzstan 2008

Source: Based on database of MIT Observatory of Economic Complexity

In summary, the restructuring of R&D systems and interaction with foreign sources of knowledge through FDI, GVC and trade have led to sectoral and regional 'pockets of excellence' in both upstream (R&D) and downstream (FDI) areas. As we saw above, the erosion of R&D systems has stopped or slowed in all of the EE&fSU. However, structurally these are still dominantly extra-mural R&D systems with weak knowledge links with Business Economic Sectors. The differences in the degree of restructuring and the number of 'pockets excellence', both R&D and FDI, have increased between the CEE and the fSU countries. CEE R&D systems are much more internationalised and increasingly integrated into the EU knowledge networks while fSU R&D systems are still isolated and weakly internationalised.

On the downstream side, innovation systems between the CEE and fSU have also diverged. The former has integrated into FDI and EU value chains, which led to highly productive foreign plants that account for significant export and employment share. In the fSU economies, a variety of factors, including the natural resource-based specialisation of many of these economies and distance from the technologically sophisticated markets, have led to a much smaller role of FDI and GVCs. However, in both macro-regions, the key weakness is the lack of dynamic interaction and complementarities between foreign technology inflows and domestic technological activities.

Overall, both upstream and downstream networks on which local firms could rely and build dynamic interactive capabilities have led to isolated sectoral and regional 'pockets of 'excellence'. The factors which lay behind these processes are not confined to these two types of networks. They are also due to several dimensions of fragmentation of the NIS we address in Section 4.

5. Misalignments within national innovation systems

This Section builds on the conclusions of Section 3. It develops the argument that the NIS in EE&fSU economies has not yet developed features of dynamic catching up economies due to complexities of (mis)alignment of different national innovation subsystems. Since we generalise over 29 economies, this conclusion should be considered a stylised fact which broadly reflects the context. Section 4.1. characterises the NIS of the EE&fSU economies as 'dual' or fragmented across several dimensions of duality. Section 4.2. addresses the State as the key mediator in the alignment of different subsystems and especially in mediating between strategies of foreign vs domestic led technological modernisation.

5.1. Fragmented (dual) national innovation systems: processes

We identify five dimensions of duality or gaps that generate fragmented (misaligned) NIS in the EE&fSU: gaps between upstream (R&D) and downstream (production, technology use) knowledge activities; between knowledge generation and knowledge deployment; between enclaves of new technology-based firms and large firms; the gap between RTD demand and supply; and gaps between transition reforms and performance gaps.

However, before we elaborate each of these five gaps, it is essential to recognise the legacy of weak interactive dynamic capabilities from the socialist period, which have shaped the current gaps. From an IS perspective, socialism was not dynamic (Stiglitz, 1996); it was an institutional structure that hindered the emergence of new organisational forms. It was characterised by business strategy poverty (Yudanov 1997), the absence of small firms (the socialist 'black hole') (Tyson et al., 1994), and the lack of a division of labour in the market (Kogut and Zander, 1999). Firms were thus unable to rely on learning from buyers, suppliers or specialised suppliers. The anti-innovation bias of socialism was caused in large part by its organisational singularity and insufficiently specialised firms, which in turn were caused by the lack of competition and the dominance of hierarchies as the only governance mode. The socialist IS were characterised by weak links between different branches and between foreign sellers and domestic users, and one-way links between R&D/design institutes and enterprises which resulted in poor feedback. The best-performing firms were those able to isolate themselves to a significant extent from the environment because they had learned to overcome their problems on their own and did not have to be exposed to the hazards of a centrally planned system (Hare et al, 1980). This lack of dynamic interactions across the innovation system lay at the core of the innovation failure of socialism.

5.1.1. A gap between upstream (R&D) and downstream (FDI) technological capabilities and activities

Downstream, especially in CEE, the NIS has grown as a result of links with FDI. However, FDI is poorly linked to local economies, is export-oriented and operates in high productivity enclaves. Upstream, they have developed science groups integrated into EU R&D networks and enclaves of New Technology-Based Firms (NTBFs). Almost all EE&fSU IT firms operate as

'exclaves' or 'born globals' and are poorly or not linked to the local economy (see Aridi et al., 2020 for Ukraine). Also, they have emerged unrelated to the local R&D sector, driven by low entry barriers and a pool of skilled programmers (EC, 2020). As a result, 'the R&D-based system is narrow and organised around a limited number of domestic technology-intensive firms and public R&D organisations and universities. Business R&D is limited and concentrated in a few large firms, usually foreign-owned R&D-based companies' (Radosevic and Stancova, 2015: 5). The emerging systems are structurally weak as there are gaps between upstream and downstream parts of the NIS. Disconnected upstream and downstream 'pockets of excellence' do not seem to have generated dynamic interactive capabilities.

