South Korea's industrial ties with Central Europe

The case of defense and electric vehicles

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CEIAS

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Content

Executive summary

1 **European militaries prefer to acquire arms from NATO member states and other like-minded countries;** decision-makers prefer engagement based on their shared ideological and political values over others in response to perceived geopolitical threats. This and the surge in demand since 2022, which has outpaced Europe's domestic production capacity, presents an **opportunity for South Korea's defense industry**. Value-driven economic and military collaboration with South Korea offers an **alternative to established suppliers such as the United States or Germany.**

2 **Due to its proximity to the war in Ukraine, Central and Eastern Europe has become one of the fastest-growing markets for South Korean arms producers**, with arms purchases from Poland, Estonia, and Romania and increasing interest elsewhere in the region. Poland is the largest customer by a wide margin, accounting for 96.4% of South Korean arms transfers to Europe in 2014-23. The Polish arms purchase, the **largest ever deal for a Korean defense company**, will see 60% of the tanks and 45% of the howitzers locally manufactured in Poland. Warsaw's arms contract with Seoul **solidifies South Korea's role as a prominent arms supplier and is central to Poland's attempts for risk mitigation and diversification of the defense supply chain.**

3 The Visegrad 4 (V4) countries have emerged as the preferred destination of both Chinese and South Korean manufacturers of electric vehicles (EV). While the **Chinese investment amounts eclipse those of their Korean competitors**, this metric does not provide a precise view of the EV manufacturers' landscape, as the **Korean firms only need much smaller amounts to convert existing internal combustion engine (ICE) production facilities into EV manufacturing.**

4 **Korean automakers in the V4 region have a number of advantages that allow them to remain competitive against their financially better-endowed Chinese competitors.** These include almost three-decade-long presence in the region, close relations with a large pool of local suppliers, an in-house trained workforce, brand recognition in the region, functional relations with local governments, and others.

5 Recognizing Chinese firms' dominance in EV battery manufacturing, **Korean firms, aided by the government, pursue a variety of strategies that enable them to remain competitive and retain market share.** Due to its deep automotive supply chains, skilled workforce, favorable business environment, and proximity to major European markets, the V4 region is a major recipient of Korean investments in this industry. The intensity of the competition between Chinese and Korean battery producers is manifested in the fact that **battery manufacturers from each country announced a total investment of 14bn EUR in the V4.**

6 South Korean battery manufacturers enhance their competitive edge in the V4 region by **striving for leadership in a single part of the battery supply chain, recycling. In doing so they align with broader European and local policy objectives**. By establishing joint ventures (JVs) with domestic firms, locating factories near major customers, and diversifying investment across multiple countries, Korean firms seek diverse avenues for enhancing profits, maintaining competitiveness, and managing risks.

Introduction

Recent geopolitical and geo-economic developments have fostered greater industrial, military, and diplomatic cooperation between South Korea and the Visegrád 4 (V4) countries—Czechia, Hungary, Poland, and Slovakia. Two key factors underpin this trend: the Russian invasion of Ukraine in 2022, which has spurred arms purchases and defense manufacturing collaboration with South Korea, and advancements in electric vehicles (EVs) and battery technology, which, when coupled with the European Union's (EU) push for decarbonization, created strong incentives for South Korean firms in the EV sector to invest in the V4 region.

While commercial interests largely drive these partnerships, geopolitical and geo-economic forces are also at play. Although South Korean arms are favored due to their quality and cost-effectiveness, we argue that South Korea has become one of the top arms suppliers of the V4 region because of its democratic governance and longstanding alignment with the United States and, more generally, the West. This puts South Korea in the category of "like-minded" countries, a critical factor in arms procurement because of the security implications of defense purchases.

In contrast, the EV and battery sectors present a more complex landscape since China is a market leader and a formidable competitor. South Korean firms, often in conjunction with the government, are pursuing strategies to maintain pace with developments in the much larger and more resource-rich Chinese market. Leveraging their established car manufacturing presence in the V4 region, South Korean EV leaders are investing billions of euros in EV manufacturing and developing entire supply chains. In fact, South Korea's announced investment in the battery supply chain within the V4 matches the scale of Chinese investments.

A key strategic decision by South Korean firms, supported by their government, has been to scale up capacity in battery recycling. This has allowed them to dominate the niche industry, including in the V4 region. It demonstrates the sort of strategic thinking that results in enhanced competitiveness and the advantages of public-private cooperation. Extending this model to overseas operations, South Korean businesses and diplomats should deepen collaboration with local firms and governments to sustain their competitive advantage and secure stable business environments. While South Korean firms already work closely with their customers and suppliers, the intense competition from Chinese firms compels them to continuously explore new avenues for cooperation.

This paper examines recent developments in South Korea's arms and EV collaborations with the V4, analyzes the underlying drivers, and offers policy recommendations to ensure these partnerships continue to thrive.

South Korea’s defense cooperation with the V4: current status and potential

Following Russia's full-scale invasion of Ukraine in 2022, EU and NATO member states abandoned their post-Cold War policies of moderate war preparedness, shifting decisively towards rearmament. This pivot reflects new geopolitical realities, emphasizing value-driven economic and military decision-making. Indeed, Europe’s increasing engagement with South Korea’s defense industry reflects a trend towards partnerships with like-minded states based on shared ideological and political values in response to perceived threats.[1]

South Korea, a liberal, democratic state that has supported Ukraine, is one of the few military-technology powerhouses offering an alternative and reliable source of arms to Europe. Given the strategic and political risks of engaging authoritarian states, the European defense supply chain favors increased cooperation with like-minded democracies. Central and Eastern European (CEE) states, due to their geographic proximity to the war in Ukraine and their increasing defense requirements, have been at the forefront of strengthening military ties with South Korea. Moreover, they serve as a compelling case study for understanding South Korea’s strengths, weaknesses, and opportunities in military collaboration with value-aligned states.

South Korea’s position in the global defense industry

Over the past decade, South Korea has become one of the world’s fastest-growing arms exporters. According to the Stockholm International Peace Research Institute (SIPRI), it was the tenth-largest arms exporter between 2019 and 2023, accounting for 2% of global weapons exports. This represents a 12% increase from 2014-2018, when it held a 1.7% share of international arms sales.

The success of South Korea’s defense industry is rooted in three primary factors. First, the ongoing threat from North Korea has driven Seoul’s pursuit of self-sufficiency in defense technology. Before the early 1970s, when it initiated its first steps toward indigenizing its defense industry, the South Korean military heavily depended on imported US weapons.[2] However, as Pyongyang's provocations escalated, the need to develop independent self-defense capabilities and reduce its dependency on foreign suppliers became a national priority.[3] Because of the mountainous terrain of the Korean Peninsula, any armed conflict would involve high-altitude attrition warfare, necessitating robust artillery and armored units to

secure critical points by neutralizing enemy forces.[4] Consequently, South Korea's defense industry initially focused on such land-based platforms.

Second, Seoul's close ties with the West facilitated the adoption and adaptation of advanced weapons technology. Like many emerging defense industrial bases, South Korea began by heavily relying on foreign technology before progressing through stages of licensed production as the country's economy and technological capabilities advanced.[5] As is usual, South Korea then transitioned to limited indigenous development and production of simpler weapons systems, with more complex systems still developed in partnership with foreign companies.[6] Then, it progressed to designing, developing, and manufacturing advanced indigenous weapons, such as fighter jets.[7] Indeed, amid growing threats from the communist bloc during the Cold War, Washington provided immense support to Seoul to help advance its economy, particularly with the growth of *chaebol*—conglomerates with multiple diversified affiliates—in the steel, automobile, and chemicals sectors.[8] Industrial growth allowed Seoul to host licensed production for Western defense contractors from the 1970s onwards.[9] Notable achievements include the T-50 Golden Eagle, the country's first indigenous supersonic aircraft co-developed with Lockheed Martin.[10] South Korea also continued developing indigenous military aviation, resulting in its first homegrown 4.5-5.5th generation fighter jet, the KF-21 Boramae, in the 2020s.[11]

Third, domestic demand for land-based forces has allowed South Korea to achieve economies of scale, in which higher production volumes lower the cost per unit, allowing manufacturers to offer competitive prices. Regardless of state subsidies, capturing a significant market share typically results in increased revenue, more investment in research and development (R&D), and wider adoption, which, in turn, solidifies the positions of market leaders, making entry more difficult for newcomers.

For example, the South Korean K9 howitzer and Germany's Panzerhaubitze 2000 (PzH-2000) are both 155 mm L52 self-propelled howitzers with comparable size, firing range, and speed. However, the PzH-2000 costs €18.4 million ($20.1 million) per unit (based on Germany selling ten units for €184 million in March 2023), while the South Korean K9 costs just $11.3 million per unit.[12] One reason is that the large volume of domestic orders of around 1,100 K9 lowered its cost per unit for K9 exports.[13] As of 2024, Germany has only ordered 225 domestic units of the PzH-2000, mostly because of Berlin's decades of disarmament policy after the Cold War.[14] This price disparity explains why the South Korean K9 accounted for 74% of all global howitzer sales between 2014 and 2023, whereas Germany's PzH-2000 accounted for just 3%, according to SIPRI data.

South Korea’s arms exports and synergies with the EU and NATO

The advantages of South Korea’s defense industry are further amplified by the country’s status as a close US ally and one of the few Indo-Pacific countries actively supporting the EU and NATO agenda following Russia’s invasion of Ukraine. Our research indicates South Korea's alignment with Europe has boosted its weapons sales.[15] (This research was based on a cross-country comparison using the trend indicator value (TIV) compiled by SIRPI. Unlike financial value, in which the actual transaction price may be affected by inflation or exchange rate fluctuation, TIV provides a standardized measure of arms transfers based on military ability.)

Our analysis examines new orders for offensive weapons systems between 2004 and 2023, focusing on artillery, armored vehicles, missiles, and aircraft. Given the land-based nature of the Russia-Ukraine war, there has been renewed emphasis in global arms procurement on artillery and armored vehicles, complemented by missiles and aircraft, including unmanned aerial vehicles (UAVs). This research excludes other weapon categories, such as naval ships or defensive systems.

