“Marketing analysis of the electromobile market as a factor in the innovation of the national economy”

AUTHORS	Serhii Kozlovskyi https://orcid.org/0000-0003-0707-4996 http://www.researcherid.com/rid/P-3856-2017 Vladyslav Bolhov https://orcid.org/0000-0002-0631-302X Allam Yousuf https://orcid.org/0000-0003-0262-1890 Albina Batechko https://orcid.org/0000-0003-2425-4104 Larisa Hlushchenko https://orcid.org/0000-0002-0108-2904 Nataliia Vitka https://orcid.org/0000-0003-4844-4770 http://www.researcherid.com/rid/U-4850-2017

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Serhii Kozlovskyi (Ukraine), **Vladyslav Bolhov** (Ukraine), **Allam Yousuf** (Hungary), **Albina Batechko** (Ukraine), **Larisa Hlushchenko** (Ukraine), **Nataliia Vitka** (Ukraine)

MARKETING ANALYSIS OF THE ELECTROMOBILE MARKET AS A FACTOR IN THE INNOVATION OF THE NATIONAL ECONOMY

Abstract

The marketing development of the electric vehicle market can be considered as a key element of innovative changes in the national economy. Object of research is the development of the electric vehicle market. The purpose of this article is the theoretical substantiation and development of guidelines for determining the rating of countries by the level of development of this market as a determining factor in the innovative development of the national economy. In the study, expert survey methods, logical generalization and comparison of results, statistical analysis and graphical presentation of results were used. The study conducted a marketing analysis of sales and production of electric cars, government programs to stimulate them, existing rating indicators of countries for the development of the electric vehicle market, and based on the results, a method for determining the integrated rating indicator of national economy innovativeness was developed. The article established that in countries that are world economic leaders, the growing interest of consumers and manufacturers of cars to electric vehicles, which is actively supported by government programs and incentives. It is proposed to use a integrated indicator of innovative development of the national economy, which are directly related to the market of electric vehicles. This indicator consists of the following factors: share of investments in the development of branches related to the national production of electric vehicles; level of growth of electric transport in the country's total fleet; the share of electric vehicles in total number of cars produced in the country; level of increase in the amount of electricity produced based on RES in total; infrastructure development; level of state support for the market. The use of these integrated factors in marketing analysis will determine the level of the world leader in the country, its innovative development.

Keywords marketing, sales, production, electric cars, market, promotion, innovation, development, rating, environmental friendliness

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Serhii Kozlovskyi, D.Sc. (Economics), Professor, Vasyl' Stus Donetsk National University, Ukraine.

Vladyslav Bolhov, Ph.D. (Economics), Associate Professor, Vasyl' Stus Donetsk National University, Ukraine.

Allam Yousuf, Ph.D. Student, University of Debrecen, Debrecen, Hungary.

Albina Batechko, Ph.D. (Law), Associate Professor, Donetsk Law Institute of the Ministry of Internal Affairs of Ukraine, Ukraine.

Larisa Hlushchenko, Ph.D. (Economics), Vinnytsia National Technical University, Ukraine.

Nataliia Vitka, Ph.D. (Economics), Oles Honchar Dnipro National University, Dnipro, Ukraine.

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INTRODUCTION

The issue of leadership in innovative development in modern conditions is the question of the efficiency and security of the national economy, the competitiveness of the state and its political weight in the world arena. According to Gitelman: "Electric cars are the priority direction of electrification, which means the saturation of the national economy with the most progressive energy carriers, which are electric power, under conditions of which the electric consumers and the electric generating sphere form an integral system" (Gitelman et al., 2017).

Most scholars agree that one of the decisive factors in the innovation development of the national economy is the institutional aspect that

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determines current and future socio-economic relations, worldview, trends and methodologies of theoretical studies. The synergy of common spiritual values and science, its popularization and accessibility are crucial in this case.

Today, the share of "electric" cars in the global car fleet is only 0.6%; there are three following leaders: China with 4%, EU – 2.3%, and North America has 1.6% of the total number of registered vehicles (Transport & Environment, 2017). However, the growth rate of sales of electric cars in the world is impressive. The sales of these cars officially started in 2010. Then in 5 years the total number of cars sold reached one million. After that it took almost 2 years to reach two million and less than one year to reach the mark of three million. In mid-2018, the fourth million was recorded. Bloomberg (2018) analysts predict that we will hear about five million of sold electric cars in March 2019. In addition, more than 49% of the total increase in sales of new cars on the markets of world leaders, namely China, the USA, Europe and Japan, were electric vehicles. The main thesis that restrains even bigger sales growth of the electrical direction of this industry is the price of the finished product (Girin et al., 2017).