5.1.2. A dual path of technological upgrading

To varying degrees all EE&fSU economies possess enclaves of new technology-based firms (NTBFs). Hence, we would expect the spread of NTBFs to increase the coherence of NIS and sectoral IS by creating new links between research and production and links to large firms as their specialised suppliers. However, the NTBFs have not yet built new ecosystems or have not become the drivers of growth. So, although significant regarding distinctive RDI capabilities, their macroeconomic impacts have been marginal. A sector of large firms, both foreign (in CEE) or domestic (in fSU), operates independently. These companies are the primary generators of employment that give them a privileged position regarding government subsidies and capital costs. Their clustering potential remains unexploited mainly due to their dominant position in the local markets.

Thus the outcome is a dual path of technology upgrading whereby NTBFs and large firms develop in parallel but without joint production or knowledge linkages (UNECE, 2017).[10] A key policy challenge is how to couple and complement two paths of industry upgrading.

5.1.3. Knowledge generation – deployment gap

[10] For an example of a dual path see UNECE (2017) chapter 4.4

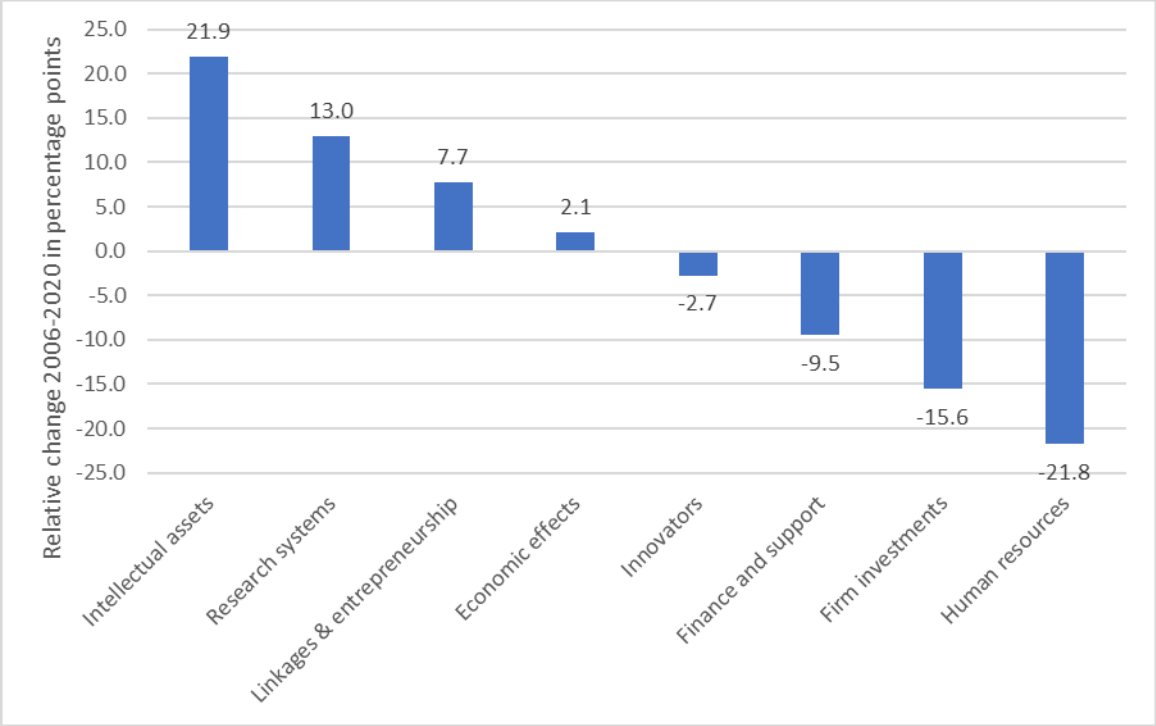
In Section 3.1. and in Figure 2, we pointed to recovery and restructuring of R&D systems in the CEE economies and stagnation and falling behind in the fSU economies. However, this increased investment in knowledge generation and increased R&D outputs in CEE has not generally been accompanied by the intensification of innovation activities in firms (see Figure 5 and the European Innovation Scoreboard reports or database).

