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ORIGINAL ARTICLE

Liberal and illiberal industrial policy in the EU: the political economy of building the EV battery value chain in Sweden and Hungary

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Abstract

In the context of an increasingly ambitious European Union (EU) industrial policy and the transition to electromobility, the main objective of the article is to uncover the interaction between the supranational level and domestic policies through examining the buildup of the electric vehicle (EV) battery value chain in illiberal Hungary and liberal Sweden. The study analyses these diverse cases through the lenses of comparative political economy. How do European industrial policy objectives translate into national policies under widely different political conditions? How do the different translations impact on the original objectives of EU policy? Through using a structured-focused comparison, the paper argues that the building of the EV battery industry implies the entrenchment of existing models of capitalism in both cases. Liberal democracy is only compatible with the coordinated market economy model of Sweden, while in Hungary the illiberal regime and the dependent market economy model reinforce one another in face of growing public recognition of the disadvantages of dependency—misallocation of resources, environmental damage, and limits to upgrading. EU strategic objectives are served only by the Swedish model, while the Hungarian model leads to deepening institutional cleavages within the EU and implies growing dependence on Russia and China.

Keywords EV battery value chain · Illiberalism · Industrial policy · Hungary · Sweden

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Introduction

Industrial policy has made a forceful comeback in the EU and the broader developed world driven by concerns about the rise of China and climate change (Aiginger and Rodrik 2020; Landesmann and Stöllinger 2020; Bulfone 2023; McNamara 2023; Di Carlo and Schmitz 2023). This means selective bureaucratic interventions to shape the structure of the economy (Pichler et al. 2021, 142) implying the abandonment of sectoral neutrality, which used to be a core principle of neoliberal economic policy (McNamara 2023). Protera and Quitzow (2022, 518) describe this enormous change in EU governance as a transformation from a regulatory into a catalytic state. The tools of industrial policy intervention include the creation of ad hoc alliances, providing supplemental resources, expertise, and incentives as well as financial instruments to leverage private sector funding (Ibid, 520). The extent of change from the previous non-interventionist, neoliberal approach reflects the urgency of challenges the EU needs to address including the digital and green transition, the rise of China, loss of trust in the US as a reliable partner, and the supply chain shocks due to COVID and the Russian invasion of Ukraine (McNamara 2023, 6). Building strategic autonomy in critical industries is the EU answer to these challenges (European Commission 2021, 11–15).

As cars and vans account for 15% of carbon dioxide (CO2) emissions in the European Union, the transition to electromobility plays a crucial role in the fight against climate change and meeting the 1.5 ◦C target of the Paris Agreement. At the EU level the target objective has been elaborated within the framework of the Fit for 55 package: new cars and vans must be emission-free from 2035 implying the transition from internal combustion engine (ICE) cars to EVs (European Council 2023a). The radical push towards EVs comes after two decades of regulatory failure by the EU to reduce CO2 emissions in the sector—between 1990 and 2020 the transport sector increased its emissions by 32% mostly due to the drift towards heavier, more powerful, and more expensive cars (Pardi 2023, 21–22). To succeed in the new strategy towards electromobility the production of EV batteries is crucially important. Given the current dominance of China in the sector and the fears of potential weaponization of economic dependence, EV battery production is one of the six areas, in which the EU aims to be self-sufficient (European Commission 2021, 12). This makes the battery sector an important case for studying the rebirth of industrial policy in the EU.

The shift at the supranational level towards greater bureaucratic intervention into the economy takes place in an institutionally heterogeneous environment, where various models of capitalism, liberal democracies and illiberal regimes coexist. This implies that the same European objectives might be translated into very different types of industrial policy, which impact upon their success or failure. The central aim of the paper is to understand the interaction between the supranational and domestic levels through examining the case of building up the EV battery value chain in two countries at the forefront of the industry within the EU: Sweden and Hungary. Given their widely dissimilar economic and political systems their comparison can be interpreted as a diverse case design illuminating

the potential range of variation within the system (Seawright and Gerring 2008, 297). From an institutional perspective, they represent optimal cases for an ideal-type analysis (Stapley et al. 2022) and can serve as benchmarks to explore the potential impact of EU industrial policy on the national level and speculate about the consequences for the supranational objectives. The analysis aims to make three contributions to the literature: (1) apply existing theories of comparative political economy (CPE) to a new case—the building up of the EV battery value chain; (2) contribute to the emerging CPE literature linking the political system to long-term developmental models through contrasting industrial policies in a liberal and an illiberal regime within the EU; and (3) formulate policy implications for the EU industrial policy in the battery sector based on early warning signs at the domestic level in Hungary.