Specialists at Bloomberg have analyzed the changes in the value of "electric" cars and made a further prediction, according to which in 2020 cars on electric motors will be cheaper than cars with internal combustion engines and their share will stand for 15% and 40% of the total fleet in 2025 and 2030, respectively. In addition, it is anticipated that the total number of electromobiles for selling will be distributed as follows: 25% of these cars will go to the US market, 26% to the European market and 45% to the Chinese market (Bloomberg, 2018).

Today, the global leader in the sales of electric cars is Chinese manufacturers, which account for almost 50%, the second position is divided between American and German brands of 16%, Japanese companies control 10%, and South Korean only 4% of the market. This success of the car from the heavens is due to the fact that almost 50% of the world's electromotive market falls on China, while the government of this country has created the most favorable conditions for electric vehicle manufacturers and provided financial incentives to consumers, which was the impetus for the electric vehicle boom (Sabinich, 2018).

It can be said that all world car makers are already producing or are claiming to start manufacturing their own electric models.

Based on the foregoing, it can be argued that the market of electric vehicles is promising, the production of these products determines the development of many spheres of the national economy based on innovative approaches and new social philosophy of consumption.

These points are not a secret and well understood in the member states Electric Vehicle Initiative (EVI).

1. LITERATURE REVIEW

Scientists and analysts from all over the world, in recent years, are paying much attention to the study of the development of the market of electric vehicles, among them:

Blomgren (2017) conducted an analysis of the development of technologies in the production of lithium-ion batteries, the prospects for their use in electric transport and development directions.

Frydenlund (2015) analyzed the reasons for the successful development of the electric transport market in Norway and proposed measures for implementation by other countries.

V. Girin and I. Girin (2017) analyzed the unexpectedly successful result of the development of the electric vehicle market in Ukraine and identified the prospects for its development.

Grigoriev (2017) made a comparative analysis of the development of the electric car industry

in Russia, Europe and the world, and suggested measures to stimulate their production.

Gitelman and Kozhevnikov (2017) considered the place and role of electric vehicles in the creation and effective development of a new social and economic formation of a "smart city".

Li, Tong, Xing, and Zhou (2016) analyzed the development of alternative energy sources, identified the relationship of the electric power market with the electric vehicle market and predicted the effect of the growth in electric vehicle consumption on the demand for electric power.

Peters, Baumann, Zimmermann, Braun, and Weil (2017), Sabinich (2018) conducted an analytical study of the level of sales of electric vehicles by countries and brands.

Also, it is quite popular, as among the scholars, practitioners and theoretical researchers is the study of issues related to innovative development. A lot of efforts are directed at identifying the factors of innovation development, its tendencies, which becomes the basis for identifying the leaders in the world on innovation and economic development of the national economy. The authorities of this field of economic research include:

Blind, Petersen, and Riilo (2017) analyzed and revealed the impact of the introduction of standards and rules on the development of new innovative markets.

Edler and Fagerberg (2017) conducted a study in the direction of creating a universal innovation policy, identifying the factors of innovative development and elements of government incentives.

Heyets (2017) conducted a study of the main macroeconomic indicators of Ukraine, revealed the level of their development and predicted the development of these indicators until 2019, taking into account the current situation.

Jaffe, Lerner, and Stern (2005) analyzed the essence of state innovation policy, revealed its tools and proposed principles for the formation of its effective form.

Matulova, Stemberkova, Zdralek, Maresova, and Kuca (2015) analyzed the elements of stimulating innovation development of the regions in the framework of the national program and identified the tools of financial influence.

Melnyk (2016) identified the tools and key factors in the formation of a "green" economy and substantiated its innovative nature.

Nauwelaers (2016) investigated the essence of state and innovation policy, its relationship with investments, their evolution and development.