Figure 5 depicts the changes between 2006 and 2020 in the different components of the European Innovation Scoreboard (EIS)[11]. Figure 5 shows increasing convergence in knowledge generation activities of the 'new' member states (EU-13) compared to the 'old' EU and an increased innovation and deployment gap. The left-hand side shows the EU CEE states' catching up in the generation of disembodied knowledge (intellectual assets which comprise of trademarks; design applications, PCT patent applications), and in research systems (international scientific co-publications; scientific publications among top 10% most cited) but an increased gap in human resources, firm investments (business R&D and non-R&D innovation expenditures) and innovation activities (SME in-house innovation, SME product or process innovations, market or organisational innovations). Radosevic et al. (2019) corroborate this result. They explore different technological upgrading components based on 35 indicators and find improvements in knowledge generation (R&D and patenting activities) but lags in production and firm (deployment) capabilities.

Figure 5: Catching up in knowledge generation and falling behind in technology deployment

Changes in European Innovation scoreboard components: performance of the EU CEE member states in 2006-2020 (in percentage points)(EU-15=100)

[11] The EIS is the main metric used for policy purposes across the EU https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en



Source: European Innovation Scoreboard database 2014 and 2020

Note: UK was excluded from the EU15 average in 2020. The economic effects component in 2020 is calculated as the average between employment and sales impact to ensure comparability with the 2006 data. The data between the two periods are not strictly comparable due to changes in individual indicators.

Unfortunately, comparable data are not available for the fSU economies, where we would most likely observe the maintenance of the existing gap. The increasing gap between knowledge generation activities and deployment of innovation in CEE suggests that increased investment in R&D and knowledge are seldom linked to areas of demand for R&D and technology. This leads us to the issue of supply and demand for R&D and technology (RTD).

5.1.4. RTD Demand-Supply gap

In Section 4.1, we evidenced surprising structural inertia in R&D systems of the EE&fSU countries' R & D systems, suggesting that demand for domestic R&D does not automatically emerge with economic recovery and growth. This was especially obvious in the transition period, where conventional growth factors like capital and labour played no role (Havrylyshyn, 2001). It continues to be relevant in the post-transition period since growth in these

economies is not yet R&D based. Kravtsova and Radosevic (2011) show that, rather than patents or R&D, production capabilities, proxied by ISO9000 certification, were the most significant drivers of productivity improvements in EE&fSU in the 1996-2005 period. Micro-level evidence for a large sample of EE&fSU economies shows that productivity drivers are related to production capabilities rather than R&D and patenting (Fedyunina and Radosevic, 2021). Radosevic (2004a), based on evidence for the 1990s, shows that weak demand for innovation is the CEE's greatest weakness compared to the developed EU.

To check this hypothesis on the demand gap, we construct proxies for demand and supply of RTD, based on subjective assessment of their components using World Economic Forum survey data. Table 3 shows that supply and demand for RTD decrease as we move from developed to less developed areas of the EU and fSU. The data suggest a demand gap which increases moving from EU north, south, CEE to Russia and Ukraine. This shows that even the significantly downsized supply of RTD in CEE and Russia/Ukraine is still stronger than the demand for RTD except in central-Asia and Caucasus (CAC), which show equal, although low, demand for and supply of RTD. This reflects the underdevelopment of their R&D systems when compared to Russia and Ukraine.

Table 3: Assessment of supply and demand for RTD (research, technology, development) (simple average 2007-2018)

	Central Asia-Caucasus	Russia and Ukraine	E.U. CEE	E.U. South	E.U. North
Supply	3.5	4.1	4.3	4.3	5.3
Demand	3.5	3.7	3.9	4.0	5.1
Demand gap	0.0	0.5	0.4	0.3	0.2

Note: Central Asia & Caucasus includes Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan

Source: World Economic Forum *Global Competitiveness Reports* database

Explanatory note: Supply (Quality of education; Quality of maths and science teaching; Local availability of specialised research and training; Quality of scientific research institutes availability of scientists and engineers)

Demand (Extent of staff training, Degree of customer orientation, Buyer sophistication, Firm-level technology absorption, Production process sophistication, Capacity for innovation, Company spending

on R&D, Gov't procurement of advanced tech products)