Empirical evidence for the comparative analysis is drawn from a wide range of sources: official government policy documents and communications, reports by international organizations, accounts by investigative journalists as well as the secondary literature. Based on a structured-focused comparison, the paper argues that the differences confirm the enduring relevance of the different models of capitalism in Sweden and Hungary—coordinated market economy (CME) in the former case (Hall and Soskice 2001), and a persistent dependent market economy (DME) in the latter (Nölke and Vliegenthart 2009; Schiering 2022). The novelty of the research to the CPE literature is the role of the political system in sustaining the dominant model—while CME and liberal democracy are mutually reinforcing in Sweden, the DME and illiberalism in Hungary similarly reinforce one another as the limits of the model become clear to the public including the misallocation of resources, damages to the environment and limited potential for upgrading. These problems are exacerbated by the growing dependence on Russian energy, Chinese FDI and technology. From an EU perspective, this implies not just that its strategic autonomy objectives are served only by the Swedish approach, but also deepening core-periphery and institutional cleavages.

The paper proceeds as follows. The next section explains EV batteries, the relevant value chain and its challenges followed by a discussion of European industrial policy initiatives to build up the sector. Section "The comparative political economy of Sweden and Hungary" gives an overview about the economic and political heterogeneity of Sweden and Hungary from a CPE perspective. Section "Building up the EV battery value chain in Hungary and Sweden" compares the building up of the EV battery industry in the two countries based on the policy process, research, and development (R&D), comparative advantages, government support and expected outcomes. Section "Discussion and alternative hypotheses" discusses the findings and refutes alternative hypotheses to explain the outcomes. The final section addresses the implications for the EU and concludes.

The EV battery value chain and its challenges

EV batteries are made up of cells, which are organized into modules then packed with electronic connections and cooling equipment to form a battery. Each cell consists of four basic components: (i) cathode, which is some type of

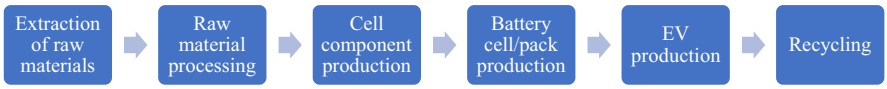


Fig. 1 The value chain for EV batteries. Figure: own editing based on IEA (2022a): 146

lithium-metal-oxide and could contain nickel, cobalt, manganese, iron, or phosphate; (ii) anode—typically graphite; (iii) electrolyte, which consists of organic carbonate solvents with dissolved lithium salts; and (iv) separator, a thin, porous plastic film (Coffin and Horowitz 2018).

The EV battery value chain is shown in Fig. 1. According to IEA (2022a, 154), there is a significant concentration in the market at every point of the process. Except for raw materials extraction, China has dominated the entire value chain. Its share in the production of anode, cathode and batteries is over 70%, while it produces more than 50% of electric cars.

The production of batteries has significant environmental and social challenges. The joint vision of the Global Battery Alliance and the World Economic Forum (WEF 2019) elaborates on three such challenges:

First, battery production is highly energy-intensive—by 2030 estimates show that the emission of the battery value chain will be 182 Mt annually. The most energy-intensive step of battery production is cell manufacturing, where the energy needed for 1 kWh battery capacity is 41.48 kWh (Degen and Schütte 2022). The source of this energy crucially influences how green electric cars are, although all types of electric cars are expected to have emission benefits (19–60%) compared to ICE cars over their total life cycle (WEF 2019, 20). At the same time, Pardi (2023, 62) emphasizes that these savings can be offset by the upmarket drift, which might be further accelerated by the Fit for 55 package in the EU.

Second, demand for the raw materials of batteries has been increasing dramatically, and mining the required materials comes at significant social and environmental costs. Nearly, 75% of cobalt is extracted in Congo using a significant amount of child labour, while lithium production is extremely water intensive.

Third, the profitability of the industry is also questionable for several reasons: high upfront costs of battery packs, lack of charging infrastructure and low utilization of existing infrastructure, as well as limited costumer acceptance of EV cars instead of ICE cars. The profitability of recycling is also problematic.

The list of challenges can be extended further. At a time of climate change and regular droughts, production requires a significant amount of water mostly for cell production and cooling—the water depletion potential is between 9 m^3 and 74 m^3 for a 40 kWh battery pack (Phillipot et al., 2019, 8). With the increasing number of battery plants, the problems during the production process have also gained attention such as the significant amount of noise from the factories as well as the various accidents affecting workers and the environment (Éltető 2023). The next section reviews how EU battery policies address these challenges.

Towards an EU battery policy

The challenges of EV battery production and electrification of mobility in general justify bureaucratic interventions to steer market actors into the preferred direction (Meckling and Nahm 2018). The policy tools of the EU in the EV battery sector fit into the broader trend of industrial policy renaissance and consist of brokering alliances, facilitating investments through simplifying regulations, protecting the EU market from competition and targeted resourcing (Di Carlo and Schmitz 2023, 7).