According to KPMG's analytical rating, an international network of independent firms that provide audit, tax and advisory services, it has been determined that the United States with 34% has become the global leader in the field of global innovation for the second year in a row. China ranked second with 26%, and was recognized as the leader of the region in the field of innovation and revolutionary shifts. The third – India (13%), and the United Kingdom in the fourth, and Japan in the fifth place (KPMG, 2018).

Table 1. The interactive database of the GII 2018 indicators

Source: The Global Innovation Index 2018.

Rank	Country	Score
1	Switzerland	68.4
2	The Netherlands	63.3
3	Sweden	63.1
4	United Kingdom	60.1
5	Singapore	59.8
6	United States of America	59.8
7	Finland	59.6
8	Denmark	58.4
9	Germany	58.0
10	Ireland	57.2
11	Israel	56.8
12	South Korea	56.6
13	Japan	55.0
14	Hong Kong (China)	54.6
15	Luxemburg	54.5
16	France	54.4
17	China	53.1
18	Canada	53.0

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According to Global Innovation Index 2018, the leaders are Switzerland, the Netherlands, Sweden, the United Kingdom and Singapore, the United States ranked 6th and China ranked 17th (The Global Innovation Index, 2018).

These significant disadvantages are due to fundamentally different approaches to the definition of the indicator and our research differs from these approaches by the fact that we are considering the development of the market of electric transport and related industries as the main factor and the key to ensuring the high rates of innovation development of the national economy in modern conditions. Thus, the combination of these two areas of research provides an opportunity to consider innovation based on current changes and trends.

2. AIMS

The purpose of the study is the theoretical substantiation and development of a methodology for determining the rating of countries according to the level of development of the electric vehicle market as the determining factor for the innovative development of the national economy. This indicator can be an indicator of the effectiveness of national innovation policy and used to adjust it.

3. METHODS

In accordance with the above objective of the research, the following tasks were identified:

- to identify the main factors determining the level of innovative development of the national economy, which are directly related to the electric vehicle market;
- to determine the proportion of each individual indicator in the overall rating structure;
- to provide theoretical justification of the developed methodology.

An important factor in the successful achievement of a goal is a review of existing knowledge and obtaining clear data in each monitored area.

Most experts and scientists argue that the basis of innovative development is the synthesis of high-tech production, the environmental friendliness of life and the availability of clean energy.

All of the above components are components of the electric transport market, so it can be said with confidence that its integrated development is the basis of the innovative development of the national economy.

Therefore, this study is devoted to the study of trends in the global market for electric vehicles, the identification of problematic issues and prospects for overcoming them, and the determination of the underlying factors. Based on this, we have developed a rating indicator of the innovative development of the national economy, which is based on the identified factors.

The theoretical basis of our research was the fundamental positions of economic theory, scientific works and methodological developments of domestic and foreign scientists in the field of economics, law, statistics, modeling, as well as legal acts, methodological and statistical materials.

In addition to analyzing statistical and normative data, we used methods of social survey and expert evaluation.

Summarizing the foregoing, we can say that the main methods of research are theoretical generalization, method of scientific abstractions, statistical and graphical methods, as well as methods of comparison and logical generalization.

At present, there are very few studies devoted to determining the impact of the electric car market on the pace of innovative development of the national economy. Works indirectly related to this topic can be considered the research of Gitelman et al. (2017) and the work of Melnyk (2016).

As an indicator of the decisive impact of the development of the lection of electric cars on the level of innovative development, we have developed a coefficient that is calculated based on the method of expert assessments. The choice of this method is justified by the following factors:

1) professional look at different aspects of the issue under consideration;

2) structuring the problem;

3) possibility of adjusting the importance of individual factors depending on changes in the market and technology.

Thus, the theoretical foundations of economic theory, scientific works and methodological developments of domestic and foreign scientists in the field of economics, law, statistics and physics became the theoretical basis of our research. Our research was based on the application of an expert survey methodology, using anonymous questionnaire, logical generalization and comparison of results, statistical analysis and graphical presentation of results.

The main aspect of this article is the formation of a modern view of the sources of innovative development and the development of a comprehensive indicator of the level of innovativeness of the national economy based on an assessment of factors related to the electric vehicle market.

4. RESULTS

4.1. Problems of electric transport on the way to world leadership

Skeptics of the development of electric transport mention two arguments against the development of electric transport, speaking about its low efficiency and high level of source pollution.

