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INTERNATIONAL TRADE AND INVESTMENT IN THE CONTEXT OF GLOBAL ELECTRIC VEHICLE MARKET DEVELOPMENT: THE UKRAINIAN-POLISH DIMENSION

Анотація. *Зростання світового ринку електромобілів формує нові тенденції у сфері міжнародної торгівлі та мобілізації інвестицій, що потребує наукового осмислення у контексті глобальних структурних трансформацій. Дослідження українсько-польського виміру цих процесів є актуальним, оскільки воно дозволяє виявити потенціал кооперації у межах європейського економічного простору та визначити напрями ефективної інтеграції національних економік у світові ланцюги доданої вартості. Метою статті є дослідження сучасного стану розвитку міжнародної торгівлі та інвестицій у контексті розвитку світового ринку електромобілів, а також визначення особливостей українсько-польських торговельно-економічних відносин та можливостей партнерства у сфері електромобільності.*

Розглянуто динаміку розвитку світового ринку електромобілів, визначено основні напрями інвестицій, а також проаналізовано особливості міжнародної торгівлі у цій сфері. Окрема увага приділяється польському досвіду залучення іноземних інвестицій та розширення виробничих потужностей у межах глобальних ланцюгів постачання, а також викликам і можливостям для України. У статті запропоновано SWOT-аналіз українсько-польської кооперації у сфері електромобільності, що дозволяє ідентифікувати сильні сторони (географічна близькість, виробничий та науково-технічний потенціал), слабкі сторони (недостатній розвиток інфраструктури, регуляторна нестабільність), можливості (залучення інвестицій ЄС, розвиток спільних проєктів) та загрози (посилення глобальної конкуренції, технологічні бар'єри).

Результати дослідження підтверджують, що формування ефективної українсько-польської кооперації у сфері електромобільності здатне стати важливим чинником інтеграції України у європейський економічний простір та сприяти прискоренню інноваційних процесів. Перспективи подальших досліджень пов'язані з поглибленим аналізом моделей державної підтримки інновацій, вивченням ефективності транскордонних індустріальних кластерів та оцінкою впливу інвестицій у сфері електромобільності на структурну модернізацію національної економіки.

Ключові слова: *міжнародна торгівля, прямі іноземні інвестиції, торговельно-економічні відносини, Україна, Республіка Польща, світовий ринок електромобілів.*

JEL Classification: F10, F21, L62, Q55

Absztrakt. *Az elektromos járművek globális piacának növekedése új tendenciákat formál a nemzetközi kereskedelem és a beruházások mozgósítása terén, ami tudományos vizsgálatot tesz*

szükségessé a globális strukturális átalakulások kontextusában. E folyamatok ukrán-lengyel dimenziójának kutatása időszerű, mivel lehetővé teszi az európai gazdasági térségen belüli együttműködési potenciál feltárását, valamint a nemzetgazdaságok globális értékláncokba történő hatékony integrációjának irányainak meghatározását. A cikk célja a nemzetközi kereskedelem és beruházások jelenlegi helyzetének vizsgálata az elektromos járművek globális piacának fejlődése tükrében, továbbá az ukrán-lengyel kereskedelmi-gazdasági kapcsolatok sajátosságainak és az elektromobilitás területén rejlő partnerségi lehetőségeknek a feltárása.

A tanulmány áttekinti az elektromos járművek globális piacának fejlődési dinamikáját, meghatározza a főbb beruházási irányokat, valamint elemzi a nemzetközi kereskedelem sajátosságait ezen a területen. Különös figyelmet kap a külföldi tőkebevonás és a globális ellátási láncokon belüli gyártókapacitás-bővítés lengyel tapasztalata, valamint az Ukrajna előtt álló kihívások és lehetőségek. A cikk SWOT-elemzést javasol az elektromobilitás területén megvalósuló ukrán-lengyel együttműködésre vonatkozóan, amely lehetővé teszi az erősségek (földrajzi közelség, termelési és tudományos-műszaki potenciál), a gyengeségek (az infrastruktúra elégtelen fejlettsége, szabályozási instabilitás), a lehetőségek (uniós források bevonása, közös projektek fejlesztése) és a veszélyek (a globális verseny fokozódása, technológiai akadályok) azonosítását.