Amid escalating US-China competition and the resurgence of armed conflict in Europe, the international order is becoming increasingly unstable and prone to inter-state conflicts. Over the past two decades, global defense spending has increased 250%, reaching $2.4 trillion, according to SIPRI.[16] In the Indo-Pacific, China's rapid military expansion has heightened tensions with Washington's Asian allies. Beijing has also increased its military presence in the Taiwan Strait and the South China Sea.[17] Meanwhile, North Korea's development of nuclear weapons has further destabilized the Korean peninsula.[18] In Europe, Russia’s invasion of Ukraine has prompted European states to once again prioritize defense spending.[19]

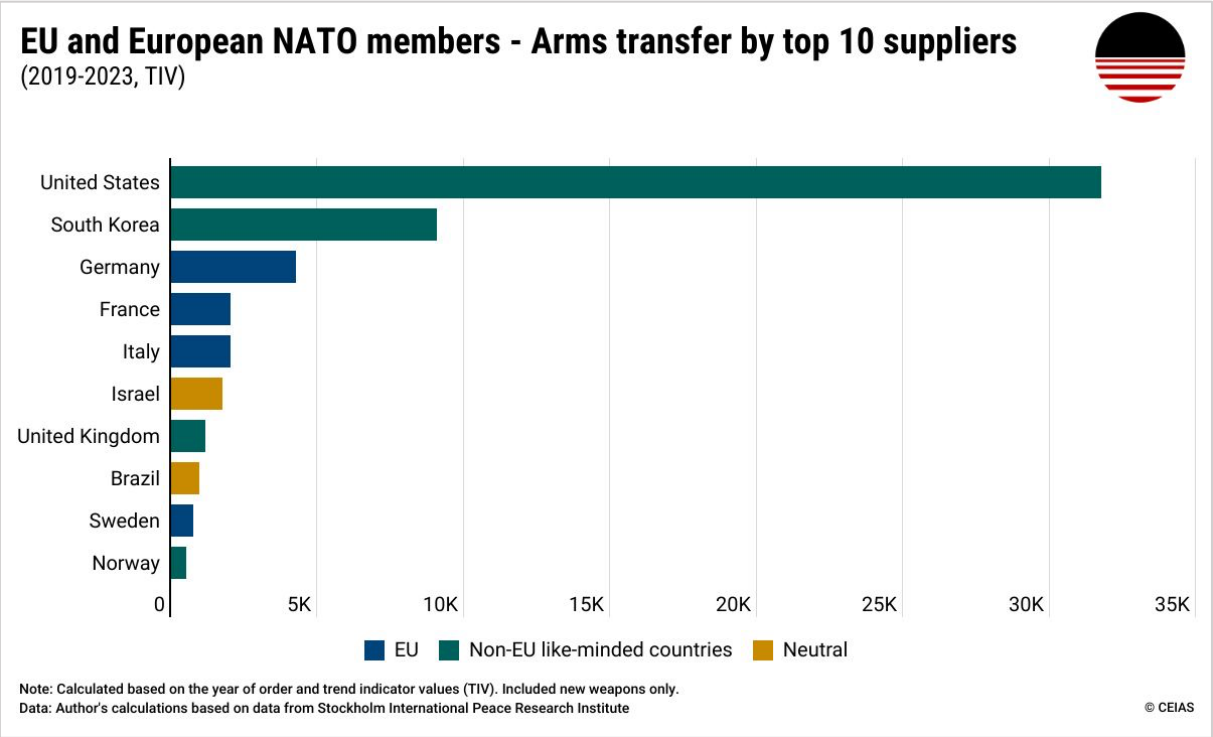
The ongoing tensions have also increased concerns over economic and supply chain security. Beijing has imposed sanctions on US defense contractors, such as Lockheed Martin and Boeing, for selling weapons to Taiwan and has restricted exports of critical minerals like gallium and germanium.[20] In August 2023, the White House banned US companies from investing in areas that would support the advancement of China’s sensitive technologies—semiconductors and microelectronics, quantum information technology, and artificial intelligence—over concern about their connection to China's "military, intelligence, surveillance, or cyber-enabled capabilities," which pose an "unusual and extraordinary threat.”[21]

Furthermore, Russia and North Korea have strengthened military ties. North Korea has supplied weapons and even troops to support Russian forces in Ukraine in exchange for advanced weapons technology and food.[22] This highlights the growing risk of great power conflicts expanding to a trans-regional level. Consequently, securing alternative sources of armaments has become a key priority for decision-makers in Europe and the Indo-Pacific.

Despite efforts to accelerate domestic defense production, Europe's capabilities have been unable to meet the sudden surge of war-driven demand, forcing European countries to rely on imports. EU and European NATO members were net arms exporters between 2004 and 2018 but became net arms importers between 2019 and 2023. During this period, European military spending rose by 61%, increasing their share of global defense expenditure from 16% to 20%. European weapons imports tripled, with 77% sourced from friendly countries.

This surge in demand has enabled South Korea's arms industry to expand rapidly to meet EU and NATO procurement needs. Among all suppliers, EU and European NATO members have sourced more arms from the United States and South Korea than from all other countries (Figure 1). Between 2019 and 2023, 57% of their arms imports were purchased from the United States, while South Korea ranked second, supplying 16% of arms—double Germany's market share.

Figure 1

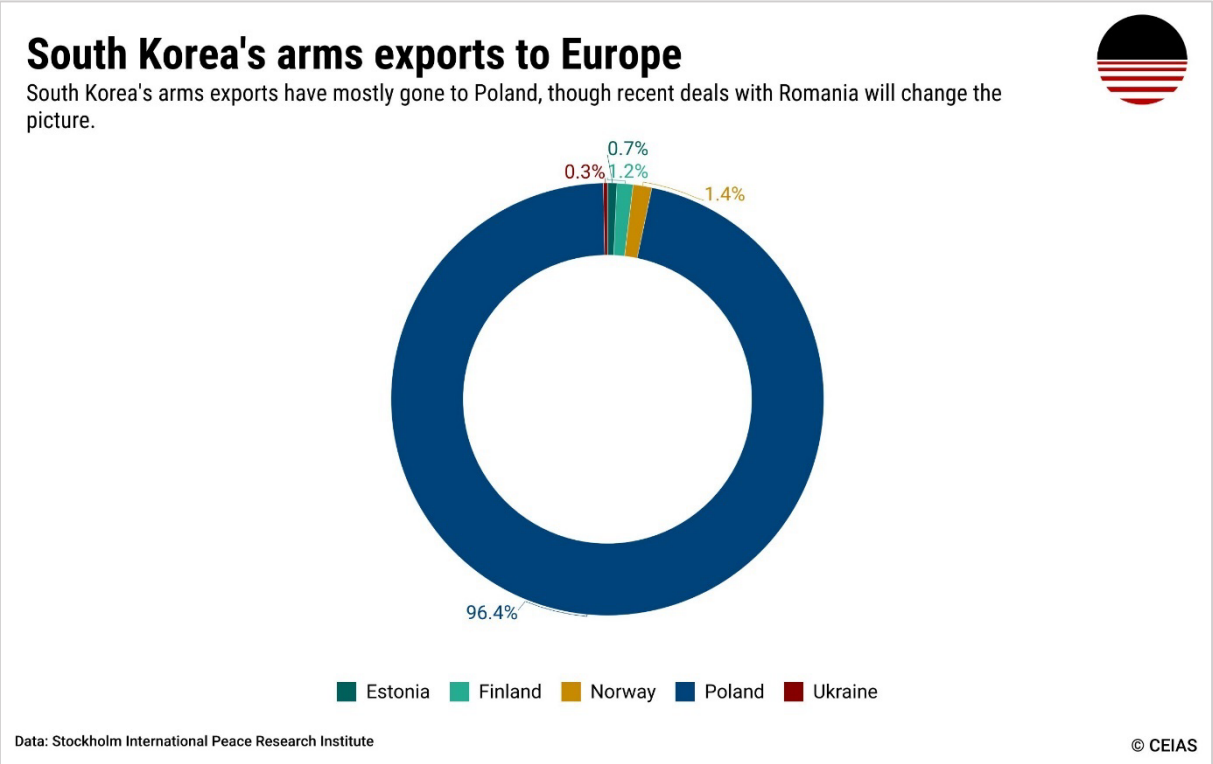


South Korea boasts well-developed supply chains rooted in its heavy industries, which are crucial for arms production and provide a competitive edge in land-based platforms. Between 2019 and 2023, South Korea secured 75% of new global orders for artillery and 33% for armored vehicles. Driven by external demand, South Korea's arms sales increased by 562% between 2014-18 and 2019-23. For instance, in 2022, Finland purchased 38 additional K9 howitzers after acquiring 48 units in March 2017.[23] Similarly, Norway placed further orders for artillery following its $215 million deal in December 2017 to buy 24 K9 howitzers.[24]

South Korea’s arms trade ties with Central and Eastern Europe

The South Korean defense industry’s expansion in the European arms market was also reflected in CEE. Poland emerged as the largest beneficiary, accounting for 96.4% of South Korea’s arms transfers to the region between 2014 and 2023. Other recipients included former Soviet republics, such as Estonia (0.7%) and Ukraine (0.3%). Outside the CEE region, Norway and Finland also accounted for notable shares of South Korea’s arms exports to Europe, with 1.4% and 1.2%, respectively. (Figure 2).

Figure 2

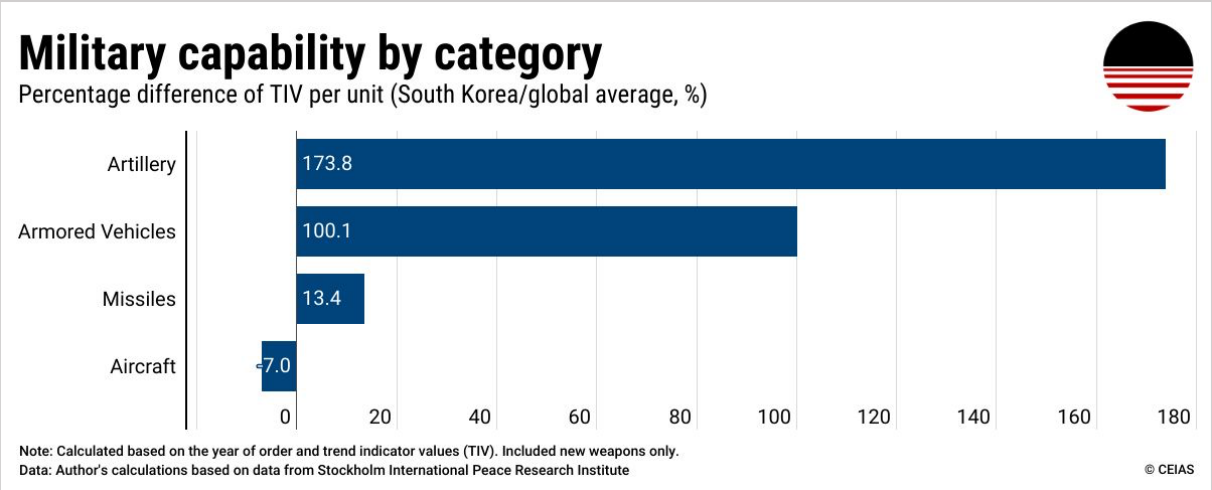


In July 2022, South Korea secured its largest-ever arms deal, valued at $12.4 billion, after agreeing to supply Poland with K239 Chunmoo multi-barreled missile launchers, K2 armored vehicles, K9 self-propelled howitzers, and FA-50 light combat aircraft.[25] Warsaw decided to purchase these units because of the Russia-Ukraine war.[27] In July 2024, Romania followed suit, signing a $1 billion deal to acquire 54 K9 howitzers and 36 K10 Ammunition Resupply Vehicles.[26]

While no official orders have been placed by other countries in CEE, interest in South Korean arms has been growing across the region. Korea Aerospace Industries has been in talks with Slovakia to export FA-50 light combat aircraft since signing a bilateral cooperation agreement with Slovakia’s state-run defense firm LOTN in November 2021.[28] South Korea and Slovakia also pledged to deepen cooperation in defense sector collaboration after establishing a strategic partnership in September 2024.[29]

Despite Poland's dominant share in South Korean arms exports, the overall trend points to sustained demand for the four major weapon systems. Poland's needs stem from self-defense priorities and support for other nations via indirect military equipment supply. For example, since 2022, Poland has provided Ukraine with 320 Soviet-era tanks and 14 MiG-29 fighter jets.[30] South Korea's defense supply chain appears well-positioned to meet the demands of EU and European NATO members. It boasts a higher TIV per unit in artillery and armored vehicles than the global average, although to a lesser extent regarding missiles and aircraft (Figure 3). This indicates that Poland's purchases align with South Korea's areas of comparative strength in military capability.