Thus, experts from the General German Automobile Club (ADAC) in 2016 modeled the terms of ownership of various electric vehicles for 4 years with an annual mileage of 15,000 km. They argue that one kilometer of path with Ford Focus electric car costs about EUR 0.566, compared with 0.51 and 0.514 euros in petrol and diesel modifications of this model, respectively. According to their research, the least profitable one was the Tesla Model S with 1.37 euro per one kilometer (Makaryan et al., 2013).

The second sceptics' thesis is the so-called supposed environmental friendliness of the electric transport, because three-quarters of electricity as a source of power for these vehicles nowadays is extracted from coal and gas, which greatly affects environmental pollution. In addition, for the manufacture of batteries for these cars such valuable raw materials as lithium, nickel, cobalt, copper, manganese and graphite are used. Due to the sharp increase in the production of lithium-ion batteries (LIA), demand for this raw material has risen in recent years, while their deposits are very limited and concentrated in several countries. Thus, Congo possesses 65% of the world's proven reserves of cobalt, and 7 out of the 10 active extractive enterprises in this country belong to China. Based on the forecasts saying that in 2030 the share of electric cars will stand at 32% of the market, their production, compared with cars with internal combustion engines, will require 56% more nickel and 4 times more cobalt than it did in 2016. Therefore, experts calculated that the production of LIA consumes the same amount of energy that is equivalent to the amount of gasoline burned by a traditional car to overcome 60 thousand kilometers (Peters et al., 2017).

However, these pessimistic conclusions, supported by mathematical calculations, have counterarguments that give hope for the further development of the electromotive industry and establishment of its leadership as a flagship of innovation development.

According to the IEA report (Market Report Series, Renewables, 2017), the deployment of new RES (renewable energy sources) capacities is caused by a significant reduction in the specific costs of their development, with appropriate investment and government support. In particular, an increase in the volume of new capacities of "clean" electricity rose by almost two-thirds in 2016. According to the World Economic Forum's Equalized Cost of Energy Analysis (LCOE 11.0) results, today the market value of renewable energy is lower than oil and gas value in 30 countries already (LCOE 11.0, 2017). According to the IEA forecast by 2022, the total average generation costs will be reduced by 25% for solar energy and by almost 15% for wind energy. In 2040, these indicators will stand for 50% and 20%, respectively. According to the forecasts of the World Energy

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Outlook 2017 IEA, by 2040, solar and wind power plants will account for 48% of total installed capacity of the world energy sector and 34% of the released electricity. The share of RES in electricity production will stand for 74% in Germany, 38% in the USA, 55% in China, 49% in India, 80% in Mexico (LCOE 11.0, 2017).

Moreover, according to the latest calculations by the Belgian research organization Transport & Environment, even receiving electricity for recharging accumulators from coal-fired power plants that are the largest polluters of the environment, electric cars would still cause less environmental damage than diesel-powered vehicles (Gopalakrishnan et al., 2017).

Regarding the cost and efficiency of lithium-ion batteries, it can be asserted with confidence that, despite the rapid increase in prices for raw materials for their production, their cost is decreasing even faster than expected. Thus, in 2012, 1 kWh cost was approximately $540, in 2016 – $140, while in 2017, according to Bloomberg New Energy Finance, their value fell by 24%. In addition, research and development work is carried out in the following areas (Bloomberg, 2018):

a) the improvement of existing technologies, which makes lithium-ion batteries become more durable and able to operate under extreme temperatures (–50° to +50°C) with a number of charge cycles up to 10,000 or more;

b) the development of new approaches and technologies, among which polymer batteries and hydrogen accumulators can be distinguished. The capacity of such instances is much higher than the current ones have, the number of recharging is not limited, and the probable cost is much lower, but the results of research implementation are kept under conditions of high secrecy.

Since 2008, the member countries (EVI) have contributed about $20 billion to the development of the market for electric vehicles. A half of these investments were aimed at the research and development related to the batteries for electric cars, which are the weakest point of this mode of transport (Girin, 2017).