The European Battery Alliance (EBA), which was officially launched by European Commission Vice-President Maroš Šefčovič in October 2017, is one of the earliest industrial policy projects within the context of the Important Projects of Common European Interest (IPCEI) initiative (Pichler et al. 2021, 145). Collaboration of relevant stakeholders is facilitated for the purpose of supporting the build-up of a safe and sustainable European battery sector for an estimated €250billion market (EIT InnoEnergy 2020). The alliance is led by EIT InnoEnergy and comprises 120 European and non-European stakeholders representing the entire battery value chain. Through a series of workshops and seminars they have identified key actions to facilitate their objectives —their recommendations range from supporting R&D, EV infrastructure as well as frontloaded financing for necessary investments.[1]

Beyond brokering collaboration, the EU has taken significant steps towards regulating the industry, which is driven by environmental and social concerns as well as the idea that strict standards would ensure a level-playing field for European companies (Melin et al. 2021). A new regulation concerning batteries and waste management was adopted on 28 June 2023 (European Council 2023b). The regulation sets out harmonised standards for the entire lifecycle of batteries from raw materials production to usage and end-of-life handling. It has labelling and informational requirements about the carbon footprint of batteries as well as rules for replaceability, interoperability, safety, and durability. It contains 100% collection and recycling requirement for EV batteries as well as quantitative targets for recycling and recycled content in new batteries, which become stricter over time. By 2030, 95% of cobalt, copper, lead, and nickel as well as 70% of lithium must be recycled, while by 2031 new batteries must contain recycled material where the targets are 16% for cobalt, 85% for lead, 6% for lithium and 6% for nickel. According to Melin et al (2021, 3) globally these are the most advanced standards, and they might also serve as non-tariff barriers against cheaper imported products.

Targeted financial support for the EV battery sector involves both state aid as well as initiatives for EU-level funding initiatives. In response to the US Inflation Reduction Act (IRA) the EU loosened and simplified regulations for state aid for battery factories through the Temporary Crisis and Transition Framework (TCTF). While originally these rules applied to the support of the economy in the context of Russia's invasion of Ukraine, in March 2023 it was announced that the rules can also be used to boost clean tech investments in the EU and compete on subsidies with the US (European Commission 2023, 2.8.). This means that large companies can

[1] The full list of recommendations is available: https://www.eba250.com/actions-projects/priority-actions/.

receive 15–35% of their eligible investment costs depending on the region with a cap of EUR 350 million per undertaking per Member State. Further initiatives are foreseen for the medium term such as the Net-Zero Industry Act "to focus investment on strategic projects along the entire supply chain" as well as the European Sovereignty Fund "to boost the resources available for upstream research, innovation and strategic industrial projects" (Von der Leyen 2023).

Overall, we can observe a strong push within the EU towards establishing a European EV battery value chain through brokering collaboration, regulations, and various targeted financial support measures. The forceful supranational intervention into the automotive industry stands in stark contrast with the earlier policy stance towards the sector, when market competition was preferred, and industry-specific measures preferring European producers were resisted (Jullien et al. 2014). At the same time concerns and regulations about the process of producing batteries have so far been scarce (Pichler et al. 2021, 148). This implies that national-level institutions and structures will be relied on to build up the sector in the EU. The European-level initiatives are implemented in a politically and economically heterogeneous environment, which is likely to impact the outcomes. The cases of Sweden and Hungary are crucial representatives of this heterogeneity.

The comparative political economy of Sweden and Hungary

Hungary and Sweden are both among the largest battery producers in the world: between 2022 and 2027 battery manufacturing capacity is expected to grow from 38 to 194 GWh in Hungary, and from 16 to 135 GWh in Sweden (Bhutada 2023).[2] Both have a strong car manufacturing industry—average number of motor vehicle production between 1997 and 2022 was 276 193 in Sweden (238 955 in 2022) and 216 191 in Hungary (441 729 in 2022).[3] Building up the EV battery sector is an important factor in saving the auto industry during the transition to electromobility (Szalavecz 2022; Pavlinek 2023). The similar focus on batteries in the two countries, however, occurs in completely different economic and political contexts.

In comparative political economy both cases have been widely cited as representatives of specific models of capitalism. From a variety of capitalism (VoC), supply-side perspective Sweden is an important case of a coordinated market economy (Hall and Soskice 2001, 20), while Hungary can be still classified as a dependent market economy (DME) dominated by transnational corporations (Nölke and Vliegenthart 2009). The illiberal turn during the 2010s did not fundamentally change the FDI-dominated developmental model (Greskovits and Bohle, 2019) as transnational

[2] Transport and Environment (2023: 11) has somewhat different numbers, and it predicts that by 2030 Hungarian battery production will be 217 GWh, while Sweden will have 110 GWh, but the report also notes that 180 GWh capacity in Hungary is at medium risk, which means that it"might be delayed, scaled down or not realised at all if further action is not taken" (4).

[3] Data: https://www.ceicdata.com/en/indicator/sweden/motor-vehicle-production and https://www.ceicdata.com/en/indicator/hungary/motor-vehicle-production.

With the exception of raw material extraction, the whole EV battery value chain is already present in Hungary with over 30 companies. For a detailed list, see Czirfusz (2023, 23).