5.1.5. Progress in transition – performance gap

In the first 10-15 years of transition, the main factors influencing growth were differences in the initial conditions, differences in the timing and scale of the introduction of comprehensive stabilisation policies, the extent of structural reforms and liberalisation, and the scale and scope of institutional change during the transition (Havrylyshyn, 2001).[12] However, afterwards, it became clear that the countries showing the greatest transition progress were not necessarily achieving higher growth. Moreover, the example of China, 'the elephant in the room' which did not follow a transition framework policy agenda, and the deep and protracted economic crisis in fSU economies, despite successful recovery in several countries in central Europe, led to a re-examination of this approach. This rethinking is epitomised by the World Bank (2005a:12) *mea culpa* study, which concluded that 'to sustain growth requires key functions to be fulfilled, but *there is no unique combination of policies and institutions for fulfilling them'* (emphasis added). We explored the relationship between changes in GDP in the late transition period (2000-2010) and transition progress in the early transition period (1990-2000), across economies that, based on EBRD transition indicators, we classify as advanced or transition laggards using the average score (1-4) as the threshold. Economies advanced in early transition (1990-2000) grew at average annual rate of 1.7% in 2000-2010 while laggards in transition grew at 2.5% annually.[13]

Thus, the broad systemic changes implemented through structural reforms have not on their own led to economic growth, which turned out to be a much more complex process. The improved business environment cannot be equated with an improved innovation environment. Drivers of market supply and demand are not necessary drivers of demand for innovation.

It has been long recognised in innovation studies that the simple market demand approach failed to produce sufficient evidence that needs expressed through market signalling are the

[12] The related literature is summarized in Havrylyshyn (2001).
[13] Calculated based on EBRD Transition reports 1990-2010 and Penn World Table, version 9.1

prime movers of innovative activity (Mowery and Rosenberg, 1979; Dosi, 1982). These include technology, users and firms, which are not just automatic transmitters of supply and demand but also the source of technology on their own (see Giada et al, 2012 for an overview).

Hence, the gap between 'progress in transition' and economic performance points to a much more complex interaction between the market and innovation systems. The market system perspective operates based on static efficacy criteria and individual optimisations. By contrast, the innovation system perspective recognises dynamic interactive capabilities, the collective nature of innovation and systemic changes driven by simultaneous processes of 'creative destruction' and 'creative accumulation' (Bergek, 2013). These two processes require qualitatively different institutional and market incentives and different organisational principles. 'Marketisation' of the economy, which disregards its effects on technology accumulation, confirms that markets can operate only when reliant on non-market institutions and processes, of which the NIS is one.

This Section discussed five dimensions of duality or gaps that generate fragmented or misaligned NIS in the EE&fSU. In the next Section (4.2), we address the balance between NIS openness and autonomy and the role of the state, which is probably the most critical dimension of (mis)alignment of NIS with the global economy.

5.2. Aligning foreign and domestic led technological modernisation - what role for the state?

The importance of balancing autonomy with the openness of the NIS stems from studies on catching up, which concludes that the coupling between domestic technological efforts (autonomy) and international technology transfer (openness) is central to catching up (Mowery and Oxley, 1995; Radosevic, 1999d). When one of these dimensions dominate, we can distinguish between domestic and foreign-led technological modernisation. Domestic (foreign) led technological modernisation is a process of technological upgrading and productivity improvements in which domestic (foreign) actors control the critical aspects of this process (assets, technology capability, distribution, supply, finance). These differences significantly affect their medium- and long-term growth, the scale and scope of industrial restructuring and integration into the global economy.

There are significant trade-offs between the two modes of technological modernisation (Radosevic, 2021). In a nutshell, foreign-led technological modernisation leads to fast growth in the short term but suffers from potential structural weakness in the long term. Domestic led technological modernisation exhibits slow productivity growth in the short- and medium-term but represents a potentially more advantageous situation in the long term. However, none of these modes leads to technological catch-up, which can emerge only through complementarities (alignments) between these two modes. Also, prolonged states of one or other technological modernisation modes will create structural crises resulted in what has come to be referred to as the middle-income trap.

The dynamics of techno-economic modernisation emerges through conflicts between the logic of the market (to locate economic activities wherever they will be most efficient and profitable) and the logic of the state (to capture and control the process of economic growth and capital accumulation to increase the power and economic welfare of the country) (Gilpin, 2001).