4.2. Electric vehicle market leader definition

The most famous indicator of leadership in the development of the market for electric vehicles in the world is the ranking of countries, which is published by Insideeves, specializing in the coverage of comprehensive information related to electric transport. The authors use the following criteria and indicators to determine the world leader: the share of electromobiles on the country's market, infrastructure development, government policy, lithium-ion batteries production and electrified transport. The calculation is based on hundred-point system: the higher the value – the better the level of development. The dynamics of the countries' position change in this ranking is presented in the following table.

Table 2. The ranking of countries with the highest level of electric vehicles development (2016–2017)

Source: Top 10 Countries in the Global EV Revolution: 2017 Edition.

Country	Position/points	
	2016	2017
China	1/61	1/70
Norway	2/54	2/54
Sweden	3/41	3/44,5
Iceland	4/39	7/43
Ukraine	5/39	9/38,5
USA	6/38	4/44,5
Japan	7/37	5/44
South Korea	8/37	6/44
France	9/37	10/38
The Netherlands	10/36	–
Germany	–	8/40

It can be seen from Table 2 that China is the undisputed leader in the development of the electric vehicle market. Figures testify these conclusions. Thus, with 602,000 electric vehicles sold, China ranks first in the world, while the share of electric cars in the domestic market increased from 1.45% to 2.1% at the end of 2017 (Ev World). This country also ranks first in the world regarding manufacturing with 43% of the total output, but most of the output is directed to the domestic market. However, Germany produces almost a quarter of the world's total electric vehicles, and also transcends the rest of the world in level of investment in the development of electric transport. In addition, Germany surpasses China the level of development of RES-based power generation.

Source: Total world plug in vehicle volumes.

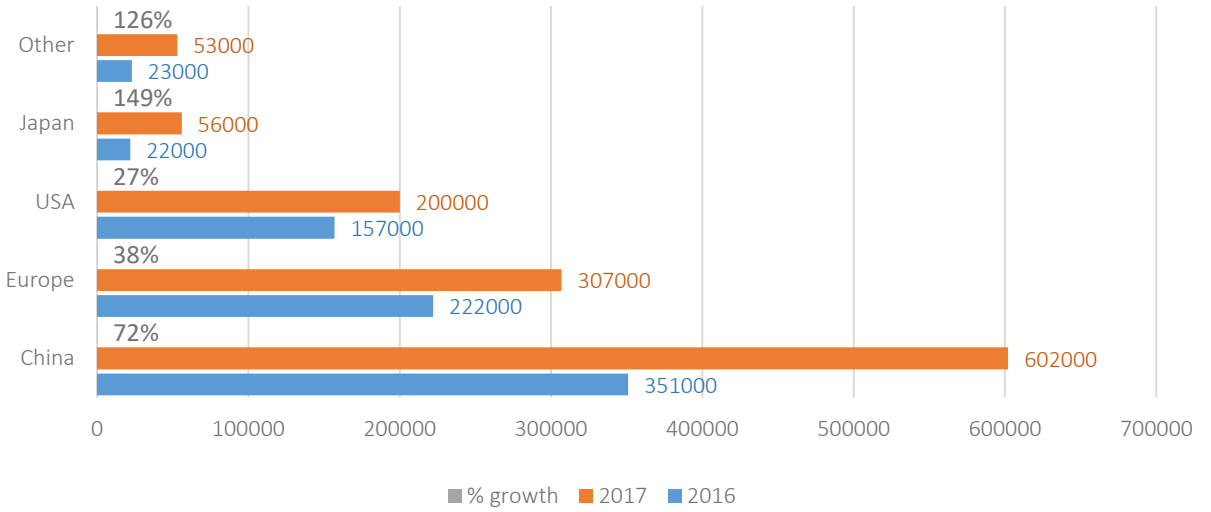


Figure 1. Sales of electric cars and % growth in 2017 compared to 2016

Analysis of the data in Table 2 allowed us to draw up the diagram shown in Figure 1. This image provides an opportunity to see the development of the countries leaders of the electric vehicle market development in dynamics. According to the Insideeves rating indicator, such countries as Germany, China, the USA, Japan and South Korea have significantly improved their position.

To a greater extent, the success of the leader countries in the Insideeves rating is due to the availability of national programs to support the production and consumption of electric vehicles. The main elements of such programs are listed in Table 3.

However, if we consider only sales volumes, by the end of 2018, the world market for new electric ve-

Source: Compiled by the authors.