A kutatási eredmények megerősítik, hogy a hatékony ukrán-lengyel együttműködés kialakítása az elektromobilitás területén fontos tényezővé válhat Ukrajna európai gazdasági térségbe történő integrációjában, és hozzájárulhat az innovációs folyamatok felgyorsításához. A további kutatási irányok az innovációtámogatás állami modelljeinek mélyreható elemzésére, a határon átnyúló ipari klaszterek hatékonyságának vizsgálatára, valamint az elektromobilitási beruházások nemzetgazdasági szerkezetváltásra gyakorolt hatásának értékelésére összpontosítanak.

Kulcsszavak: *nemzetközi kereskedelem, közvetlen külföldi tőkeberuházások, kereskedelmi-gazdasági kapcsolatok, Ukrajna, Lengyel Köztársaság, elektromos járművek globális piaca.*

Abstract. *The growth of the global electric vehicle (EV) market generates new trends in international trade and investment mobilization, requiring academic reflection in the context of global structural transformations. The study of the Ukrainian-Polish dimension of these processes is highly relevant, as it makes it possible to identify the potential for cooperation within the European economic area and to determine the directions for the effective integration of national economies into global value chains. The purpose of the article is to examine the current state of international trade and investment development in the context of the global EV market, as well as to identify the specific features of Ukrainian-Polish trade and economic relations and the prospects for partnership in the field of electromobility.*

The article considers the dynamics of the global EV market, outlines the main investment trends, and analyzes the specifics of international trade in this sector. Special attention is paid to Poland's experience in attracting foreign investment and expanding production capacities within global supply chains, as well as to the challenges and opportunities for Ukraine. The study presents a SWOT analysis of Ukrainian-Polish cooperation in electromobility, which identifies strengths (geographical proximity, production and scientific-technological potential), weaknesses (underdeveloped infrastructure, regulatory instability), opportunities (EU investment inflows, development of joint projects), and threats (intensifying global competition, technological barriers).

The results confirm that the development of effective Ukrainian-Polish cooperation in electromobility could become an important factor in Ukraine's integration into the European economic area and contribute to the acceleration of innovation processes. Future research perspectives are linked to an in-depth analysis of models of state support for innovation, the study of the effectiveness of cross-border industrial clusters, and the assessment of the impact of electromobility investments on the structural modernization of the national economy.

Keywords: *international trade, foreign direct investment, trade and economic relations, Ukraine, Republic of Poland, global electric vehicle market.*

Problem Statement. The global electric vehicle (EV) market has demonstrated dynamic growth over the past decade, driven by a combination of technological innovations, government policies on economic decarbonization, and rising demand for environmentally friendly transport. Under these conditions, the issue of integrating national economies into the global production and distribution chains of the EV industry, particularly through mechanisms of international trade and investment, has become increasingly relevant. For Ukraine, which seeks to strengthen its position in the green technology market while advancing European integration, as well as for Poland, which has already emerged as one of the leaders in the production of EV components, the search for effective forms of bilateral and multilateral cooperation constitutes an important task. Therefore, the problem of shaping an optimal model of Ukrainian-Polish trade and economic relations in the context of the development of the global EV market is of both scientific and practical significance.

Literature review. The development of the global EV market is widely covered in the works of both foreign and domestic researchers. In particular, Bohnsack R. et al. [1] examine the trends of globalization in the automotive industry and the impact of decarbonization policies on demand structures. Kohpaiboon A. and Durongkaveroj W. analyze trade and investment models in the EV sector [2]. Pavlínek P. [3] investigates the progress of the transition from the production of internal combustion engine vehicles to EV manufacturing in Eastern Europe, focusing on the implications of this shift for the position of Eastern European countries in automotive value chains, production networks, and the division of labor within the European automotive industry. The publication by Tucki K., Orynycz O. and Dudziak A. [4] aims to identify changes in the automotive sector resulting from the advancement of electromobility. To achieve this goal, the Polish market for electric and conventional vehicles is discussed in detail, along with a comparative analysis of EV development in Poland relative to other EU countries. The Polish experience in the development of the EV market is also analyzed by Sendek-Matysiak E. and Łosiewicz Z. [5], whereas Ukrainian scholars [6; 7] focus on studying EV development and related infrastructure in Ukraine through the lens of global experience.