Figure 3



Poland's ongoing procurement of South Korean defense assets forms part of its broader initiative to modernize its defense capabilities and meet NATO guidelines of spending at least 2% of GDP on defense. In response to the escalating security threat from Russia, Poland has significantly increased its defense budget compared to other European nations. In 2023, it allocated 3.9% of GDP to defense, with plans to raise this to 4.7% by 2025.[31]

In 2022, Poland signed its largest-ever arms deal to strengthen its defense capabilities and replace weapons it had sent to Ukraine following Russia's invasion. The $14.5 billion deal with South Korea included over 1,600 K2 main battle tanks, K9 howitzers, and more than 50 FA-50 light fighter jets. Poland's then-defense minister, Mariusz Błaszczak, remarked that the K2 was "compatible with, or even identical to" America's Abrams tank.[32]

Beyond imports, Poland is emphasizing domestic production of defense equipment. As part of the 2022 deal, South Korea and Poland announced plans to co-develop a new variant of the K9 howitzer, known as the K9PLA3.[33] The deal also included the delivery of 180 K2 tanks and 820 K2PL tanks, a Polish-specific variant of the K2. Of these, 500 K2PL tanks will be produced in Poznań, along with 300 of the 672 K9 howitzers set for local manufacturing (Figure 4).[34] In June 2024, Poland agreed to manufacture 180 K2 armored vehicles domestically.[35]

Recognizing the imbalanced nature of the deals, which could prompt domestic criticism in Poland, South Korea is pursuing reciprocal arms purchases to sustain the partnership. As part of this effort, Seoul plans to acquire 200 Polish loitering munitions and expand its drone fleet using Polish-manufactured products.[36]

Figure 4

Despite its deepening defense relationship with South Korea, Poland continues to procure US defense systems. In response to Russia's invasion of Ukraine, Warsaw announced plans to purchase various US weapons, including M1 Abrams tanks and HIMARS light multiple rocket launchers—systems that overlap with South Korea's K2 tanks and Hanwha Aerospace's Chunmoo rocket artillery. However, Poland is also acquiring weapons outside South Korea's portfolio, such as Apache and Black Hawk helicopters, Patriot air defense missiles, and the fifth-generation F-35 Joint Strike Fighter.[37]

This dual approach demonstrates how US weaponry continues to fulfill certain Polish defense needs, like aerial defense. Yet, Warsaw's arms agreements with Seoul have solidified South Korea's position as a prominent supplier of land-based weaponry for Poland. It also reflects Poland's efforts to diversify its defense supply chain and mitigate risks associated with overreliance on US systems. Diversification also addresses concerns about potential delays or disruptions in US arms deliveries due to increasing demand from other European allies.

East Asian EV makers in the V4 countries

An analysis of EV production in the CEE region by East Asian carmakers must begin with an overview of how South Korean and Japanese automotive firms entered the region during the internal combustion engine (ICE) era. Since the early 2000s, several South Korean and Japanese firms have built car factories in all V4 countries. This was part of a broader wave of outsourcing manufacturing capacity from industrialized Western nations to the post-communist region, driven by globalization, production fragmentation, and regional integration.[38] The emergence of a German-Central European manufacturing nexus[39]—dubbed "Factory Europe" by Richard Baldwin— further entrenched transnational production networks in this region.[40]

Several factors drew South Korean and Japanese companies to the V4 region. Chief among them was the significantly lower cost of production compared to their domestic markets. Proximity to major car markets in Western Europe and integration into European structures were additional advantages. The presence of Western European carmakers and their suppliers created synergies beneficial for the East Asian manufacturers. Additionally, V4 countries offered a skilled yet relatively inexpensive workforce and a long tradition of manufacturing excellence.[41] Lastly, governments in the region actively attracted foreign direct investment by offering substantial subsidies, primarily through tax cuts, along with improvements in the business environment and political stability.

By 2020, the Japanese and South Korean automakers, along with their dense network of suppliers, were deeply embedded in local economies and transnational production networks. This integration is reflected in the growing share of South Korean car production in the CEE region, higher brand recognition, and improved public perceptions of both countries. Specifically, South Korean car production in the V4 region accounts for 3.5% of the EU's total car production, with three-quarters of South Korean cars in Europe manufactured in the V4 countries (Figure 5).

Car sales data further demonstrate South Korea's established presence and brand recognition in the region. In the V4 region, sales of South Korean car brands are more than double those of Chinese brands, including non-Chinese brands like Tesla and Volkswagen (Figure 6). South Korean brands hold a 15.4% share of car sales in the V4, nearly twice the European average of 8.6% (Figure 7).[42]

Figure 5

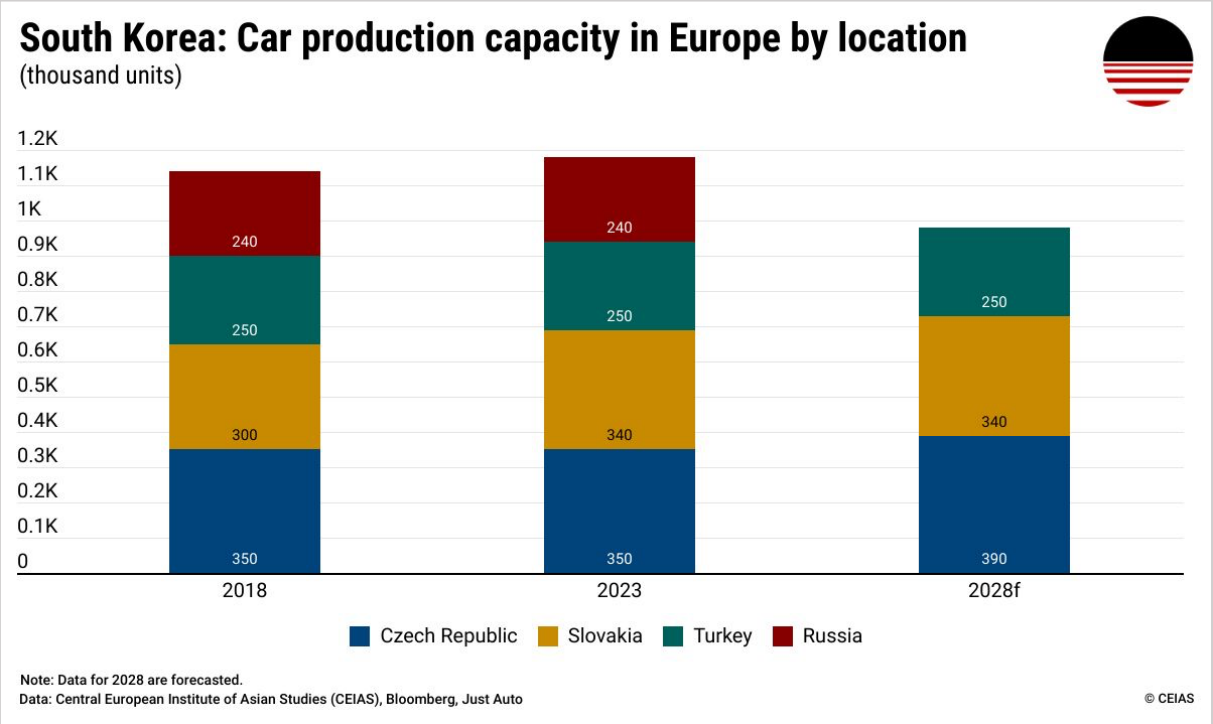


Figure 6

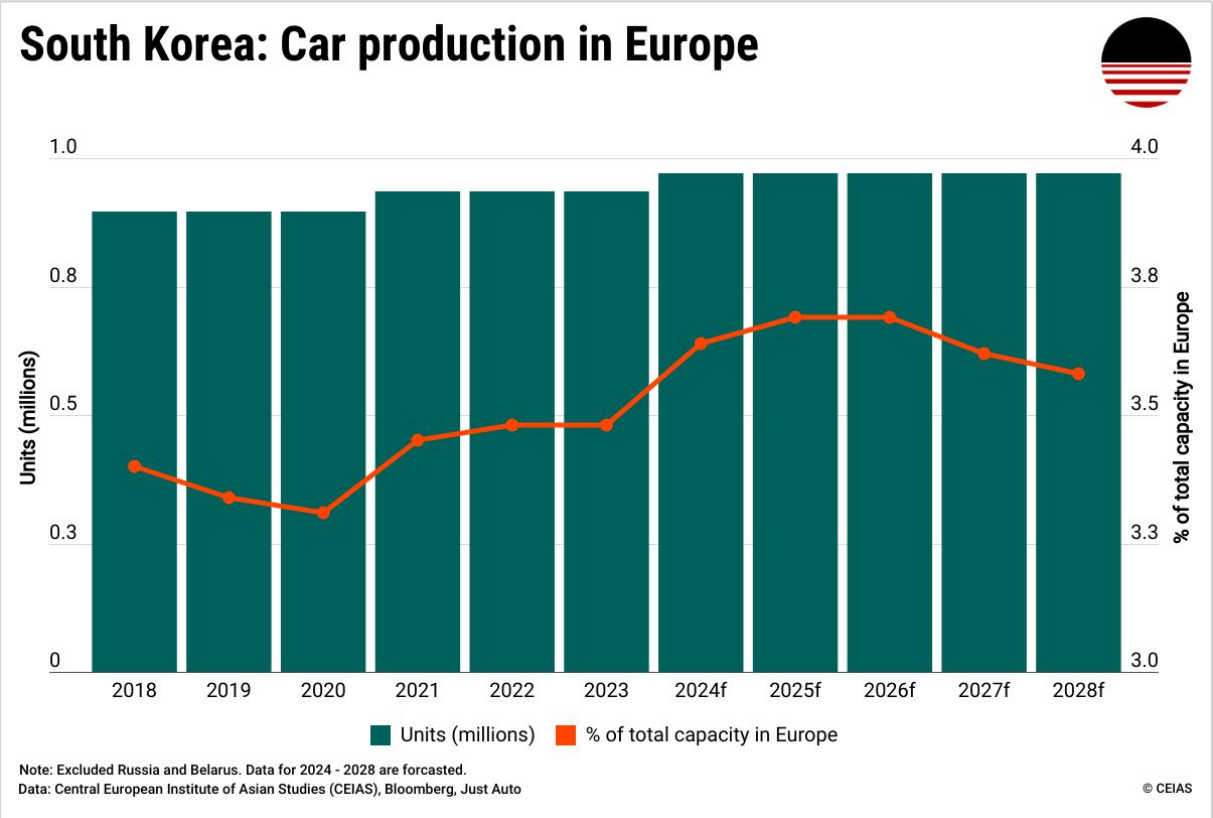
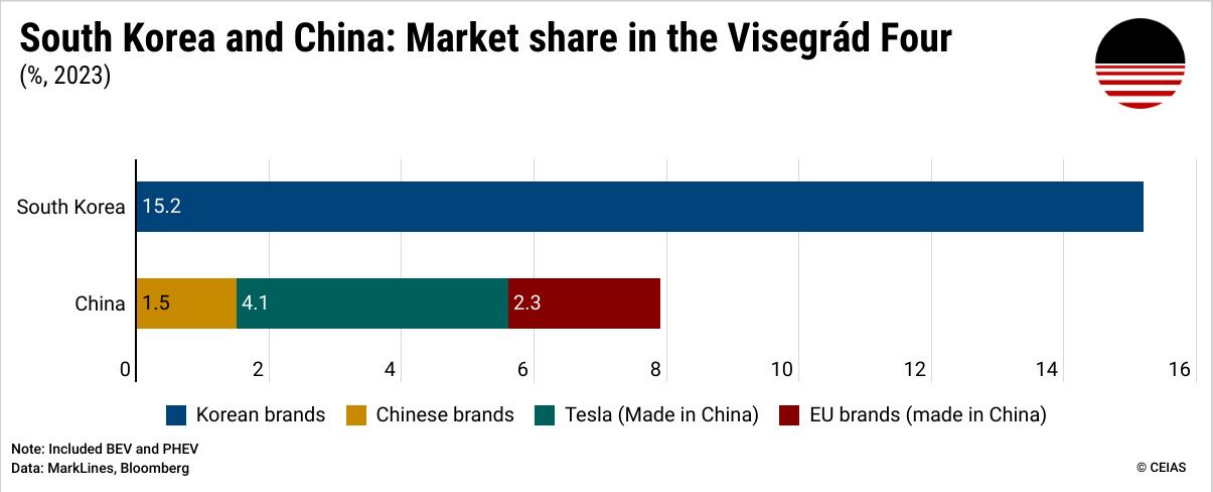