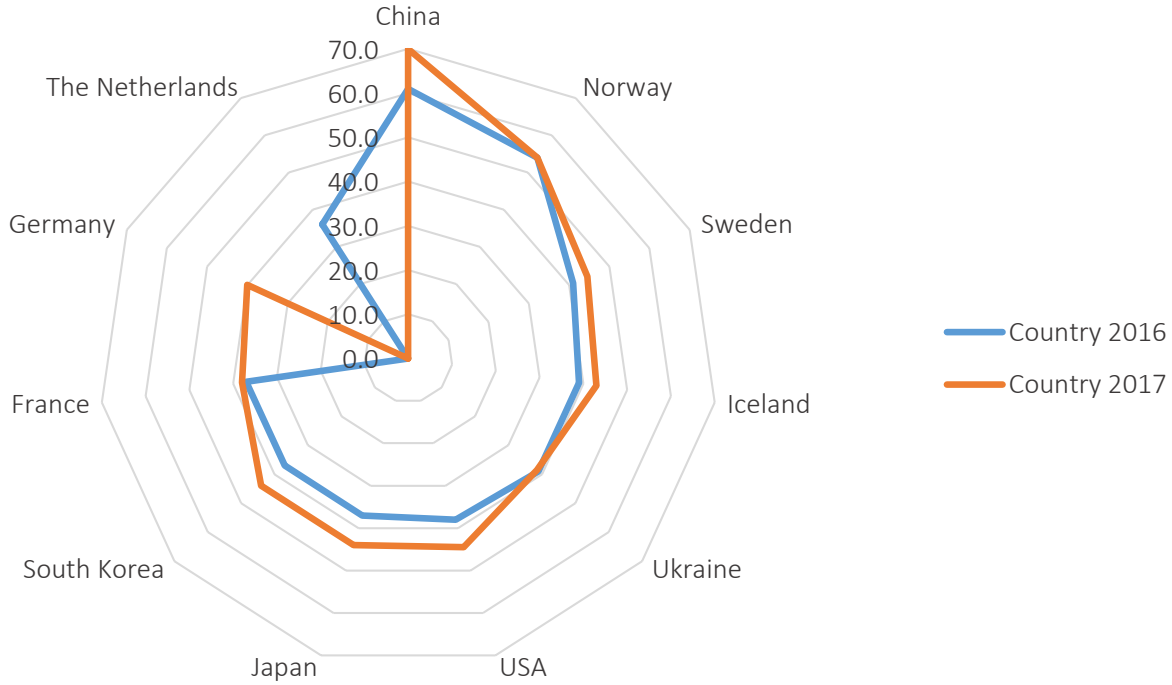


Figure 2. Analysis of the development of countries on the rating Insideevs for 2016–2017

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Table 3. Comparison of national programs supporting the development of markets for electric vehicles

Source: Compiled by the authors.

Country	Elements of the national program of stimulation of the electric transport market
China	The central government grants subsidies for the purchase of electric vehicles in the amount of $5,000 to $8,500, which may be supplemented from local budgets at a rate of 50% of the central budget, but these payments are valid only in large cities and are not paid to the consumer, but the manufacturer. On the other hand, for automakers from 2019 strict conditions are set: the quota for the production of products, working on alternative fuel not less than 10%, foreign companies that do not adhere to these conditions will be closed. Buyers are encouraged by the fact that they are exempted from paying VAT, excise, purchase tax and annual road tax for the purchase of a new electric car.
Norway	Buyers of new electric cars are exempt from VAT, registration tax, and the annual road toll is reduced for them 7 times. In addition, owners of electric cars are exempt from parking fees and motorway travel.
Ukraine	Establishment of preferential taxation of imports of electric vehicles, which includes the abolition of VAT and excise taxes on the import of vehicles.
USA	The national incentive is to provide the federal tax service (IRS) with tax credits in the amount of $ 2,500 to $ 7,500 for the purchase of a new electric vehicle. In addition, federal budgets of individual states provide additional subsidies.
Japan	The size of the state subsidy for the purchase of a new electric car is calculated depending on the capacity of its battery, the maximum value of which reaches $ 7,700.
Germany	The program provides subsidies for private buyers of $ 5,000, while for corporate customers, € 3,000 for every electric vehicle. Drivers of new electric cars are exempted for 5 years from the annual road toll (Kfz-Steuer).
France	The Corri-Door state program was adopted and implemented, according to which the entire country will be equipped with a network of high-speed chargers for electric cars, the bounce between which must not exceed 80 km. Buyers of new electric cars receive compensation in the amount of € 10,000.
South Korea	Buyers of new domestic electric cars receive a subsidy of up to $ 10,000, with the expectation that its cost to the consumer does not exceed $ 5,000. A government program is launched to create a charger network throughout the country.
The Netherlands	Buyers of new electric cars are exempted from paying the registration tax and annual road toll. Large cities pay owners of electric cars a one-time subsidy of 1,450 euros for the installation of a home charging station.