Nevertheless, despite the availability of numerous studies, the issues of Ukrainian-Polish trade and economic relations in the global EV market remain insufficiently explored.

Research aim and objectives. The purpose of this article is to examine the current state of international trade and investment in the context of the development of the global electric vehicle market, as well as to identify the specific features of Ukrainian-Polish trade and economic relations and the prospects for partnership in the field of electromobility.

Results and discussions. Over the past decade, the global electric vehicle market has transformed from a niche segment into a critically important sector of the global

economy. The number of EVs sold worldwide exceeded 17 million units in 2024, accounting for more than 20% of total passenger car sales (Figure 1). This reflects a steady trend toward the expansion of electric transport, driven by both environmental and economic factors [8].

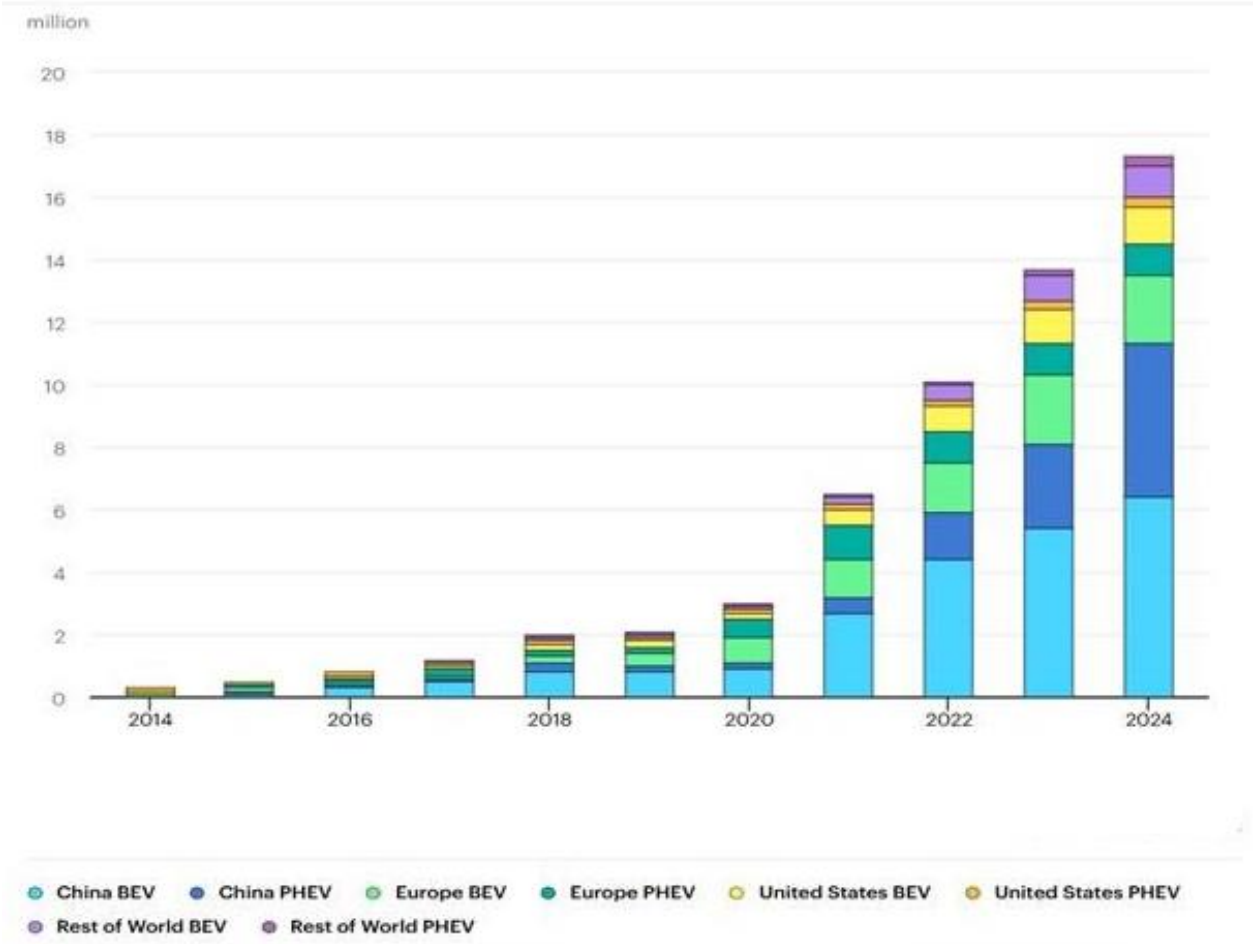

Figure 1. Dynamics of Global Electric Vehicle Sales, million units
Source: [8]

In the first quarter of 2025, more than 4 million EVs were sold, representing a 35 % increase compared to the first quarter of 2024, which exceeded the growth rates observed in the corresponding periods of the previous two years. During the first three months of 2025, over 1 million more EVs were sold compared to the same period in 2024, with nearly 60 % of these sales taking place in China.

It is expected that global EV sales will increase by 25 % over the entire year 2025, a growth rate similar to that of 2024. As a result, the number of EVs sold worldwide is projected to surpass 20 million units. Although sales volumes may be influenced by economic and political uncertainty, it is anticipated that more than one in four vehicles sold in 2025 will be electric [8].

The main drivers of growth include government policies aimed at reducing greenhouse gas emissions, technological advances in battery production, and rising consumer demand for environmentally friendly transport. At the same time, significant barriers remain, such as uneven development of charging infrastructure, high initial production costs, and dependence on the supply of critical minerals (lithium, cobalt, nickel).

International trade in electric vehicles demonstrates significant scale and rapid growth. Global EV exports increased by nearly 20 % in 2024, reaching around 3.2 million vehicles and accounting for almost 20 % of global sales, a share similar to that observed in 2023 and 2022. As with production, China had the largest share – 40 % of global exports, or nearly 1.25 million EVs [8].