Figure 7



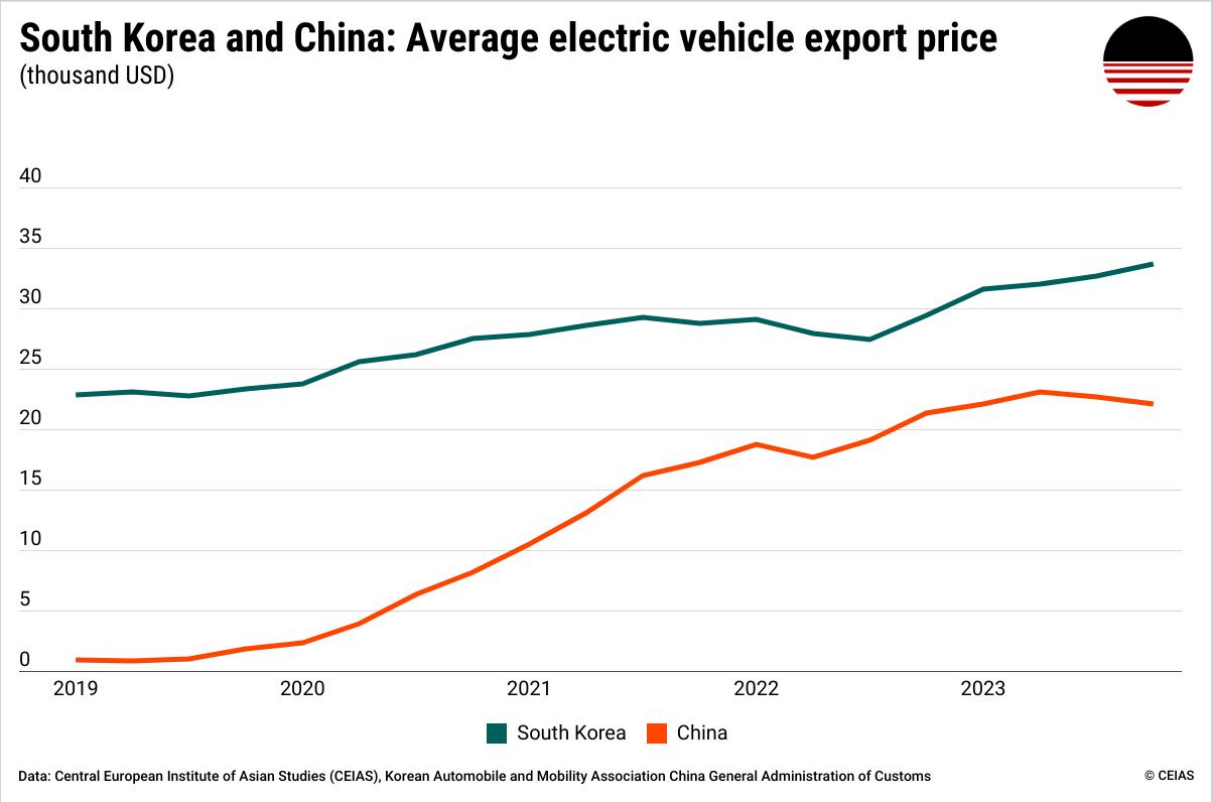
The rise of Chinese EV producers

Chinese car manufacturers have only emerged as competitive players globally since the rise of EVs in the early 2020s. Historically focused on ICE production, the CEE region saw minimal Chinese investment before 2020 due to the limited integration of Chinese producers into global supply chains. However, this dynamic has shifted recently, as China became a world leader in electromobility. Nevertheless, the motivations driving Chinese investments in the CEE markets differ significantly from those of South Korean and Japanese carmakers.

Unlike South Korean and Japanese firms, which were drawn to the CEE region by lower production costs, Chinese manufacturers have little incentive to pursue cost advantages. Thanks to China's relatively low labor costs, economies of scale, advanced EV technologies, and modern automated factories, Chinese carmakers can already produce vehicles at a lower cost than most global competitors.[43] This cost differential diminishes the appeal of establishing production facilities in the CEE region for purely economic reasons, setting Chinese firms apart from their East Asian counterparts (Figure 8).

Chinese firms invest in the CEE region primarily to achieve regulatory alignment with European institutions. First, Chinese exports to Europe must comply with environmental regulations, most notably the carbon border adjustment mechanism (CBAM), which will be fully implemented in 2026 and impose costly requirements on Chinese exports.[44] Second, Chinese firms face relatively high tariffs and duties to European customs when exporting vehicles to Europe. The recently adopted countervailing duties on Chinese-made battery electric vehicles to the EU increased tariffs on cars by as much as 45%. These duties stem from EU investigations, which concluded that China's alleged market-distorting practices—such as state-driven resource allocation, economic planning, and preferential treatment for key sectors—have facilitated the rapid export of Chinese EVs into Europe.

Figure 8



To avoid the rising costs of environmental regulations, tariffs, and countervailing duties, it is often more cost-effective for Chinese firms to manufacture cars directly within the EU. However, regulatory considerations have meant that Chinese EV companies limit their EU operations to the final stages of car production, such as assembly, a low-value-added activity. This allows firms to minimize exposure to tariffs while retaining the higher-value segments of the production cycle—such as battery manufacturing—within China.[46] This creates new forms of import dependency, as many components for both EVs and batteries are shipped from China to the EU.

This strategy contrasts with the approach of South Korean and Japanese firms, which also initially focused on assembly when entering the CEE market. Over time, however, these firms expanded their operations to include other parts of the manufacturing cycle, such as research and development, design, and branding. Unlike Chinese companies, South Korean and Japanese manufacturers source a significant portion of intermediate goods locally within the CEE region or the broader EU, reflecting their deep integration into regional supply chains. This embeddedness reduces dependence on their home countries and strengthens ties with local economies.[47]

Lastly, Chinese companies invest in the CEE region to foster goodwill with local and European politicians, serving economic and political objectives. From a purely commercial perspective, maintaining positive relations with local governments allows firms to lobby for favorable regulations, subsidies, or preferential treatment. Politically, these companies can act as vehicles for advancing the strategic

interests of the Chinese state.[48] For instance, Leapmotor's joint venture project with Franco-Italian carmaker Stellantis was reportedly abandoned under pressure from the Chinese government, which sought to respond to Poland's support for countervailing duties on Chinese EV imports (see case study).

Difference in impact on V4

The political objectives of Chinese firms are influenced not only by the nature of China's regime, which differs from the democratic governments of South Korea and Japan, but also by the prevalence of state-owned enterprises (SOEs) in China. Firms such as SAIC, Chery, and Dongfeng, which are directly owned by the Chinese state, have made inroads into European markets. While South Korean and Japanese companies maintain close communication with their governments, they are privately owned entities primarily driven by profit-maximization strategies. In contrast, Chinese SOEs often pursue both economic and political objectives simultaneously.

Chinese EV makers also possess some of the most advanced technology and manufacturing processes, enabling them to produce cheaper and more advanced vehicles, which gives them a competitive edge. However, this technological advantage comes with a strong emphasis on protecting intellectual property. While all companies guard their technological know-how, industry leaders like Chinese firms are particularly cautious. This reluctance to engage in technology transfer has implications for workforce development. Chinese factories in the CEE region offer less potential for skills development than their South Korean and Japanese counterparts.[49]

The divergent motivations and incentives of Chinese, Korean, and Japanese companies result in distinct investment strategies in the CEE region. Chinese EV makers typically adopt two approaches: invest in the construction of new factories and establish joint ventures (JVs) with local manufacturers. Conversely, South Korean and Japanese producers focus on upgrading existing factories to enable the production of electric vehicles. This difference leads to several key outcomes.

First, Chinese companies primarily engage in greenfield investments—building new factories as sole investors—while South Korean and Japanese companies use brownfield investments, utilizing and retrofitting existing facilities. As a result, Chinese investments in EV production in the CEE region are larger, encompassing the construction of new facilities and the purchase of advanced machinery. Secondly, Chinese greenfield investments expand overall production capacity by adding new facilities. In contrast, South Korean and Japanese firms often reduce ICE production when adding EV models, resulting in smaller net increases in total output. Thirdly, Chinese greenfield investments typically generate hundreds of new jobs, while South Korean and Japanese firms tend to transition existing employees to EV production lines, creating fewer new positions.

Chinese and South Korean firms also differ in their approach to the types of vehicles produced in the CEE region. South Korean EV manufacturers largely concentrate on non-premium models. In contrast, Chinese companies like BYD plan to invest in a balanced portfolio of economy and non-premium vehicles, potentially intensifying competition in the medium market segment.

The geographical focus of EV investment also differs between the two groups. South Korean and Japanese firms concentrate their operations in Czechia and Slovakia, with smaller capacities in Hungary and no production in Poland. In contrast, Chinese firms focus heavily on Hungary and have a notable presence in Slovakia, with investments concentrated in a few large projects. Poland is an exception, as Chinese companies invest there through joint ventures with established local firms. Interestingly, there is no active or planned Chinese EV investment in Czechia.

Role of governments

While debates about the security implications of Chinese investment in the V4's EV sector persist, governments in the region generally adopt a positive stance and actively encourage such investments.[50] However, Slovakia and Hungary follow traditional strategies, such as offering tax cuts and investing in infrastructure development. In contrast, the Polish government has pushed for the establishment of a domestic EV carmaker, which aims to leverage Chinese technology to produce smaller, affordable cars tailored to the domestic market, facilitating risk and profit sharing and fostering technological upskilling of the local workforce.