As a broad tendency, the central European countries followed a foreign-led technological modernisation path while Russia, Ukraine, Belarus and most other fSU republics experienced domestic led technological modernisation. There are important sectoral patterns that help to explain this split, with ownership of natural resource-based sectors the most significant. However, a detailed examination of the different sectors would provide a more nuanced picture, including sectoral gaps in the access to markets, technology and finance, and the political power of local elites.

In all the central European countries, state actors tried actively to promote the emergence of a domestic ownership class ('national capitalists') by subsidising the sale of state-owned assets. However, in general, domestic privatisation schemes to promote efficient firm restructuring were unsuccessful and, by 1998, all (except Slovenia) eliminated the obstacles to FDI.

The balance between foreign and domestic led technological modernisation depends on the

state as a mediator and the ultimate controller of the process. The original vision of the 'progress in transition' agenda was that the state should be the regulator and act in a 'night watchman' capacity. After 30 years of post-socialist transformation, we find a wide variety of state roles, none of which corresponds to this normative ideal. The EBRD (1999: 128) *Transition Report* notes that 'although the dismantling of central planning and privatisation have sharply reduced the level of state intervention throughout the region, progress in transition is not necessarily synonymous with a reduction in state intervention in enterprises'.

The state's role in the EE&fSU technological modernisation process waits to be written. Common to most is that contrary to narratives that describe passive regulatory states promoting change through the interplay of market forces in CEE, we also find many cases of developmental states promoting sectoral specialisation and often outsourcing development to MNCs. At the same time, the EE&fSU experienced a plethora of failed attempts to promote specific sectors, although analyses of these attempts have not been widely documented. The trend seems to be more towards CEE states that resemble 'competition states' that have embraced competition for investment and focused on lower taxes, while fSU states continue to experiment with different 'developmental state' options. An exception in all EE&fSU countries is ICT services, which has emerged as a significant new sector despite lack of state promotion. Low entry barriers to foreign markets and abundant human capital have enabled them to become major players in their industry segments.[14]

In summary, developments post-2008 have returned the state to its former central position, as shown in the 2020 EBRD report *The State Strikes Back*. The global Covid-19 crisis (2020-2022) has further reinforced this trend. However, the outcome remains unclear. Aligning domestic technology absorption and generation with open access to FDI and GVC to local markets remains a considerable challenge. In conditions of fragmented SI and absent strong local firms, foreign capital will reinforce the existing structural weaknesses. On the other hand, the newly found legitimacy of the state to follow domestic led technological modernisation is not without risk in a GVC-driven global economy.

[14] The most notable cases are Kaspersky in Russia, the Belarussian ICT services company, EPAM, and the Czech antivirus firms, AVG, Avast and ESET.

6. Post-socialist transformation as uni-dimensional 'progress in transition' or open-ended process of (mis)alignment of different parts of the national innovation system?

The march towards an 'open market economy', implicit in transition economics, assumes that there is either advance or retreat towards the 'open market economy' model.[15] This reasoning was challenged in political science research by Carothers almost two decades ago (2003). In the same way, it is evident that in 2021 the transition paradigm has outlived its usefulness in regard to economic and innovation policy. Here we draw on Carothers' analysis of five core issues to draw parallels to the case of transition economics.

First, any movement away from 'real existing socialism' economies cannot be considered automatically to be a transition towards an 'open market economy'. Moreover, transition to a market economy does not necessarily go hand-in-hand with democracy but can also lead to authoritarian (illiberal) capitalism. Several fSU economies illustrate how previously dominant party leadership switched easily to authoritarian capitalism without substantial changes in the nature of politics (Uzbekistan, Turkmenistan, Belarus). Also, the emergence of illiberal democracies in CEE shows that capitalism can operate well with the worsening of the rule of law and principles of parliamentary democracy (Hungary, Poland).

Second, transition paths, determined by 'progress in transition' metrics, assume that the speed and direction of change can be defined only in terms of progress along a transition path rather than some alternative. These alternatives can be different and often incompatible varieties of capitalism whose metrics of progress would have to be specific to that particular type. This leads to increasing gaps between how systems are legally presented compared to how they operate in practice. For example, authoritarian regimes can try to improve their scores on metrices like *Doing Business* or World Economic Forum *Global Competitiveness Reports* without fundamentally changing business practices.