The European Union is the second most important player in the EV trade market. On the one hand, EU countries actively export electric vehicles (primarily Germany, France, and Sweden), while on the other hand, they import substantial volumes of finished products and components from Asia. Within the EU, the single market ensures the free movement of goods and creates opportunities for the effective integration of national producers into global value chains.

A particularly important role in trade is played not only by finished electric vehicles but also by components – lithium-ion batteries, electric motors, and control systems. The value of battery trade has already surpassed that of automobile exports, underscoring the strategic significance of this segment. Thus, international EV trade is becoming increasingly diversified and dependent on the technological specialization of individual countries.

Alongside trade development, investment activities in the electric vehicle sector are being intensified. The volume of foreign direct investment (FDI) in EV manufacturing has shown substantial growth in recent years. Specifically, in 2022, 281 FDI projects were recorded in this sector with a total value of $93.7 billion, which exceeds the 2021 indicators by more than 1.5 times [9]. The United States is the leading country in attracting investment in EV and battery production, surpassing announced investment levels in China, the EU, and other countries [10].

An important factor is the active participation of transnational corporations (Tesla, Volkswagen, BYD, Hyundai), which are shaping global production and distribution chains. This involves capital concentration in countries with favorable conditions for investors, availability of a skilled workforce, and access to raw materials. Europe, in this context, is a highly attractive region due to large-scale government subsidy programs for innovation and infrastructure development (e.g., the European Battery Alliance).

At the same time, investment processes are marked by regional concentration. Central and Eastern Europe are gradually becoming one of the centers for EV component manufacturing, creating opportunities for attracting investment to countries with lower production costs. Thus, the EV investment market not only facilitates technology diffusion but also shapes a new architecture of international economic relations.

In recent years, Poland has held a noticeable position in the global EV production and distribution chains and has been gradually strengthening its role as an EV exporter. In 2023, Poland exported EVs worth $1 billion, making it the 17th largest exporter of EVs (out of 116) worldwide. The main export destinations for Polish EVs in 2023 were: Italy ($394 million), Germany ($115 million), France ($104 million), Ukraine ($97.3 million), and the Netherlands ($39.4 million) [11].