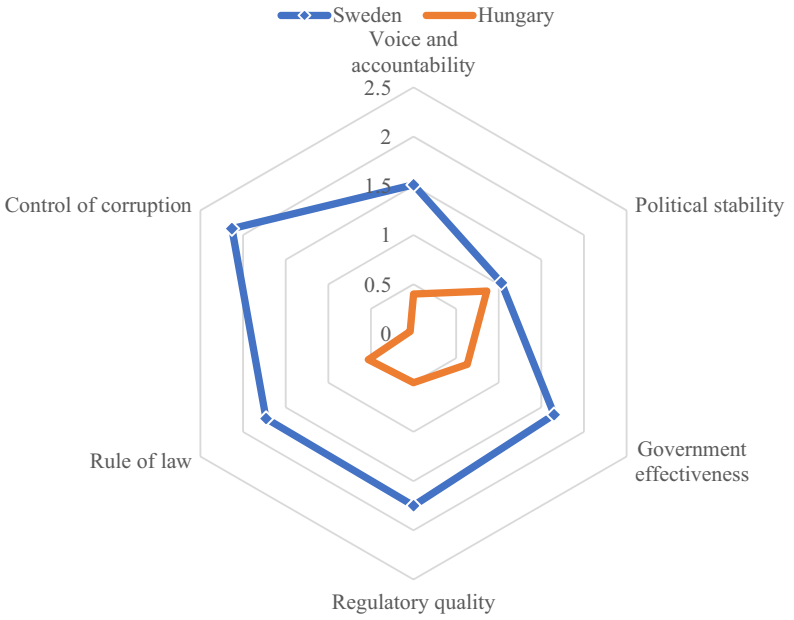
manufacturing firms are still among the major winners of the regime (Schiering 2022) along with selected domestic companies in the construction and various service sectors. From a demand-side, growth model perspective Sweden is a primary example of a balanced growth model, which ensures the growth of both exports and household consumption given its strong productivity growth (Baccaro and Pontusson 2016, 176). In contrast, Hungary is a clear case of an export-led model (Ban and Adascalitei 2022, 202), where wages are suppressed through the devaluation of the currency (Győrffy 2022, 104).

During the build-up of the EV battery sector, research and development (R&D) has crucial importance. In Sweden the combination of public investment into education and R&D, competitive product and flexible labour markets as well as generous welfare arrangements produce a highly competitive and innovative economy (Farkas 2016, 145). In a DME such as Hungary innovations are primarily transferred by transnational companies (TNCs), neither education nor R&D are priority areas for the government, and the comparative advantage lies in cost-effective assembly of semi-standardized industrial products (Nölke and Vliegenthart 2009, 687–688).

Following the 2010 global financial crisis both the Swedish and the Hungarian growth model faced challenges. While the decline of foreign export demand shifted the Swedish model towards financialization and growing private indebtedness (Erixon and Pontusson 2022), the DME model has been challenged by the emergence of regional labour shortages, the decline of global FDI as well as technological change including robotization (Galgóczy and Drahokoupil, 2017). The rise of EV battery sector responds to these challenges in both cases—strengthening exports in Sweden and ensuring the continued flow of FDI in Hungary.

The EV battery value chain is built under widely different political conditions. While Sweden is consistently among the top-performers in democratic quality, Hungary has emerged as the first only 'partly free' country in the EU (Kelemen 2017; Freedom House 2023). Although from the perspective of Hacker et al (2021, 7) Sweden and Hungary are both unitary, parliamentary, unicameral states with a single veto player, effective control over the executive is lacking in Hungary. Underlining illiberalism is useful as it is the self-definition of the regime (Orbán, 2014) and it also focuses on the key difference from EU basic values, the opposition to liberal constitutionalism: weak protection for human rights, the absence of checks and balances, weak rule of law, insecurity of property rights and repression of civil society (Zakaria 1997).

At the same time, democracy is the input side of democracy, and illiberalism is just as important on the output side, as it strongly impacts the quality governance and in particular the ability of the state to impartially serve the public interest (Rothstein 2011, 12–20). In the absence of liberal checks and balances on the state, private interests are likely to dominate government decision-making. Figure 2 shows the differences in institutional quality in Sweden and Hungary based on the World Bank's governance indicators in 2021. While the two countries are similar on political stability, Sweden performs orders of magnitude better than Hungary on all other indicators, and especially on controlling corruption.



Note: The scores represent an index between -2,5 and 2,5 with 0 being the world average.

Fig. 2 World governance indictors in Sweden and Hungary (2021). The scores represent an index between −2.5 and 2.5 with 0 being the world average. Source: Worldwide Governance Indicators, available at: https://info.worldbank.org/governance/wgi/

Table 1 Systemic differences between Sweden and Hungary

	Sweden	Hungary
Type of capitalism (VoC)	CME	DME
Growth model	Balanced	Export-led
R&D	Domestic	Imported via TNCs
Challenge	Financialization	Technological change, labour shortage
Political system	Liberal democracy	Illiberal regime
Quality of governance	High (90th percentile)	Medium (50th percentile)

Overall Sweden and Hungary represent two contrasting economic and political systems within the EU; the differences are summarized in Table 1. We can hypothesize that the economic system influences the type of EV battery industry being built, and the political system impacts on the process and motivation for the sector.