Another significant pull factor for Chinese and South Korean firms is the governmental policies influencing incentives and reshaping the risk-reward calculations for private investors. These policies are driven both by EU institutions and national governments.[51] At the EU level, the two major areas of policymaking impacting the EV sector are the green transition and the emerging economic security initiatives. Meanwhile, national governments primarily rely on traditional supply-side incentives to attract foreign investors.[52]

The European Green Deal, for instance, commits EU member states to phase out the production of ICE vehicles. Under the "Fit for 55" program, automakers will be prohibited from producing ICE vehicles from 2035 onwards, driving the transition to EV production. This shift has created a pressing need to upgrade existing car manufacturing facilities or construct new ones, leading to increased investment in the V4 region.[53] Notably, a significant portion of this investment has come from East Asian countries, particularly China.[54]

European economic security policy has evolved since the outbreak of the Covid-19 pandemic, culminating in a coherent framework with the publication of the "Economic Security Strategy" in 2023.[55] This strategy aims to promote the competitiveness of European strategic industries and the industrial base, protect

regional economies from economic coercion and unfair practices, and foster partnerships with like-minded states.[56] In the context of EV production, it includes policies to encourage battery manufacturing, safeguard critical raw material supplies, and regulate foreign investments and subsidies.[57]

Amid the rise of electromobility, the V4 countries continue to benefit from their traditional strengths in car manufacturing. However, these advantages have been reshaped by EU-level policies targeting the green transition and economic security. Specifically, efforts to de-risk supply chains and enhance domestic production resilience have attracted substantial greenfield investments from Chinese companies, which are proactively mitigating the risk of being excluded from European markets.[58]

Case study: Geely’s SEA deal with Polish car manufacturer

In November 2022, Geely, one of China's leading private automotive manufacturers, signed an agreement with ElectroMobility Poland (EMP), a Polish, government-backed electric auto manufacturer. Geely would license its Sustainable Experience Architecture (SEA) platform to EMP for use in its new Izera EV brand, including models, such as a compact SUV, an estate, and a hatchback[59].

Launched in September 2020, the SEA platform reflects Geely's rapid international expansion. Designed for scalability and adaptability, the platform caters to the diverse needs of Geely's subsidiaries, including Volvo, Proton, and Lotus.[60]

Under the 2022 deal, Poland’s EMP became the first external user of the SEA platform. The Polish state-backed firm plans to manufacture its SEA-based vehicles using Chinese technology at a fully owned plant in Silesia. As a turnkey project, EMP will produce its own SEA components under Geely's patents and designs.[61] EMP executives expressed optimism in the partnership, with CEO Piotr Zaremba stating that "SEA architecture perfectly fits the Izera product concept" and praising the SEA as the highest-class industry know-how that can bring new business opportunities.[62]

A significant driver of Chinese EV corporations' overseas ventures is their effort to mitigate potential EU tariffs. These firms aim to secure market access and reduce tariff risks by establishing manufacturing operations within Europe. Besides Poland, Geely is also exploring potential EV production opportunities in Spain.[63]

However, Geely's deal with EMP faces challenges. The planned Izera manufacturing plant relies on EU funding, but the Polish government, which is still negotiating fund allocations with Brussels, has expressed skepticism about the investment's returns. In April 2024, Deputy Minister of Development Funds Jan Szyszko called the project "not an ideal solution." Warsaw now faces a dilemma: support a controversial project or risk Geely redirecting its investments to another EU country.[64]

While China's expansion in EV and V4 is still subject to political-economic factors and changing policies, Geely's venture—and, more broadly, Chinese EV firms' push into the EU—demonstrates that, despite policy complications and tariff risks, the Chinese EV sector's scale and internationalization are on an expansionary trajectory.

Case study: Leapmotor's uncertain EU entry through venturing with Stellantis

Leapmotor's joint venture with Stellantis in Poland highlights how Chinese outward investments are increasingly subject to geopolitical uncertainties and Beijing's use of economic ties as tools for political leverage. In May 2024, Chinese auto manufacturer startup Leapmotor established a joint venture with Stellantis, an Italian-American-French automotive manufacturer headquartered in the Netherlands, to target the European market. The joint venture allows Leapmotor to tap into Stellantis' extensive global sales and after-sales network while contributing to its EV expertise. Stellantis holds a 51% stake in the venture.

This joint venture began when Stellantis acquired 21% of Leapmotor for €1.5 billion in October 2023. Within five months, Leapmotor addressed challenges related to products, compliance, sales channels, and services under the joint venture. Using Stellantis' plant in Tychy, Poland, the venture produces the compact urban T03 model and the large SUV C10, priced at €19,500 and €36,400, respectively. These models are distributed across Europe, with access to Stellantis' robust after-sales service network.

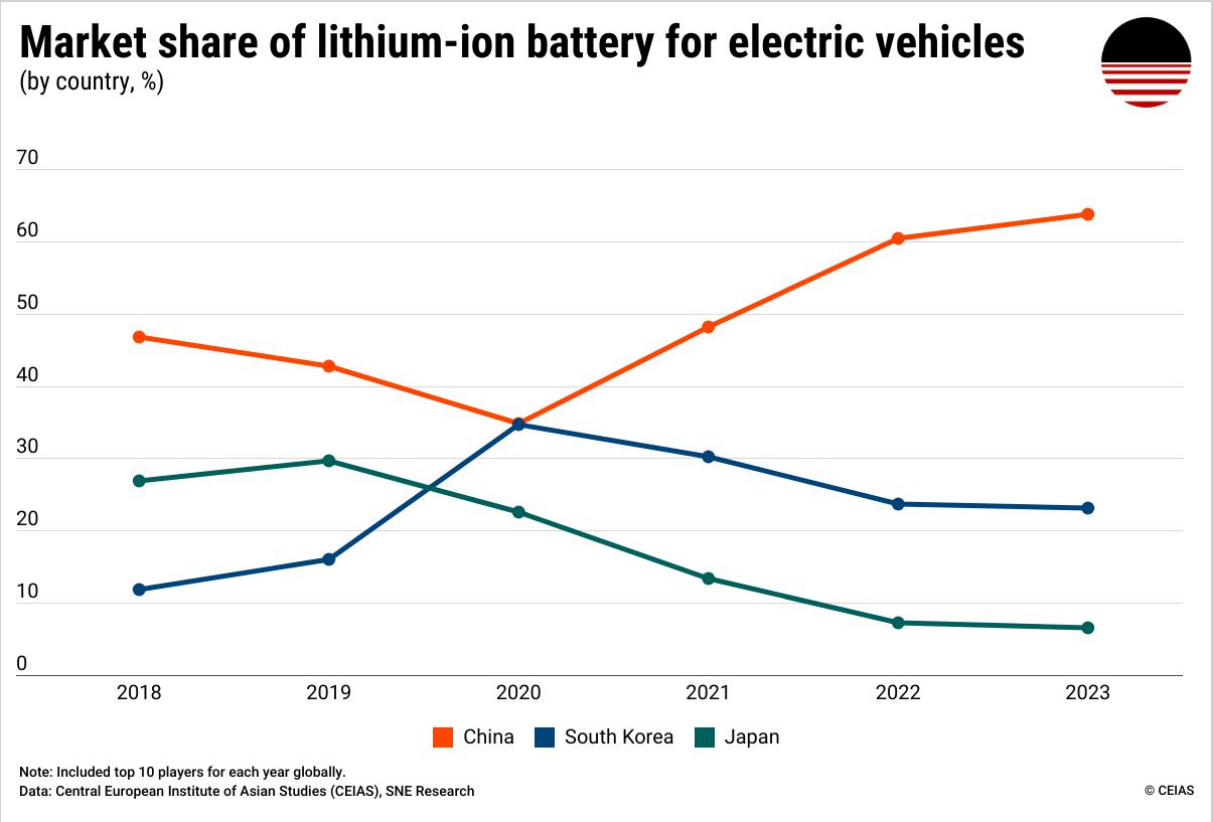
The deal was initially an example of leverage for the firm's R&D and parts manufacturing. By collaborating with an established European manufacturer, Leapmotor could reduce costs, navigate market entry barriers, and integrate its research and development (R&D) capabilities into the European production ecosystem while avoiding EU tariffs.[65]

However, the venture soon became entangled in geopolitical tensions. In November 2024, plans to produce a second EV model at the Polish plant were scrapped following Beijing's retaliation against the EU's imposition of countervailing duties on Chinese-made EVs. Beijing reportedly instructed its automakers to halt investments in countries that supported the duties, such as Poland. Instead, production of the new model was redirected to Stellantis plants in Slovakia or Germany—countries that opposed the duties. It is worth noting that producing the model in a new location would incur higher utility and labor costs than in Poland, indicating that this decision is political rather than commercial.[66]

East Asian battery makers in the V4 countries

The automotive industry's shift towards EVs has been more profound for supply chains than for automakers. This is due to the centrality of battery manufacturing. Unlike the ICE sector, Europe currently lacks sufficient production capacity and technological expertise in battery manufacturing, with the industry largely driven by developments in East Asia (Figure 9).

Figure 9



EV batteries rely on two electrodes, cathode and anode, for the flow of electric charge. The most common chemicals used in battery production are Nickel Manganese Cobalt Oxide (NMC) and Nickel Cobalt Aluminum Oxide (NCA)—collectively known as ternary lithium batteries—as well as Lithium Iron Phosphate (LFP).

Ternary batteries prioritize high performance, offering longer driving ranges and shorter charging times. However, they are more expensive and less reliable in terms of thermal safety. They generally perform better in colder climates and are preferred by automakers like Tesla, BMW, and GM. On the other hand, LFPs are more cost-efficient and reliable in terms of safety but have lower energy density.[67]

South Korea and Japan dominate the ternary market, while China is now the largest producer of LFPs and clearly focuses on prioritizing LFP sales. This trend is reflected in the growing global market share of Chinese battery manufacturers, which rose from 43% in 2018 to 64% in 2023.[68] This growth has primarily come at the expense of Japan and, to a lesser extent, South Korea.

A key factor in this shift is Panasonic, Japan's leading battery maker and a major supplier to Tesla, which has focused on producing high-quality ternary lithium batteries. However, the trade-off is that LFP's cost-effectiveness makes it suitable for a broader range of EVs and consumers (Figure 10). In contrast to Japan, South Korea has been more proactive in diversifying its battery production to include various types, positioning itself to tackle the challenges posed by China's expanding dominance.

The technological gap has widened for several reasons. A significant advantage for Chinese companies stems from substantial government subsidies. Notably, three of the top ten direct subsidy recipients among publicly listed firms in China are from the EV sector (Figure 11).