In 2023, Poland imported electric vehicles worth $1.09 billion, ranking as the 27th largest importer of electric vehicles (out of 207) worldwide. During the same year, electric vehicles constituted the 52nd most imported product (out of 5,286) in Poland. In 2023, Poland imported electric vehicles primarily from Germany ($401 million), China ($149 million), South Korea ($114 million), Japan ($101 million), and the United Kingdom ($63.5 million) [11].

Within the global electric vehicle value chains, Poland has achieved remarkable results, primarily due to its specialization in the production of batteries and components. Currently, 60 % of all batteries manufactured in Europe are produced in Poland, making the country the second-largest producer of lithium-ion batteries worldwide after China [12].

In Poland, and simultaneously in Europe, the largest battery producer is the LG Energy Solution plant located in Biskupice Podgórne near Wrocław. LG is currently investing and expanding operations by opening additional production facilities in Kobierzyce. Upon completion, this will become the largest electric vehicle battery production plant in the world.

Other leading battery sector companies that are already investing in Poland include:

– Enchem – also investing in Kobierzyce and set to become the only producer of lithium salt in Europe, one of the key components used in the production of battery electrolytes, and thus in EV battery manufacturing.

– Northvolt – in 2023, completed the construction of a plant producing energy storage systems and battery solutions for industry and construction.

– Umicore – in 2021, launched a new plant in Nysa, which became the first cathode materials plant in Europe.

– SK Innovation – is constructing a new copper foil plant in Stalowa Wola for lithium-ion batteries.

– Mercedes-Benz Manufacturing Poland, Capchem, Guotai Huarong, as well as a number of subcontractors, including SK Hi-tech, Battery Materials Poland, KET Poland, Foosung, Enchem, and LG Electronics.

Thus, Poland is currently making a significant contribution to ensuring that the European automotive industry becomes less dependent on lithium-ion batteries manufactured and supplied from China [13].

The development of the industry is supported by a targeted government policy aimed at attracting foreign investment and creating industrial clusters. The Polish government has designed a number of programs to support electromobility, including the Electromobility Poland Strategy [14], which provides for the stimulation of both

production and domestic demand. In parallel, tax incentives and EU programs are implemented in the country, which facilitate the establishment of favorable conditions for investors.

Thanks to the combination of a domestic market, a skilled workforce, and a strategic location, Poland is gradually transforming into a major European hub of the electric vehicle industry. This opens new opportunities for integration with neighboring countries, particularly Ukraine.

The Ukrainian electric vehicle market is still at an early stage of development but demonstrates positive dynamics. The number of registered EVs in Ukraine has been steadily growing in recent years, indicating a gradual increase in demand for green technologies. The total size of the EV segment in the first quarter of 2025 amounted to 20.7 thousand units, representing a 14.6 % increase compared to the first three months of 2024. The structure of the segment as of Q1-2025 is as follows: imported used EVs dominate, accounting for 56.6 %, or 11.7 thousand units. The second-largest subsector is domestic resale of BEVs, representing 33.4 % or 6.9 thousand units. New electric vehicles constitute 10 % of the group, amounting to 2.1 thousand units [15].

Consumer demand for new electric vehicles in the Ukrainian market is fulfilled through import channels. Unfortunately, there is currently no national production of electric vehicles, although the potential exists. Ukraine has the capacity to manufacture electric vehicles, as it is one of the few countries in the world with a complete automotive production cycle. By leveraging the latest Industry 4.0 technologies and its scientific and industrial potential, Ukraine could produce next-generation vehicles, and developments in this field are ongoing. One example is the “Engineering – Automation – Mechanical Engineering” cluster, which is actively exploring the possibility of creating a joint product that would maximize the existing potential of its members and become competitive in both domestic and international markets [7].

Ukraine also possesses a strong resource base (lithium, graphite, manganese), which can ensure a strategic role in global supply chains for battery production. Its geographical location and integration into the European space open prospects for the development of joint projects with EU countries. Thus, Ukraine is capable of gradually transforming from an import-dependent consumer into an active participant in international cooperation in the field of electromobility.

Ukrainian-Polish relations in trade and investment hold significant potential in the context of electric vehicle market development. At present, bilateral trade volumes in this field remain relatively small (for example, in 2023 Poland accounted for 10.8% of Ukraine’s electric vehicle imports, ranking third among leading importers [16]). However, there are several directions in which cooperation could be intensified. Poland already serves as a key exporter of components and batteries, while Ukraine can offer both a sales market and resources for production.