Building up the EV battery value chain in Hungary and Sweden

To compare the emerging battery sector in the two countries, a structured-focused comparison will be conducted—structured to reflect the aims of the research and focused to limit the discussion to the theoretically relevant aspects of the cases (George and Bennett 2005, 67–70). The empirical assessment is focused on five critical dimensions: the policy process and the motivation for the industry reflecting the differences in the political system; R&D and government support indicating the differences in the economic system; an analysis of expected outcomes assessing the impact of these differences at the national and EU levels.

Developing an EV battery strategy: the liberal and illiberal approach

The differences in the political system are clearly manifested in the policy process: while in Sweden the battery value chain has been developed through strong cooperation among the stakeholders, in Hungary top-down, secretive decisions have been dominant excluding key groups from the process.

The Swedish battery strategy was drawn up by FossilFree Sweden, an organization initiated by the Swedish government in 2015, in cooperation with EIT InnoEnergy, an EU body created in 2008 to foster innovation. Based on the introduction of the strategy (FossilFree Sweden, 2020, 5) they relied on a broad reference group, which included stakeholders from the entire EV battery value chain such as companies like Northvolt, Scania, Volvo, as well as academics and representatives of relevant municipalities. The collaboration does not stop at the Swedish borders. In response to the assignment from the Swedish Energy Agency, Business Sweden—an organization jointly owned by the state of Sweden and the Swedish business sector—completed a report based on interviews with the relevant stakeholders on a joint Nordic EV battery value chain, a cooperative endeavour with Norway and Finland. In the report (Business Sweden 2021), they argue that the three Nordic countries have different comparative advantages, but when considered together, they have complementary strengths across the entire value chain, which provides strong incentives to join forces and build the industry together.

The process of building up the battery industry is very different in Hungary. Although Samsung SDI in Göd had been producing batteries since 2017 and the number of battery investments had proliferated in Hungary,[4] the official strategy for building an EV battery value chain was published only in September 2022 (ITM 2022). The authors of the strategy are not named, and the report is basically a government communication about the state of the battery value chain in Hungary and future plans. There is no trace of consultation with the relevant stakeholders in the report. The Hungarian public learnt about the plans for making the country an EV battery manufacturing superpower from PM Viktor Orbán's speech in Tusványos

[4] The new government regulation (146/2023) allows for the requirement of public consultation related to local authorities be fulfilled through the posting of relevant information on a website, and the relevant stakeholders need not be present for a hearing. Available: https://magyarkozlony.hu/dokumentumok/79dc6517729cbce68fb360f8b1864cdb529a2f8a/megtekintes.

earlier in 2022, where he said "[i]n Hungary we are making huge investments in batteries, and in no time we will be the world's third largest battery producer—the third largest battery producer in absolute terms, not in percentage terms—and the world's fifth largest exporter " (Orbán, 2022). A month later, on 12 August it was announced that the Chinese CATL brings a €7.5bn investment to Debrecen, building a 100 GWh battery gigafactory. As the announcement of the largest-ever FDI project in Hungary completely surprised the public, the lack of social consultation came into the focus of the debates on the battery industry. Since the process was shrouded in secrecy, fears about the local environmental impact intensified, especially after the emerging social protests were dismissed by the government as political, opponents as foreign agents (Éltető, 2023, 38). Public hearings related to the environmental permits of these factories were highly contested, as the companies did not provide all the relevant information—though they were deemed sufficient by the authorities to issue all the necessary permits (Éltető, 2023, 39–43). In February 2023, due to the debates surrounding the build-up of the battery sector, a public survey showed that 50% of the Hungarian population wants to ban the building of all new battery factories (Cseke 2023). In response to the avid protests, the government announced a new regulation, which makes it possible to hold the relevant public hearings without the presence of the public.[5] Proposals for local referendums on the factories were rejected as well.[6]

Diverse motivations for the EV battery industry

While building up the battery sector is motivated by environmental and business considerations in Sweden, in Hungary it is forced by a coalition of the government and the car industry even though the relevant resources are lacking.

Building up the battery value chain fits into a broader strategy of making Sweden one of the first fossil-free welfare states, contributing to competitiveness and fulfilling of EU strategic autonomy objectives (Fossil Free Sweden 2020). In collaboration with other Nordic countries Sweden has the prerequisites to make the battery industry profitable. Business Sweden (2021, 9) identifies comparative advantages in key dimensions: availability of green and affordable energy; robust grid network ensuring stable energy supply; cold climate reducing the energy needs for the cooling phases of cell production; highly developed digital communication and efficient logistics; availability of important raw materials. Sweden also has extensive experiences with recycling. It has been a leader in energy transition, as it has almost fully decarbonised its electricity generation already by 2019 (IEA 2019).

Similar comparative advantages are absent in Hungary—there are no raw materials, while energy, water and workers are in short supply. The country relies on fossil fuels for 68% of total energy supply, while 59% of energy is imported (IEA

[5] See the reporting: https://www.budapesttimes.hu/hungary/election-committee-rejects-lmps-referendum-bid-on-requiring-local-consent-for-building-battery-plants/.