Figure 10

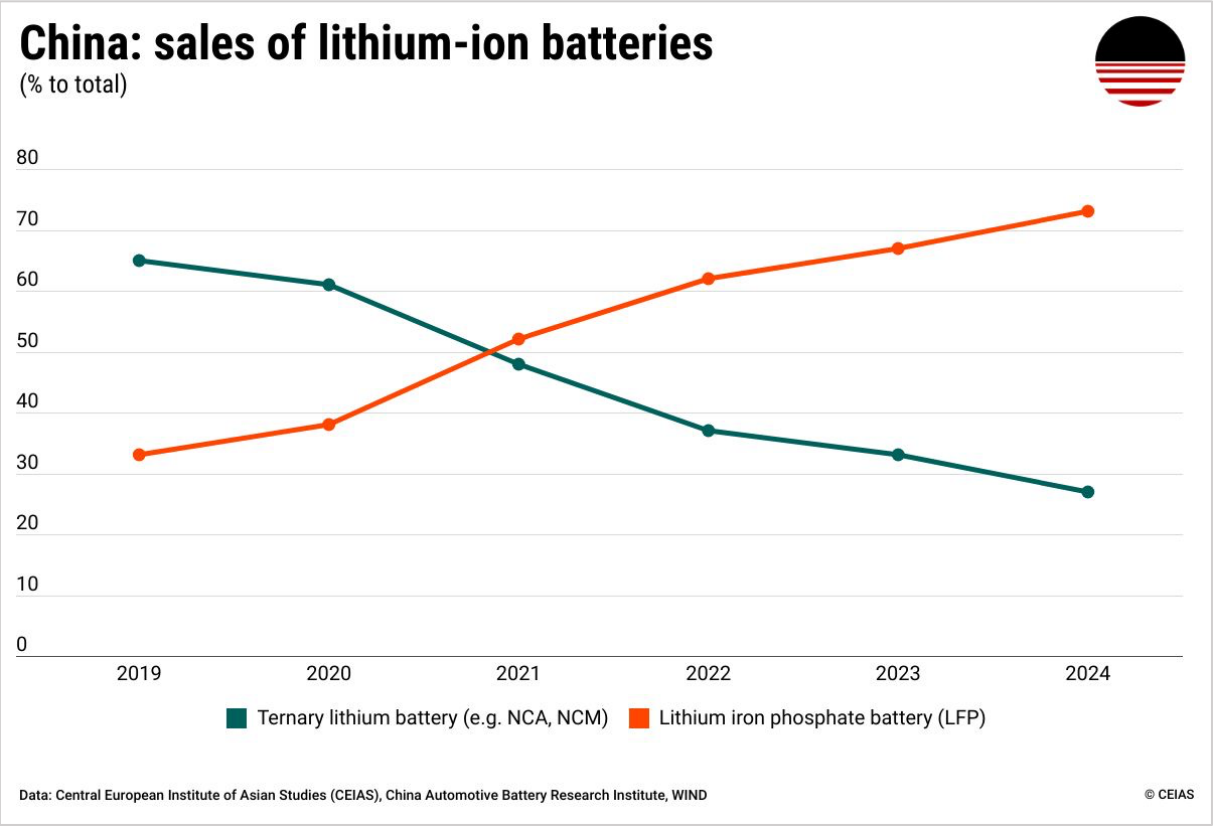


Figure 11

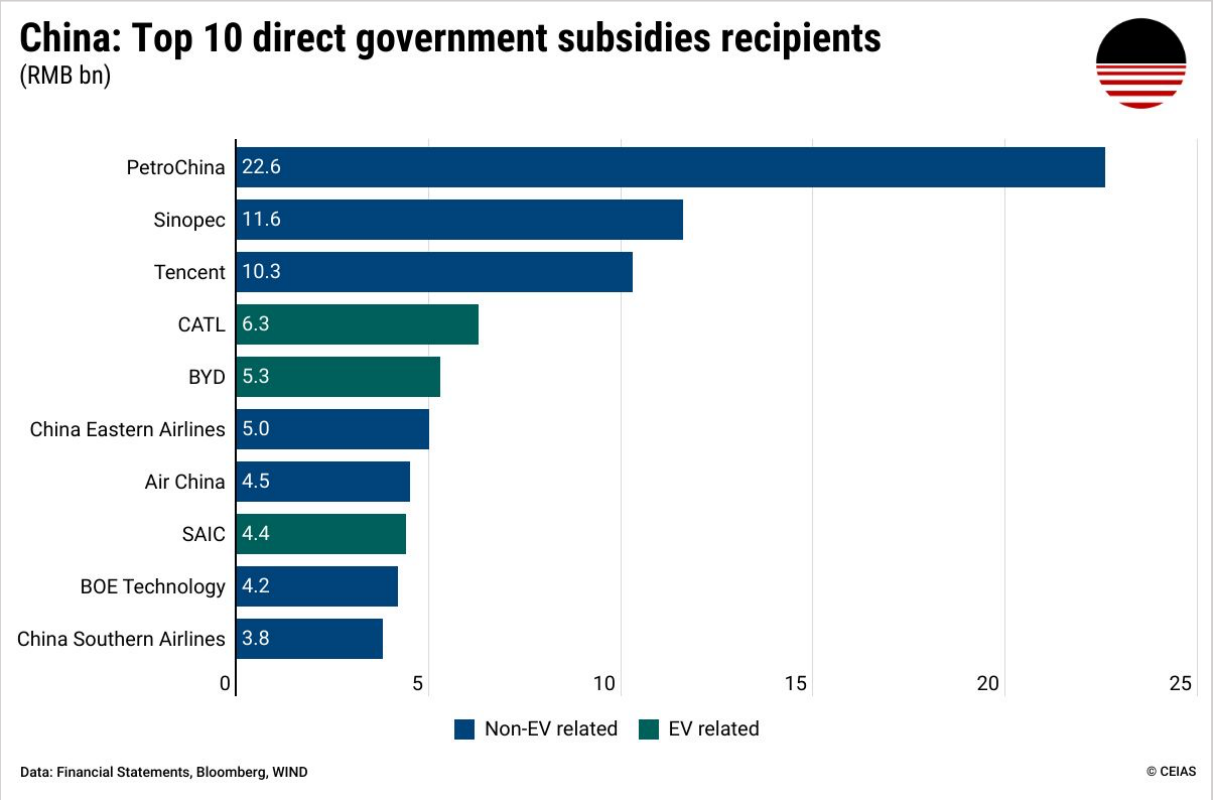
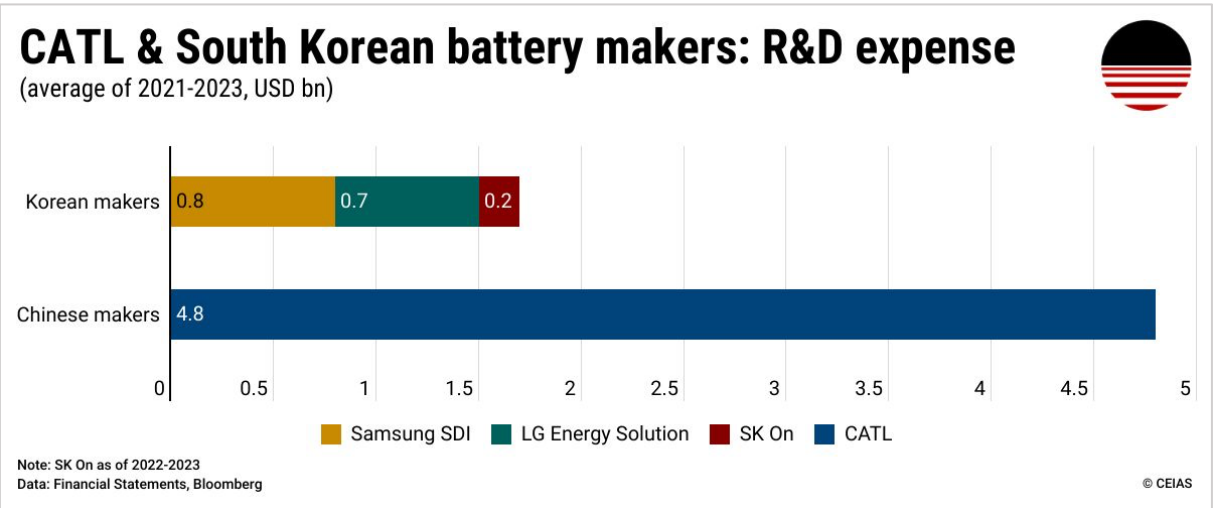


Figure 12



However, another more direct factor contributing to the widening technological gap is the significantly larger domestic market revenue, which enables Chinese firms to invest more heavily in R&D than their international competitors. For instance, China's largest battery manufacturer, CATL, allocated an average of 4.8% of its total revenue to R&D between 2021 and 2023. In absolute terms, this investment surpassed the combined R&D spending of South Korea's three largest battery makers: Samsung SDI, LG Energy Solution, and SK On (Figure 12). The disparity is even more pronounced when other Chinese EV makers, such as BYD, are considered.

Battery supply chain

The EV battery supply chain consists of four steps. Upstream activities involve extracting raw materials for battery production, such as lithium, cobalt, and other minerals. Chinese companies have gradually taken control of upstream processes in sourcing nickel, lithium, cobalt, graphite, and manganese—all vital for lithium-ion cells. As a result, Chinese firms hold a majority stake in companies processing lithium products and minerals.[69] A similar dominance is seen in nickel extraction, where the conversion of nickel-to-nickel sulfate—a critical component in ternary lithium batteries—is controlled by Chinese entities. Of the 16 companies globally capable of this process, 11 are Chinese. By 2030, China is projected to produce 824,000 metric tons (mT) of nickel sulfate annually, compared to just 146,000 mT in North America and Europe combined.[70]

Midstream processes involve refining raw materials to create cathode and anode active battery materials. This is passed downstream to assemble battery cells into modules and then sold to automakers. Once batteries reach the end of their life cycle, they can be reused and recycled.[71] Currently, China dominates the midstream processing step, controlling nearly two-thirds of global lithium processing capacity and the vast majority of cobalt and graphite refining. This dominance extends further downstream, with China producing nearly 90% of cathodes and virtually all anode components globally.[72] China's lithium-ion battery production overcapacity stands at 600%, meaning it produces six times the actual market demand. In comparison, Europe and South Korea have overcapacity levels of 140% and 90%, respectively. This overcapacity allows China to manufacture EV batteries at a fraction of the cost in Europe, maintaining a technological and economic edge,[73] driven in part by lower production costs and a large domestic market.[74]

Besides the cathode and anode, lithium batteries have two more components: the electrolytes that facilitate the movement of ions and the separators that prevent contact between the cathode and anode. China's position is again dominant. Between 2014 and 2020, China experienced an increase in market share in all four components, but by 2020, it had secured at least 60% of all of them (Figure 13).

Currently, Chinese firms process 60% of EV-related rare earth minerals, have a strong position in nickel ore conversion, control 90% of manganese refining capacity, and account for six out of the world's top 10 EV battery makers—as opposed to three from South Korea and one from Japan.[75]

China plays an even more dominant role in cell components; its market share rose from 54% in 2018 to 82% in 2023 (Figure 14). South Korea has traditionally not been strong in this field, which could potentially cause a bottleneck in its battery manufacturing. This is why there are now more policies in favor of investing further in developing capabilities in recycling.