[15] For example, recent democratic backsliding of the EE&fSU economies, and a surge in populist and the 'illiberal democracies' in CEE together with already existing authoritarian or semi-authoritarian regimes in Russia and Central Asia, have been interpreted in terms of linear travel towards or away from democracy or autocracy (see Cianetti and Hanley, 2021)

Third, privatisation does not equate with a 'free-market economy' if privatisation means control of the economy and society by elites integrated into the State. Mass privatisations in institutionally weak economies have deepened rent-seeking, undermining the rule of law. Instead, diversity of forms of ownership (mixed economy) with their different objectives more than the singular aim of achieving a fully privatised economy can ensure robust and resilient growth.

Fourth, contextual structural factors, such as development, historical, institutional, cultural and ethnic legacies, may be much more decisive for transformation processes than 'progress in transition'. Even when they are perceived as all-encompassing programmes, policies can only facilitate or hinder but not drive the economy. The actual impact of policies will be how they interact with the structural factors and strategies of dominant stakeholders. The first best solutions may not be workable or could create perverse effects.

Fifth, a 'progress in transition' agenda implicitly assumes a coherent and functioning state that is able to operate as a 'nightwatchman' rather than an arena for resolving conflicting distributional interests like shares of income between capital and labour or between different sectors. This is a heroic assumption that implicitly assumes only the state's regulatory role and ignores diverse state capacities for policy design and implementation.

With the benefit of hindsight, the transition period can be interpreted as a failed attempt to build a utopian 'open market economy'. This might seem inevitable from a contemporary viewpoint since many of the transition programme's initial assumptions, like well-functioning state and markets supporting institutions, were not in place. The way the EE&fSU economies restructured and advanced during the neoliberal revolution of the 1990s up to 2008, is less the outcome of how well their transition progressed and much more the outcome of the interactions between policies and the structural, technological and institutional legacies of individual countries.

Thus we argue that we cannot understand post-socialist transformation and divergent country outcomes if we only adopt the lens of the transition paradigm or its counterpart 'backsliding paradigm' (Cianetti and Hanley, 2021). Instead, the post-socialist transformation

is an open-ended process whose outcomes can be better understood as the evolutionary process of (mis)alignment of different parts of NIS, moderated by the State and international stakeholders, leading to dynamic or static interactive capabilities.

This approach builds on understanding the relationship between economic, institutional and technological changes as depicted by Freeman. In *As Times Goes By* (Freeman and Louca, 2002) the history of capitalism from the industrial to the information revolution is framed as a history of (mis)alignment of several subsystems: science, technology, economy, politics and culture. These systems are relatively autonomous, and catching up, forging ahead or falling behind can be understood through the interactions among these subsystems. In this essay, we took a similar, though narrower, view on subsystems or parts of the NIS. This reasoning is in line, also, with von Tunzelmann's 'network alignment' framework (see McGowan et al., 2004). Von Tunzelmann (2004) explicitly focuses on EE&fSU transition, which in the 'network alignment' perspective can be understood as a widespread network failure to align different IS subsystems.

Finally, transition economics see an 'open market economy' as the ultimate aim rather than a tool or mechanism for achieving a more prosperous economy. In that respect, in its original form, transition economics is anti-Polanyian. Polanyi argued that 'free-market capitalism' is not a real choice; it is only a utopian vision since a democratic society has to integrate different principles (Polanyi, 2001: 264, 265). This Polanyian insight into integrating different principles as essential for democratic society leads us to hybridisation as a crucial interface that connects different parts of NIS.

This insight is also in line with Freeman (2006) and Nelson (1996) understanding of ISs as hybrid systems, driven by public and private activities, by the market, the state, and the commons. Market governance alone does not provide a sufficient explanatory framework to understand catching up or falling behind. The hybrid nature of IS assumes that the different subsystems operate on different governance modes, valuation principles and rationalities.

From a neo-Schumpeterian perspective, a radical shift towards 'marketisation' of the economy impoverishes the organisational diversity of IS. Also, it deprives it of different

principles on which the economy and society are built. This shift is similar to the swing of a pendulum, which moves from hierarchy and central planning as the organising principles towards markets as the only organising principle. Paradoxically, an extreme Hayekian perspective does not lead to the 'extended order' based on a variety of organisational and valuation principles, but to just a single principle, similar to its polar opposite, central planning. Conceptualising the post-socialist transition solely as progress towards an 'open market economy', reduces the multidimensionality of the IS.