Moreover, cooperation between Ukraine and Poland in electromobility fits into the broader context of Ukraine’s integration into the EU. Joint industrial projects could become not only a form of bilateral cooperation but also an integral element of European energy transition policy.

The development of the electric vehicle market amid global energy transformation necessitates the search for new models of international cooperation. Ukraine and Poland, despite differences in the level of industrialization and integration into global value chains, have the potential to establish joint production and innovation clusters. To assess the opportunities and risks of such cooperation, it is appropriate to use SWOT analysis matrix (Table 1).

Table 1.

SWOT analysis matrix of Ukrainian-Polish cooperation in the field of electromobility

Strengths	***Weaknesses***
– Poland is one of the EU leaders in battery production. – Ukraine possesses significant reserves of lithium, graphite, and other critical materials. – Geographical proximity and integration into the European space. – Gradual growth in demand for electric vehicles in both countries. – Availability of joint educational and research programs.	– Low level of R&D investment from the Ukrainian side. – High energy intensity and vulnerability of Ukrainian infrastructure due to the war. – Differences in technical standards and regulatory frameworks.
Opportunities	***Threats***
– Creation of joint Ukrainian-Polish production clusters. – Attraction of EU investments for Ukraine's recovery and green transformation. – Development of transborder charging infrastructure. – Innovative cooperation (joint R&D projects, startups).	– Competition from China, the USA, and other EV market leaders. – Risks of protracted war and political instability. – Possible strengthening of protectionist measures within the EU. – Volatility of global prices for critical metals. – Slow adaptation of Ukrainian legislation to EU standards.

Compiled by the author.

An analysis of strengths shows that Poland already occupies a significant position in the European battery production chain, particularly thanks to the operations of major manufacturers (e.g., LG Energy Solution, Northvolt). Ukraine, in turn, possesses substantial reserves of lithium, graphite, and other critical minerals that are strategically important for the EU's green transition. A shared advantage of both countries is their geographical proximity, as well as growing demand for electric transport in Central and Eastern Europe.

At the same time, the weaknesses of cooperation reflect structural challenges, such as differences in the level of regulatory harmonization. An additional challenge for Ukraine is the ongoing Russian military aggression, which significantly increases investor risks and complicates the attraction of long-term capital investments.

Opportunities for cooperation are primarily related to the prospects of establishing joint production clusters, attracting EU funding for recovery and energy

transition projects, and developing cross-border charging infrastructure. Another important direction may be innovative collaboration within research programs and academic projects between universities of both countries.

Finally, among the threats, the most critical are competition from leading global electric vehicle hubs (China, the United States), high price volatility of strategic metals, and the possible introduction of additional protectionist measures in the EU. For Ukraine, a further constraint lies in the lengthy process of harmonizing its legislative framework with European Union standards.

Thus, the conducted SWOT analysis demonstrates that the effectiveness of Ukrainian-Polish cooperation in electromobility will depend on the ability to minimize institutional and infrastructural weaknesses while maximizing the synergy of strong sides – Ukraine's resource potential and Poland's production and technological advantages.

Conclusions and prospects for further research. The global electric vehicle market is characterized by dynamic growth driven by a combination of technological innovation, environmental requirements, and government support programs. Poland is gradually consolidating its position as a European manufacturing hub in the field of electromobility, while Ukraine, possessing significant resource and scientific potential, continues to face institutional and infrastructural challenges.

Ukrainian-Polish cooperation in this sector is mutually beneficial: Poland is able to integrate Ukrainian resources into its production clusters, whereas Ukraine gains access to EU markets, investment flows, and advanced technologies. The main advantages of such cooperation lie in the complementarity of the two economies and their geographical proximity. At the same time, the principal risks are linked to competition from other countries in the region and the instability of the external environment.

Future research should focus on assessing the prospects for integrating Ukrainian manufacturers into European supply chains, analyzing the effectiveness of state policies for promoting electromobility, and examining the influence of security and energy factors on the development of the electric vehicle market in Eastern Europe.

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