hicles is distributed as follows: China is ranked 1st with 49.5% stake, in the second place in the EEC – 25.6%, the United States are ranked 3rd with 17.7%, with Japan's 4.5th quarter reaching 4.5%, South Korea is ranked 5th, which holds 1.1%; sales in all other countries of the world together accounted for only 1.6% (Sabinich, 2018).

Analyzing the data in Table 3, it can be argued that China's leadership position is not accidental. High-tech industries are the basis for the future economic development of this country. China has already begun the transition from commodity-industrial to technological, and the basis for this was the promotion of the development of industries related to the production of electric vehicles.

In addition to the above rating, Insideeves also has a rating of the German economic magazine Wirtschaftswoch developed jointly with the international McKinsey consulting company and based on the Electric Vehicle Index (EVI), according to which Germany in 2019 has opportunity to become the world leader in the production of electric vehicles (Hattrup-Silberberg, 2018).

It makes us believe that the rating made by Insideeves cannot be considered completely objective, because it does not take into account certain aspects that characterize the innovative nature of this market and the factors associated with it. Thus, this index does not allow to fully determine the world leader in the development of this market.

In conditions of significant differences in population size, size of countries, saturation of the general market of vehicles and other factors, we reckon that it would be more correct to consider the growth rate of electric vehicles in the country instead the rate of electric vehicles in the national fleet.

We propose to use a complex indicator covering factors determining the directions of innovative development of the national economy, which are directly related to the market of electric vehicles.

It can be calculated using the formula:

$$K = \sum_{i=1}^{n} P_i \cdot p_i, \quad (1)$$

Table 4. The essence and importance of the specific weight of indicators in the overall structure of the rating of the electric vehicle market

Source: Compiled by the authors.

No.	Name of factors	Symbol	The number of experts who gave priority to this factor	Value
1	Share of investments in the development of branches related to the national production of electric vehicles	p_1	24	0.29
2	Growth of electric transport in the country's total fleet	p_2	21	0.26
3	The share of electric vehicles in total number of cars produced in the country	p_3	15	0.19
4	Increase in the amount of electricity produced based on RES in total	p_4	4	0.15
5	Infrastructure development	p_5	2	0.07
6	Level of state support for the market	p_6	1	0.04

where K – rating coefficient of development of the market of electric vehicles, which determines the innovativeness of the national economy, P_i – country rating on the *i*-th indicator of innovation development, p_i – the specific weight of the *i*-th indicator in the overall ranking structure, i – factor of innovation development, $i = 1,\ldots,n$.

Indicators are calculated for the analyzed period, they include:

- share of investments in the development of branches related to the national production of electric vehicles;
- growth of electric transport in the country's total fleet for the analyzed period;
- share of electric vehicles in total number of cars produced in the country;
- increase in the amount of electricity produced based on RES in total;
- infrastructure development;
- level of state support for the market.

The specific weight of the factors was obtained during the analysis of experts' questionnaires. The group of experts consisted of 81 people, including: heads of industrial enterprises of the Vinnytsia region of Ukraine, scientists and heads of local authorities responsible for the development and implementation of regional innovation programs.

Source: Compiled by the authors.