Figure 13

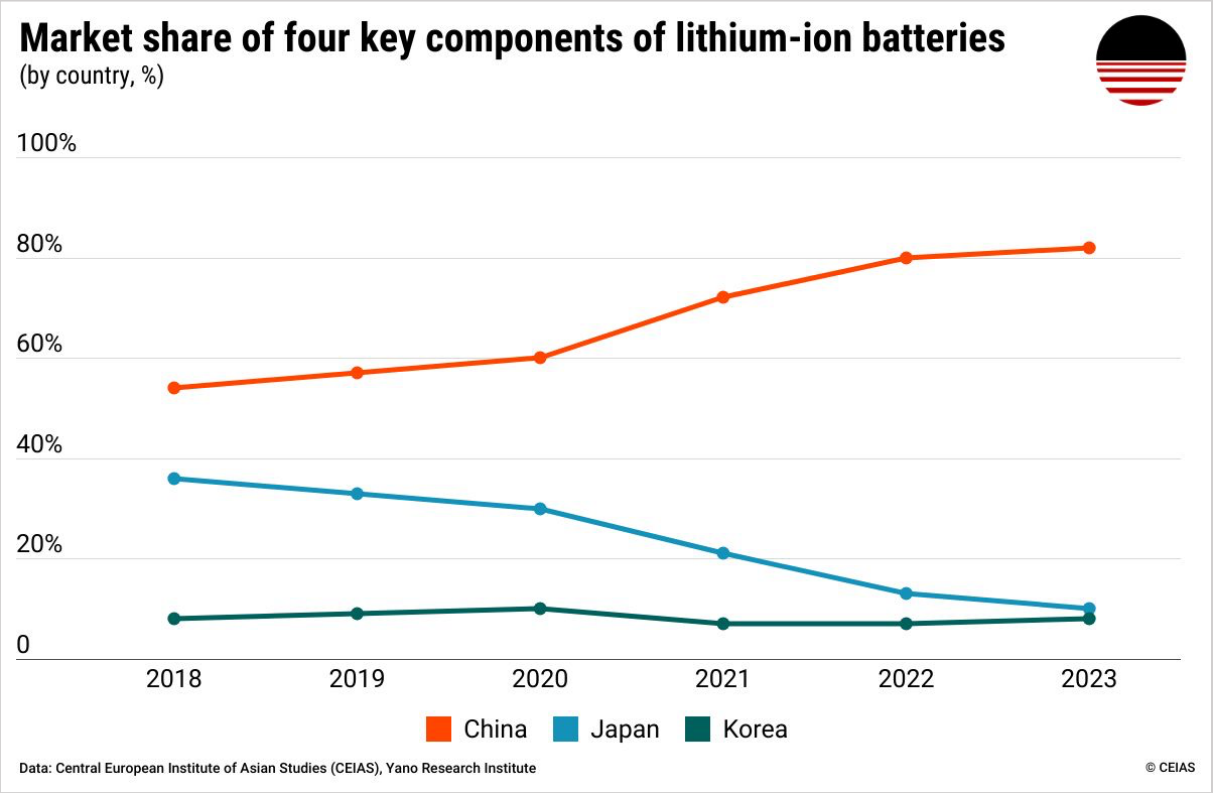
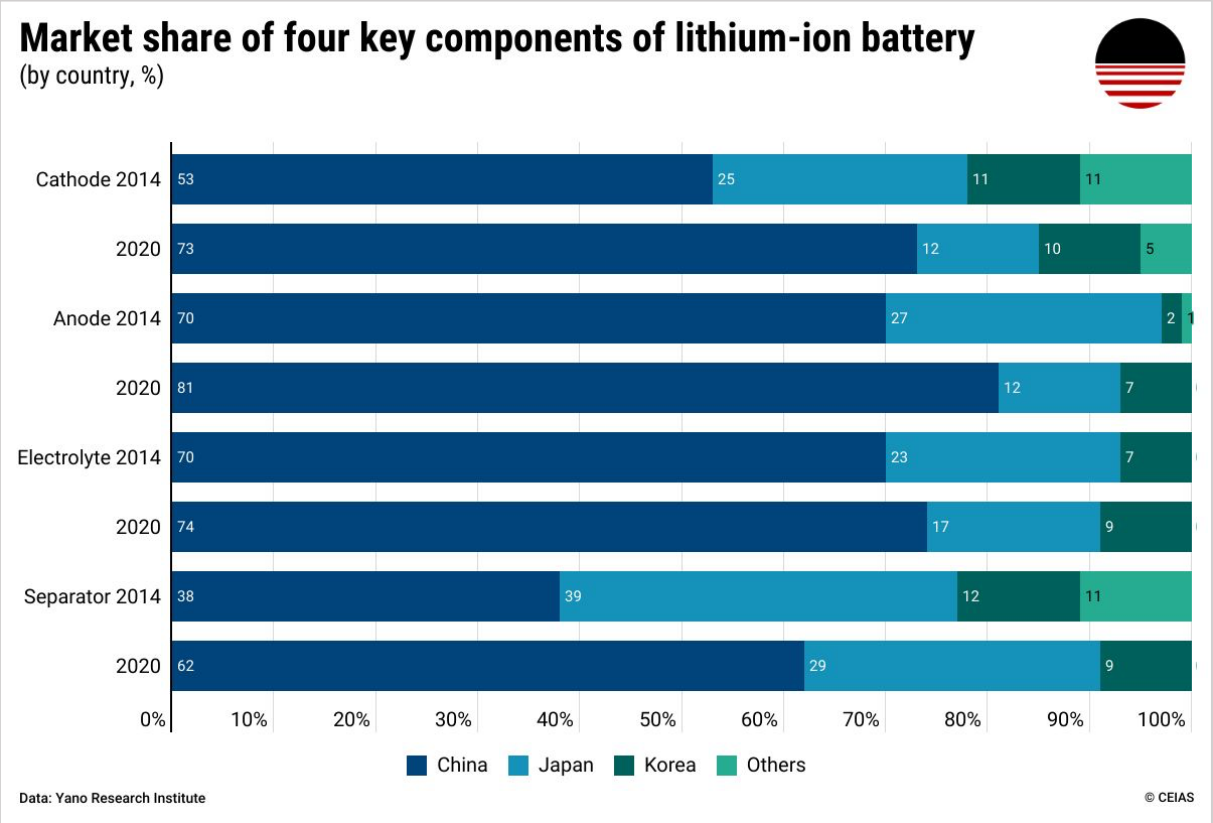

Market share of four key components of lithium-ion batteries
(by country, %)
100%
80%
60%
40%
20%
0
2018
2019
2020
2021
2022
2023
China
Japan
Korea
Data: Central European Institute of Asian Studies (CEIAS), Yano Research Institute
© CEIAS

Figure 14



Indeed, another key aspect of the EV battery supply chain is recycling. Effective reuse and recycling can reduce the need to source new materials and alleviate the long-term pressure on battery demand. With the accelerating global adoption of EVs, the recycling of EV batteries—particularly the extraction of valuable materials like lithium, cobalt, nickel, and manganese—is poised for significant growth.

A successful EV battery recycling mechanism can create a closed-loop ecosystem for the EV lithium battery industry, where used batteries and manufacturing scrap from the upstream supply chain stage are repurposed. After assessing a battery's recyclability, it undergoes a pretreatment process and is shredded into black powder, a mixture of minerals to be separated. The hydrometallurgical process, which uses acid leaching, is increasingly preferred over the pyrometallurgical process, which relies on high temperatures, is less efficient, and cannot recover high-purity lithium. The hydrometallurgical process can recover over 98% of key metals by processing black power through acid leaching.[76] While recycling rates remain low today, major manufacturers like Tesla and Ford are investing in systems to significantly improve their mineral recovery rates.[77]

Recycling is set to rise in importance in the European market. In 2023, the EU passed Regulation 2023/1542, which requires battery companies to conduct supply chain due diligence for key raw materials, to disclose carbon footprints from July 2024, and to report recycled lithium, cobalt, and nickel content from July 2025. From 2030 onwards, batteries must contain a certain percentage of recycled materials—12% for cobalt, 4% for lithium, 4% for nickel, and 85% for lead—while

used batteries will have a recycling target by weight of 80% for lead-acid and 70% for Li-ion.[78]

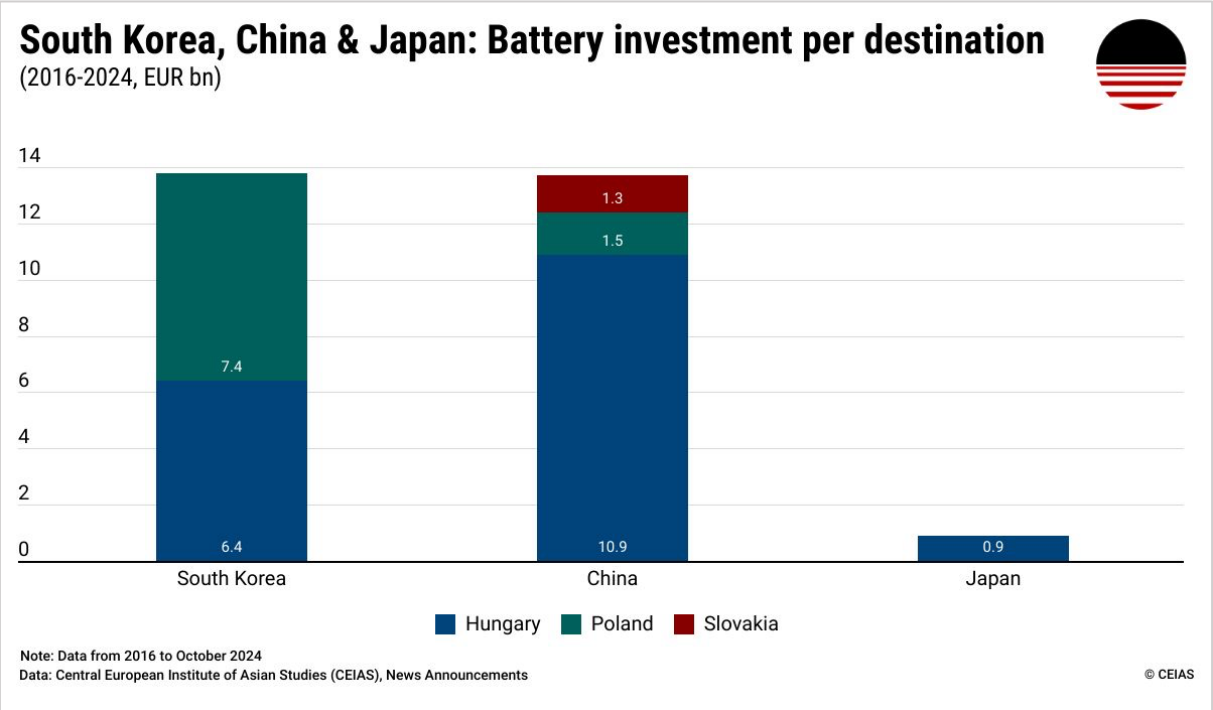
Regarding recycling, South Korea is developing a technological advantage to reduce its reliance on Chinese battery materials. The Korea Atomic Energy Research Institute has developed a process to recover nearly 97% of lithium from spent EV batteries and extend anode material lifespan by 30%. South Korea has also invested significantly in R&D and policy initiatives to boost EV battery recycling, aiming to make EVs more affordable in the long run. Meanwhile, China faces inefficiencies in its recycling sector. Less than 25% of decommissioned batteries are sent to approved recycling facilities, with the majority handled by unregulated small workshops.[79]

Battery supply chains in the V4

East Asian investors have established dominance in the V4 region's battery manufacturing and upstream supply chain activities. A notable aspect of this landscape is the intense competition between Chinese and South Korean companies. Collectively, both nations have invested approximately €14 billion in the region, with Japanese investments trailing at nearly €900 million (Figure 15).