[6] While in 1980 the population in Hungary was 10.7 million, by 2022 it has shrunk to 9.7 million. See the time series data by the Central Statistical Office of Hungary: https://www.ksh.hu/stadat_files/nep/hu/nep0001.html.

2022b, 19–20). The main source of imports is Russia, from where 95% of natural gas imports come from (IEA 2022b, 132). The National Battery Strategy estimates that battery production will increase Hungarian energy needs by at least 50% within 3–5 years (ITM 2022, 27). Fulfilling this need has dominated the government policy agenda including its stance on Russians' war on Ukraine (Government 2023). The country's energy grid network is also in poor condition—the electricity system is not able to accommodate the energy produced by residential solar panels and the grid needs to be upgraded throughout the country (IEA 2022b, 76–77). There are also concerns about the water-intensity of battery production as Hungary is hit by climate change and droughts. The water network is also highly degraded with an average loss of 23% due to the poor condition of the pipelines (Éltető, 2023, 19–20). Skilled workers and operators are also missing as the country has experienced severe labour shortages given its steadily declining population since the 1980s.[7] To keep the cost advantages, battery factories are expected to provide jobs to foreign nationals—this is already the case in Samsung Göd as half of its workers are from abroad (Czirfusz 2023, 11). Going against his former anti-migrant sentiments, PM Viktor Orbán has announced that Hungary will need 500 000 new workers for its reviving industry[8]—who might be foreigners if Hungarians are not available.

According to ITM (2022, 19), the main advantages for the sector in Hungary are the commitment of the government and the presence of car manufacturing companies. This implies that the government is prioritizing the interests and requests of these firms, which are among the main beneficiaries of the regime (Schiering 2022).

The involvement of domestic R&D

As expected from their different model of capitalism, the EV battery industry relies on domestic innovation in Sweden, while technology is imported in Hungary.

The largest Swedish battery manufacturing company, Northvolt, was founded in 2016 by Peter Carlsson, formerly Vice President at Tesla. Northvolt's vision is that by 2030, their CO2 emissions from battery production will be 90% lower than the industry average, thanks to their environmentally friendly technology (Northvolt 2021). To achieve this, they have designed their own battery—the prototype was completed in 2018.[9] Building a manufacturing site in Skellefteå started afterwards, while the next step of the process is to expand through building up a global value chain. This includes an R&D centre in San Leandro, USA, lithium processing in Setúbal, Portugal, new production sites in Gdansk, Poland, as well as in Heide, Germany, and recycling in Fredrikstad, Norway.

In contrast to Sweden, the National Battery Sector Strategy (ITM 2022: 19) underlines that in Hungary there is no independent product design; the collaboration

[7] See the report: https://abouthungary.hu/news-in-brief/pm-orban-hungarian-economy-to-provide-jobs-for-hungarians-first.

[8] In describing the history of the company, unless otherwise indicated, I rely on the Northvolt website, the information is available at: https://northvolt.com/about/.

[9] According to OECD (2022, 238) Hungary spends 3.8% of GDP on education, well below the OECD average of 4.9%.

between universities and industry is weak as well as the knowledge of advanced battery technology. There is no domestic R&D in the sector, and Hungary relies on foreign multinational companies to bring in the technology. There is no R&D site planned for the industry, and the steady deterioration of the Hungarian education system characterized by low spending on the sector, low teacher salaries[10] leading to severe teacher shortages and sharply declining performance,[11] make it unlikely to move towards such activity. The government has resisted strikes and protests to raise teacher salaries with force and plans to curb autonomy further [12]

The contrasting nature of government support

While both the Swedish and Hungarian governments have strongly supported the battery industry, the nature of this support varies significantly.

The Swedish government has been an important initiator of the collaboration among the actors within the battery value chain. The report by Fossil Free Sweden (2020, 32–38) foresees various supporting role for the government—this includes supporting demand for electric cars, providing credit guarantees for investments as well as funding for basic research, investing in relevant education, and taking part in marketing. At the same time, the sector is foreseen to rely on private funding. This is shown by the case of Northvolt. The project has been financed mainly through private capital—while $12 million was raised from investors in 2017, in 2019 $1 billion of shares were issued to build the Northvolt Ett factory in Skellefteå. As the company expands, new funds are drawn in—according to Milne (2023) $8bn in equity and debt have been raised so far, making it the best-funded start-up in Europe. The European Investment Bank's loan of $52 million in 2017 and $350 million in 2019 has played an important role in this development—a successful project the bank enthusiastically reports on its website (Smit 2020). The company is not entirely lacking public funding either: the state-backed Swedish Energy Agency provided a €15 million subsidy (0.375% of the investment) for the planned €4 billion investment in Northvolt Ett—after it was clear that private actors were confident in the project (Clover 2018).