Our argument is hopefully clear: central to NIS is the notion of complementarities among different subsystems that operate based on different valuation principles and different governance modes. The alignment or realisation of complementarities of different subsystems of the NIS inevitably requires hybridisation between different valuation principles. This issue is not specific to the NIS approach but is present broadly in social sciences. For example, complementarities are critical to the idea of Varieties of Capitalism (VoC) where one institution's functional performance is affected by the presence/functioning of another institution. However, within VoC specific types never occur in their 'pure form'. Hodgson (1999) explains this using the notion of impurity. The 'impurity principle' contends that different kinds of subsystems are necessary for the system to function. He argues that 'every socio-economic system must rely on at least one structurally dissimilar subsystem to function' (Hodgson, 1999:126).

In the context of our analysis of the transformation of the post-socialist IS it follows that a mixture of market and non-market elements is essential for varieties of IS. For example, capitalism promotes market and profit-seeking activity, but relies on family and state, which are run on non-market principles (Hodgson, 2015). Orthodox centrally planned systems could not survive based only on central planning; they also need informal network exchanges (Ledeneva, 1998). A second (informal) economy was essential to the socialist system's reproduction by helping to alleviate consumer shortages and bureaucratic bottlenecks (Sampson, 1987; Portes and Borocz, 1988). An increasingly diversified 'second economy', whose production and exchange networks eventually suffused the entire economic system with an increasingly marked degree of 'rationality', was essential to Hungarian growth and a peaceful transition into a market economy during the 1980s (Seleny, 2006). In the context of

the post-Soviet transition of the 1990s and contemporary Russia, Ledeneva (2006, 2013) shows how informal networks among professionals and power networks which all operate along the legal system are essential to understand how *sistema* works (ibid, 2013)

7. Conclusion: what Eastern Europe teaches us about the transformation of innovation systems

EE&fSU socialist and post-socialist transformations are a rare social sciences 'natural experiment'. They provide a unique opportunity for innovation studies scholars to analyse this region that, for 100 years was ruled by two radically different political and policy philosophies, and to observe the impact of these philosophies on the capabilities for technical change and sustained growth.

Three political and ideological shifts reflect the experimental features of the EE&fSU transformation: a) a shift from hierarchical 'real existing socialism' towards an 'open market economy'; b) a shift from the inward-oriented industrialisation of the socialist period towards foreign-led structural change and opening of the economy in the transition period; and c) a shift from absolute dominance of the 'socialist developmental state' towards the 'regulatory state' of the transition period.

In both periods, economic systems were unable to produce sustainable growth and catch-up in their 'pure' forms. A key lesson from EE&fSU experience is that neither socialist nor transition to 'open market economy' systems can operate in their pure forms, confirming the proposition that ISs are necessarily always hybrid systems. The social capability for technical change depends on the variety of the social subsystems operating on different principles, whose complementarities do not emerge automatically, but must be nurtured and generated by the activities of major stakeholders. Attempts to enforce one governance principle as the sole principle, be it hierarchy or market, face (in Polanyian terms) counter-movements. From a neo-Schumpeterian perspective, EE&fSU is an example of the idea that growth emerges as a (mis)match between different social and economic subsystems, between the business sector and public R&D between large firms and SMEs and between foreign and local firms.

Catching up as distinct from growth spurts, requires the development of 'dynamic interaction capabilities', that is, complementarities among different subsystems. A growth spurt is characterised by weak individual learning mechanisms or weak alignment among different learning mechanisms.

Moreover, this process is evolutionary in form and political in nature. The second decade of the 21st century has been a period of a fundamental crisis of the existing model of capitalism and a search for alternatives. In this context, the experience of EE&fSU shows that social capability for technical change and, thus, growth and prosperity cannot emerge without finding a way to reconcile the self-regulating market with a democratic society. Both socialism and the transition period, in their own ways, failed in that respect.

This leaves us with Chris Freeman's (1992) *Economics of Hope* and his vision of simultaneous political and economic democracy. The *Economics of Hope* is Polanyian in its aim to free societies from both 'the tyranny of the market and the dictatorship of the political elite' (Brook, 1994). The current global situation has renewed the relevance of the *Economics of Hope*. The EE&fSU experience provides us with valuable lessons about how an 'economics of hope' is required to counter an 'economics of despair'.

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