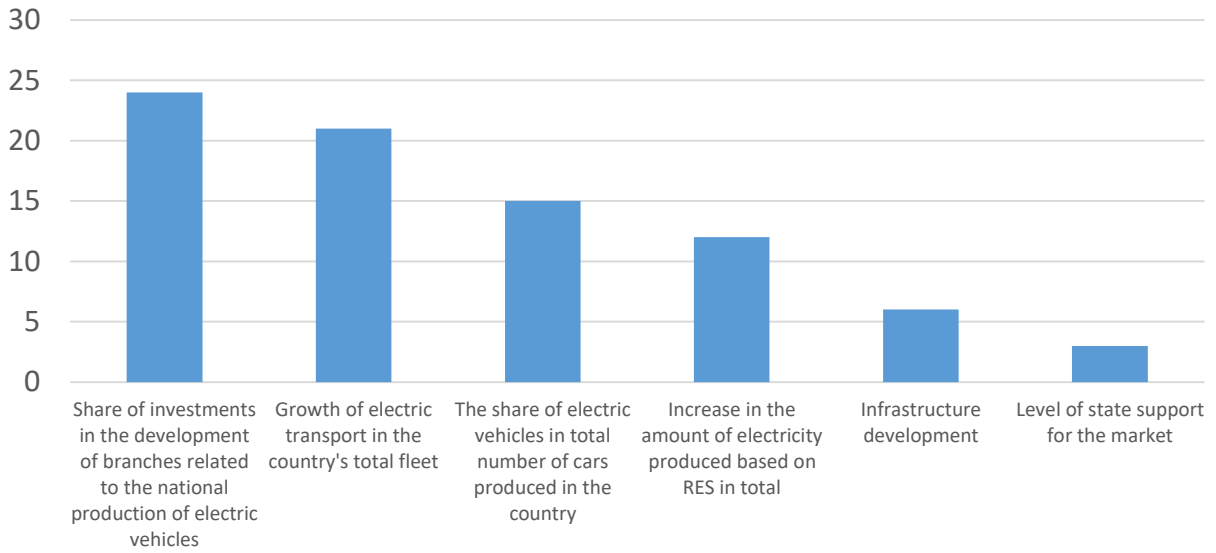


Figure 3. The number of experts who gave priority to this factor

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5. DISCUSSION

The main discussion point of this article is the recognition of the electric vehicle market a decisive factor in the modern innovative development of the national economy.

Proponents of classical economic thought tend to consider basic research to be the main source for creating the basis for the innovative development of the national economy.

In our opinion, applied science has the same meaning as fundamental science, but it allows solving tactical tasks.

The above material shows that developed countries attach great importance to research in the direction of production of electric transport and related industries. Scientific discoveries and the creation of a production base in this particular area leads to scientific, technical and technological leadership.

In subsequent works, it is planned to test the developed rating indicator: at the first stage, it is planned to expand the expert field, with the involvement of international experts, to obtain a more sustainable value for the weight of each factor; at the second stage, to collect statistical data, make calculations and compare with indicators of existing ratings.

CONCLUSION

Based on the information above, one can conclude that the market of electric vehicles is decisive in stimulating the innovative development of the national economy. This market is rapidly developing, despite the high cost of development and implementation of technologies. The large public demand and the inevitable need for the introduction of "clean" productions and means of transportation are pushing national states to support the development of this industry as a locomotive of innovation transformation and development.

In spite of impressive figures in the development of the electric vehicle market, the leadership of China may be challenged in the coming years. A current leader may be replaced by such states as Germany, USA, France and Japan due to their own potential contributed to the development of the electric-vehicle market and related industries.

According to Bloomberg New Energy Finance (BNEF), by 2020, electric cars will match the price of ones with gasoline engines, which should contribute to the burst of popularity of this type of transport and a leap in market development (Bloomberg, 2018). Until that moment, there is the possibility and probability of an unplanned change of leader or the emergence of a new one that will aim at restructuring the national economy based on innovative development, which will be based on the development of the electric vehicle market.

Thus, the development of this market should be considered as a complex issue that covers most areas of the national economy and determines the direction and strategy for its further development.

Regarding the definition of world leadership in the development of the electric vehicle market, in our opinion, there is no universal and correct indicator that could impartially identify it. That is why we offer our own approach to calculating the leader's ranking of countries, where this market is developing most rapidly. The basis of this indicator is the understanding of the innovation component and defining base of this market. Unfortunately, the difficulty in accessing the necessary statistics for the calculation of the indicator that has been offered does not allow us to derive its results in this work.

There are following prospects for further research: improving the offered rating index of leadership in the development of the electric vehicle market, collecting the necessary statistical data and calculating the final value for the identification of the world leader in innovative development.

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