In contrast to Sweden, the Hungarian government supports the battery industry through direct state subsidies as well as lax regulations for environment and worker rights in line with an economic strategy relying on costs-based competitiveness (Aiginger 2018). While the precise amount of support is highly non-transparent, subsidies consist of cash grants, tax credits, soft loans, and infrastructural investments. Czirfusz (2023, 17) calculates that battery projects receive 10–20% of their investments as directly paid cash subsidies. An even greater source of support is the infrastructural developments for energy, water, and transport, which are also financed by the state budget. Czirfusz (2023, 18) mentions SK battery plant in Iváncsa, where

[10] Teachers earn 40,4% less than other tertiary workers (OECD 2022, 254).

[11] Average PISA scores dropped from 496 to 479 between 2009 and 2018 (Győrffy 2022, 102).

[12] See the reporting by Reuters: https://www.reuters.com/world/europe/thousands-protest-against-government-move-strip-teachers-public-servant-status-2023-05-03/

Table 2 Summary of building up the EV battery value chain in Sweden and Hungary

	Sweden	Hungary
Policy process	Collaborative	Top-down
Motives	Environment, business opportunity	TNC preferences, corruption opportunity
R&D	Domestic	Imported
Comparative advantages	Exist	Lacking
State aid	Mainly indirect	Substantial direct aid, lax regulations
Economic outcome	Competitiveness	Reinforce middle-income trap
Political outcome	Liberal democracy sustained	Reinforce illiberalism
Serving European strategic autonomy	Yes	No

the value of the investment is HUF 681 billion (~€ 1.8 billion), which received HUF 76.4 billion (~€ 200 000) VIP cash grant as well as HUF 90 billion (~€ 237 000) infrastructure support to develop water pipelines, the local electric power system, roads, and railways—a total of 24% subsidy for the investment.

In an environment with weak control of corruption (Fig. 2), this amount of public spending on direct state aid and infrastructure building carries a high potential for rent-seeking. Indeed, the so-called MGTS + companies,[13] whose owners are close to the government and who received 19% of government public contract value between 2011 and 2021 (Tóth and Hajdú, 2022, 237), are also the recipients of the infrastructure building contracts for battery investments (Bodnár and Balogh 2022).

Besides direct state aid, the government is assisting the battery sector via extremely favourable regulations. Battery plants are typically installed as priority investments, which practically means that the permission process is greatly simplified, and local residents, municipalities have no say in what happens in their area (Éltető, 2023, 21). This provides considerable regulatory relief for the investing companies. Given the low priority of environmental issues in the past decade, there is little public confidence in the environmental authorities in Hungary. A case from Samsung SDI in Göd illustrates the problem. Suspecting water contamination, a civil organization asked the authorities for the water monitoring data—and after a lengthy court case they had to learn in 2023 that the monitoring well was simply buried in 2018, so no data collection was carried out (Bodnár, 2023).

Expected outcomes for long-term development

The building up of the EV battery value chain reinforces the main features of the economic and political models of the two countries as summarized in Table 2. While Sweden is successfully building up a global value chain in an emerging industry, Hungary remains dependent on FDI. Given such considerations it is unsurprising

[13] According to Tóth and Hajdú (2022, 259–271) the MBTS + group includes the companies of 12 businessmen, who have frindship or family ties to PM Viktor Orbán such as his childhood friend and the richest man in Hungary, Lőrinc Mészáros or his son-in-law, István Tiborcz.

that the Swedish battery sector is expected to be more successful than the Hungarian battery industry. This is the conclusion of the analysis by Business Sweden (2021, 11), which predicts the Nordic countries as the main winners of the expected value of the sector, based conditions for production and the operational climate, while Poland and Hungary can expect low value from producing batteries.

There are no similar calculations of expected value in the Hungarian battery strategy (ITM 2022), and there are no other publicly available government forecasts either. Győrffy (2023) attempts to quantify the expected length of return on public subsidies in the case of Samsung SDI in Göd. She shows that the calculations are highly sensitive to initial assumptions such as the number of foreign workers as well as whether the crowding out effect on the Hungarian job market is included into the analysis or not. Still, the range of cutting even on government subsidies is between 7.5 and 17 years, which is extremely long given the speed of technological development in the battery industry. In the meantime, these funds are missing from traditional state functions such as education, health care and social security, which would be necessary to raise human capital, step on the path of productivity- and quality-based growth and help Hungary out of the middle-income trap (Győrffy 2022).

From an EU perspective strategic autonomy is only served by the Swedish approach, while the reliance of Hungary on Chinese technology and Russian energy increases the vulnerability of the EU to supply disruptions due to geopolitical tensions.

Discussion and alternative hypotheses

Comparing the diverse cases of Sweden and Hungary reflects the wide range of possible outcomes in response to the forceful return of industrial policy in the EU. The stark contrast between the two cases in process and outcomes underlines the enormous impact of the political system on implementing industrial policy.

While in Sweden the collaborative approach to building up the industry is compatible with liberal democracy, the unpopularity of the EV battery industry in Hungary and the growing recognition for its environmental and social costs makes the government reliant on illiberal means for control. This includes secrecy, limits on referendums, changes to the regulation of public hearings and the clear dominance of private interests over the public good. From a broader perspective prioritizing state support for battery manufacturing over education entrenches the illiberal regime through supporting its own voting bloc—low-skilled workers—with jobs, while preventing the growth of its opposition, who are usually better educated.[14] This implies a mutually reinforcing relationship between foregoing economic upgrading and sustaining the DME model of capitalism on the one hand and intensifying political repression and an illiberal political system on the other. Increasing dependency on authoritarian powers entrenches this outcome further.