Of the V4 states, Hungary has emerged as a top destination for investment from East Asia, followed by Poland and Slovakia. In contrast, Czechia has received almost no investment from East Asian countries in this sector. However, the selection of investment destinations varies significantly among individual East Asian countries.

Figure 15



Chinese investment is primarily concentrated in Hungary, with smaller shares directed to Poland and Slovakia. South Korean investment is evenly split between Poland and Hungary. The rationale seems mostly driven by existing partnerships; battery manufacturers tend to follow their EV customers when making investment decisions. However, this might not be true for all investment decisions, as the largest one, by Chinese CATL, appears to have been largely influenced by political motives.[80]

Looking at the distribution of investment across different stages of the battery supply chain—battery parts suppliers, battery manufacturers, EV parts suppliers, and battery recycling—most of Chinese and South Korean investments have been directed toward battery manufacturing (Figure 16). Nearly two-thirds of this investment is concentrated in Hungary (chart), driven largely by a massive €7.3 billion investment from Chinese battery giant CATL. This single investment dwarfs others in the region, being more than twice the size of the second-largest investment—South Korea's LG Energy Solutions in Poland—and roughly equal to the next four largest investments combined.

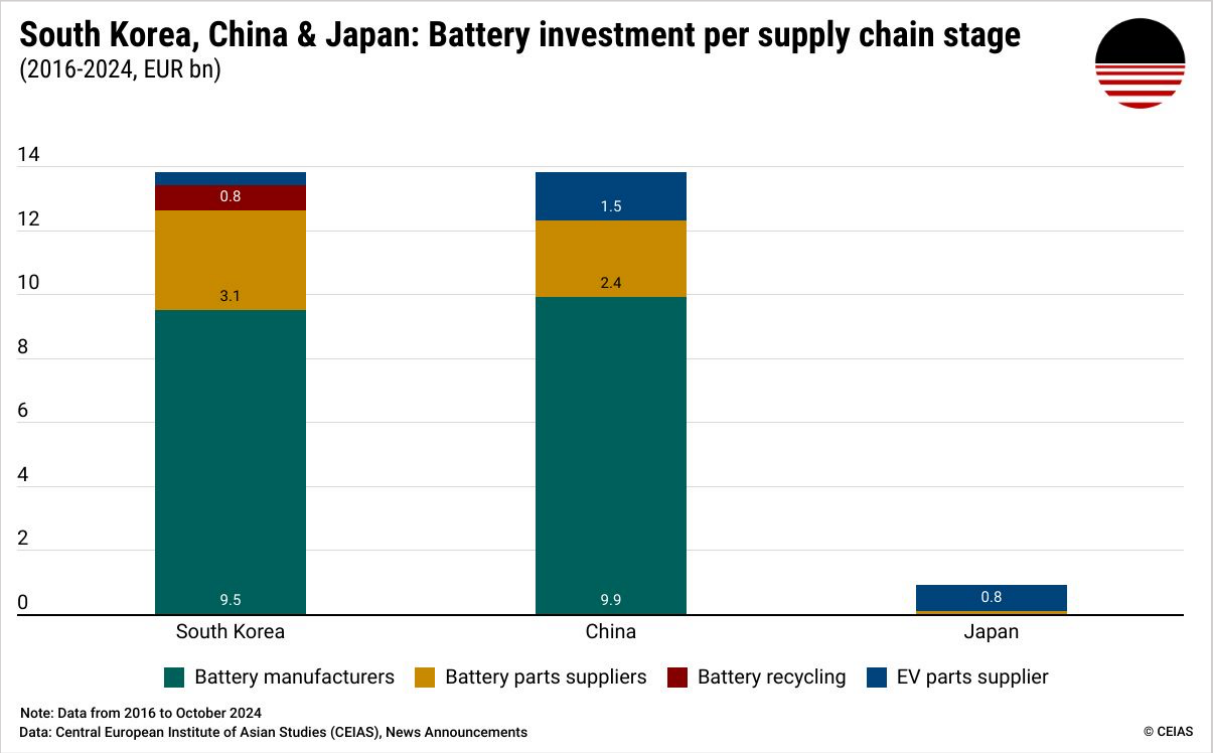
Chinese firms appear to be creating industrial clusters—geographic concentrations of interconnected businesses and suppliers in one field, which they also apply in their domestic facilities in China. This typically leads to increased efficiency and innovation, the development of a larger pool of skilled labor, and the presence of firms providing specialized services.[81] On the other hand, it creates concentration risks, such as political risks associated with doing business with a single country, and there might be a smaller number of critical suppliers that most manufacturers rely on. Conversely, South Korean investment patterns reflect a greater focus on risk management at the expense of marginally lower efficiency.

There is a larger number of smaller investments in battery parts manufacturing, which geographically overlaps with the distribution of battery plants since suppliers follow their major customers. The most interesting dynamic can be seen in battery recycling, where South Korean firms dominate, with only one Chinese battery recycling investment in the V4 region.

In October 2023, South Korea's Ministry of Environment reclassified EV battery waste as recyclable resources, removing its exemption under the Waste Control Act. This policy shift reflects South Korea's commitment to reducing reliance on Chinese raw material imports and strengthening its domestic EV closed-loop ecosystem.[82]

Since EV battery manufacturing is a new industry in the V4 region, nearly all investments are greenfield investments, with only a few repurposing old manufacturing facilities. These investments contribute to local GDP growth through construction activities and the operation of these new factories.

Figure 16



Perhaps the most important contribution is the expansion of the workforce in these factories. Our research shows that the number of potential new jobs created exceeds 50,000 across all V4 countries.[83] Additionally, the novelty of this technology should lead to technology transfer and the acquisition of new skills by the local labor force.

With their expansion into Europe, Chinese EV battery companies are bringing their partnership model with them. Several key Chinese companies are already supplying batteries to European automakers. For example, CATL provides batteries to Volkswagen, Stellantis, and Solaris, while CATL and EVE have been selected as suppliers for BMW's EV cylindrical batteries. Stellantis sources batteries not only from CATL but also from two other Chinese companies, Rept Battero and SVOLT, alongside South Korean firms LG Energy Solution and Samsung SDI.

Another challenge South Korean EV battery companies face is that some Chinese competitors are vertically integrated. For instance, BYD not only manufactures EV batteries but also produces EVs, benefiting from Beijing's policies that actively promote EV production. This integration creates an economy of scale that is hard to compete with. To remain competitive, South Korean companies must focus on staying relevant to European automakers by offering reliable ternary batteries tailored to prevailing business needs. Differentiation lies in building a strong reputation for quality, safety, and transparency. This would enable South Korean firms to position themselves as trusted partners, offsetting China's aggressive price competitiveness and large-scale production capabilities.[84]

Policy recommendations

South Korea's arms industry has greatly benefited from the increasing emphasis on values-driven policies within the European defense industrial supply chain. This underscores the importance of policymakers and industry leaders adopting forward-looking strategies that safeguard defense production capabilities while aligning with a value-based foreign policy. Similarly, South Korean EV and battery manufacturing firms have emerged as formidable players in the V4 region, capable of competing with Chinese counterparts. To sustain and enhance its competitiveness, South Korea must continue strengthening relationships with diverse stakeholders in the region. This includes aligning strategies with the needs and priorities of local governments and businesses, ensuring mutual benefits and long-term partnerships.

Defense

- Continuous R&D: South Korea should invest in R&D in land-warfare systems and leverage its cost advantage over European suppliers like France and Germany to stay competitive. Expanding into aerial warfare could also be beneficial, with offerings like the KAI T-50 providing affordable fleet upgrades for CEE post-Soviet jet donations to Ukraine.

- Diplomatic flexibility: South Korea should maintain diplomatic flexibility among like-minded countries and position itself as a neutral and interoperable supplier. Poland's embrace of South Korean arms stems from its decision to mitigate the risks of overly relying on US defense supply chains. Moreover, Slovakia has had an uneasy relationship with the EU and the US, but has a neutral view of South Korea, leading to its decision to purchase South Korean anti-aircraft systems and consider the K2.

- Better financing solutions: South Korean arms manufacturers should collaborate with policy and commercial banks to provide flexible financial support for international buyers. For instance, an arms deal with Poland was nearly jeopardized due to credit limitations at Eximbank, requiring legislative intervention. To prevent similar issues, South Korea's financial sector must develop adaptable financing options, including new legislative measures and comprehensive financial packages.

- Closer collaboration with buyers: To counter rising protectionism, South Korea's arms industry should deepen ties with European counterparts through joint ventures and R&D programs. This approach could address

competition concerns, like Poland's preference for its domestic Krab howitzer over South Korea's K9. Licensing agreements, such as Poland's deal to locally produce 180 K2 tanks, enhance integration while supporting host-country economies. Collaborations like these could enhance South Korea's role in Europe's defense ecosystem while driving advancements in adjacent sectors, such as electric vehicles and batteries, generating broader economic benefits.

- Narrowing the trade surplus if necessary: South Korea could balance imports by purchasing European weapons, starting with Poland's Warmate drones. This aligns with increased interest in drones for asymmetric warfare, spurred by lessons from Russia's invasion of Ukraine. This strategy would also narrow South Korea's trade surplus and maintain South Korea's favorable political standing in the EU.

- Diversification to new sectors: South Korea should strengthen its focus on armored vehicles and artillery while expanding into aircraft, missiles, AI, and drones for its competitiveness. Diversification into naval technologies or collaborations on advanced emerging technologies, such as military UAV development, can provide sustainable growth opportunities.

EV and battery

- Apply long-term strategic planning: South Korea's success in competing with China in the battery sector stems from strategic planning, within which the country selected and supported the development of a particular element in the battery supply chain, established long-term relationships with strategic buyers to ensure continuity of demand and strategically locates its investments to avoid concentration risks. Hence, the South Korean government should continue fostering strategic thinking and ensure close alignment with the business community to maintain a unified long-term framework.

- Nurture relationship with domestic suppliers: South Korean firms can only achieve a competitive advantage vis-a-vis better-funded Chinese firms through enhanced cooperation with local suppliers. Many Korean firms have been active in the region for the past two decades and established close relationships with local stakeholders. These should be further utilized to achieve synergies, economies of scale, and manufacturing efficiencies.

- Geo-economic support from South Korean diplomacy: South Korea's government should engage stakeholders in V4 countries to ensure a favorable business environment, support for new initiatives, and a positive perception of South Korean contributions. The recently concluded Slovak-Korean strategic partnership serves as a successful example of such collaboration.

- Continuous workforce development: The ability to educate and train local employees not only allows for achieving enhanced short-term profitability due to higher employee retention and satisfaction but also a lower number of failures or incidents. It also ensures the companies remain competitive vis-a-vis their competition in an industry with a breakneck development speed. This recommendation also implies that South Korean companies should not be closely guarding their technology but should allow for a managed technology transfer to local management and technical staff.

- Maintain sensitivity to ecological concerns: Battery production is resource-intensive, requiring significant electricity and water while posing environmental risks. South Korean firms conducting manufacturing activities in this sector should be transparent about the environmental challenges and solutions they apply to mitigate them. This would contribute to maintaining public support.

- Build on brand recognition: South Korean ICE firms have strong brand recognition in the V4 region, which can be leveraged during the transition to electromobility. However, brand recognition in the EV sector must also relate to quality products and good quality-to-price ratio, as this has traditionally been the reputation of Korean ICE vehicles.

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