[14] During the April 2022 general election, Pálos and Hajdú (2022) found a 0,65 correlation at district level between the share of population with only primary education and the vote for the ruling party, FIDESZ.

These findings contribute to the recent literature in CPE aiming to link political institutions to developmental processes. The coalition of the government, its cronies in the construction sector, German and Chinese multinationals over the long-term economic interests of Hungary eerily resembles the developments in the so-called Red states of the US. As elaborated by Grumbach, Hacker and Pierson (2021) in the left-behind states of Red America voters support the economic agenda of the wealthiest Republican donors, which is contrary to their interests of receiving more transfers from richer states dominated by the Democrats. The priority of identity politics over economic interests, the rejection of the knowledge economy and the resistance to invest into education are also shared features of Hungary and Red America.

Before drawing implications for EU industrial policy, it is necessary to address possible alternative hypotheses to explain the differences between Sweden and Hungary. Given their initial conditions, at first sight it is hardly surprising that their EV battery industries differ as well. It could be argued that initial economic and social conditions rather than their different political systems could explain their divergence.

Given the importance of the auto industry in the Hungarian economy with its 29% export share in manufacturing exports and 4% share in total employment (Szalavetz 2022, 2), it might seem that the turn towards the EV battery industry is a necessity. However, this is hardly the case for at least two reasons. First, the EV battery industry is significantly greater than the number of cars produced in Hungary would justify—the full electrification of its annual ~ 450 000 car production with a 100 kWh, relatively large battery would require only 45 GWh battery capacity instead of the current plans close to 200 GWh. Second, similar countries in the region that produce even more cars annually, Czechia (~ 1.4 million cars) and Slovakia (~ 1 million cars) do not focus on the EV battery sector—as Pavlinek (2023) shows the Czech government has been reluctant to give significant amount of public subsidies to EV battery companies, which chose Hungary instead, while in Slovakia the government provided 5% direct support to the Slovak startup InoBat to build a 10 GWh factory. This also implies that domestic innovation and building a value chain is possible even in a DME country, and increasing dependency on FDI should not be taken for granted.

Social conditions such as environmental consciousness and the strength of civil society are also insufficient to explain the differences between Sweden and Hungary. While concerns over the environment in general are far weaker in Hungary than in Sweden, local environmental issues do arouse significant civil resistance. This has been the case during the building of the EV battery sector, which led to widespread public protests and large-scale organization in civil society (Éltető, 2023, 37–44). With a significant majority opposing the government's plans to make Hungary an EV battery superpower, the inability of the society to influence or stop the process underlines the relevance of illiberalism in building up the EV battery industry.

Implications for EU industrial policy

In the short-term the increasing capacity of European battery industry might be welcome in any format including the Hungarian approach. For the core it might be even advantageous to have these environmentally burdensome factories in the periphery

regions. German car manufacturing companies can also benefit from the scale and capacity of the Hungarian EV battery industry. However, from an EU perspective, this implies the growing distance between the core and the periphery, which can threaten the integration process through more difficult joint decision-making, further penetration of the system by geopolitical rivals as well as growing social resentment.

Considering the Hungarian case, relaxing regulations on the battery industry (Transport and Environment 2023, 6) is excessively dangerous as it increases the possibility of similar cases and could lead to rising public resistance to the entire sector. Looser rules for state aid also raise serious concerns—this has been noted by Agnolucci (2022), who emphasizes the differential fiscal capacities of member states and the resulting distortions for the internal market, as well as Éltető and Medve-Bálint (2023), who show that state aid in illiberal countries barely contributes to economic upgrading and rather entrenches existing structures. Through the case of the battery industry, we can add the concerns about increasing corruption, the distortion of companies' business decisions as they shop for more aid over considerations of local conditions for production, as well as the diversion of taxpayers' money from public services.

As the EU considers the build-up of a European battery value chain, it should also consider the process of doing so. This means the need for a stronger focus on the process of producing batteries rather than just regulations over the lifecycle and quality of the batteries themselves. EU standards should include fossil-free energy supply for production, anti-corruption policies as well as specific standards for working conditions and environmental impacts. Since a prime interest of the EU is to reduce the energy needs of battery production, public funding should go primarily into improving production technology rather than the direct subsidy of individual companies as suggested by Degen (2023, 11). To avoid further distortions of the internal markets, subsidies for environmentally important tasks should come primarily from the EU level rather than the national governments together with supranational regulations for their use. Rule of law conditionality as well as geopolitical considerations should be highly relevant both for state aid approval as well as the allocation of EU funds.

As industrial policy is experiencing a renaissance in the EU under the pressures of climate change and geopolitical tensions, the possibility of various government failures should not be overlooked. The buildup of the Hungarian EV battery value chain should serve as an early warning about these for the entire EU.

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