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# Investigation into International Innovative Management of Creating and Producing Electric Cars

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**Abstract.** The research paper provides an insight into various aspects of producing electric vehicles in leading foreign countries. Dynamics of increasing specific weight of electric vehicles in the total volume of transport and its predictive indices are under study considering the countries planning their full transition to electric mobility. Topicality of building a wide network of charging stations of various capacity is highlighted. It is indicated that the German Volkswagen, the world largest automobile concern, is going to introduce more new makes of electric vehicles than it was planned before – 70 instead of 50 by 2028. In the coming decade, there will be a trend of raising the number of Volkswagen electric vehicles from 15m to 22m. With that, the share of electric vehicles in the total production is planned to exceed 40%. It is indicated that VW is going to invest 44B euros in designing new equipment. It is mentioned that in many foreign countries, subsidies and tax allowances for electric car owners are essential stimuli from the state. Besides, special attention is paid to improving and developing production of batteries for electric vehicles, in particular in the EU countries. The article suggests outlines of designing electric-mobile innovations and power supply providing sustainable and economically substantiated production of primary power by using wind-generators. Possible production of Ukrainian and Uzbek electric vehicles is under analysis. It is highlighted that production of electric vehicles allows combining two very profitable economic factors – innovative character and mass production. Here, novelty, great demand and scale economy will produce a desirable effect. The authors consider influence of COVID-19 on the global economy and various types of vehicles.

## 1. Introduction

At the beginning of 2020, the world economy faced the most unexpected and long forgotten factor expressed in a new form – COVID-19. Wide and fast spread of the virus all over the planet shows the degree of globalization development. The world economy has revealed its vulnerability to crises like that due to its global character, all-pervading relations that wipe out boundaries between countries, continents, industries and companies.

In spite of the fact that modern challenges that determined earlier trends, especially in the most developed countries, and associated with essential innovative trends preserve their general direction, they have also changed greatly, that being the scope of our analysis.

Design and production of electric vehicles is a very promising economic trend nowadays. Electric vehicles possess a number of unique properties that make their use in big cities especially appropriate due to their exploitation in city tunnels, which is complicated for conventional cars because of ventilation problems. Finally, there are no additional power expenditures in city traffic jams, while



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cars with internal combustion motors consume much more fuel than usually. Environmental advantages of electric vehicles are also evident. Besides, electric vehicles consume far less power than conventional cars – fuel.

In spite of dynamic advance of the world electric mobility, theoretical elaboration and integrated study of practical experience of controlling these complicated innovative processes are far from being complete and remain topical.

**The research is aimed** at investigating into innovative management of creating and producing electric vehicles in leading foreign countries and analyzing various factors associated with potential production of Ukrainian and Uzbek electric vehicles and development of the corresponding infrastructure.

**There are used methods** of analysis and synthesis. The research is based on official data of automobile concerns, world economic statistics and Internet-resources.

## 2. Results

The global economy is well on the way to the innovation model of development that involves not only developed countries, but also other countries except some outsiders with traditionally retarded economies.

In 2018, 31% of all the cars sold in Norway were electric ones, this number being the (relatively) highest in the world. It is also known that the country is going to stop using fuel engines from 2025. Norway is the largest European sales market for Tesla. Last year, the US producer sold over 8.600 electric cars. It is expected that in 2019, the number of sold cars will rise abruptly with the appearance of the new Tesla Model 3 on the Norwegian market. It is also mentioned that sales of green cars has increased by 40% as compared to 2017. Thus, 10% out of 2m cars on the Norwegian roads are green ones [1].

Another Scandinavian country, Sweden, is going to ban combustion engines in 2030. The country will follow the example of Denmark, Israel, Ireland, Iceland and the Netherlands as well as the capital of France, Paris. They all announced their intention to stop registration of cars with combustion engines in ten years.

The world largest concern Volkswagen is going to introduce much more makes of electric vehicles than it planned before. By 2028, almost 70 new makes with electric drives will have appeared. The concern announced its intention to produce only 50 makes of electric cars before. In the nearest decade, 22m electric vehicles will roll off the production line instead of 15m planned. The concern site states that the share of electric cars in the total volume of cars produced by the concern by 2030 is to make no less than 40% (about 4m cars per year considering the present production rate). The VW Head, Herbert Diess reports that the concern is going to invest 44B euros into designing new parts (electric engines), autonomous driving technology and digitalization of various systems in the coming five years [2].

Subsidies and tax allowances for electric car owners in Germany are essential tools of the state influence on developing this transport type. According to [3], the state is going to pay extra 4000 euros to those buying an electric car 40 000 euros worth in 2021-2022 and after 2022 – 3000 euros.

Some time ago, the Japanese corporation Sony unexpectedly presented a prototype of the Vision-S electric vehicle at the hi-tech exhibition in Las-Vegas. While creating the car, Sony used assistance of its international partners (Bosch, ZF, Continental and Here). Designers of Vision-S also combine technologies from Magna Steyr, Benteler, Nvidia, Blackberry and Qualcomm to accelerate development of electric mobility [3].

In November, 2019, Volkswagen started mass production of the ID.3 electric vehicle. It will be produced in Zwickau, Saxony, at the first plant producing only electric cars in Germany. Volkswagen also decided to focus its electric car production in Emden still producing VW Passat at present. Industrial automation is widely introduced: 1700 industrial robots will be used in production and assembly of electric vehicles in Zwickau [3].

At the end of 2019, it became known that the American company specializing in production of electric cars and development of new technologies to accumulate power, Tesla, the co-founder of which was Elon Mask, invested 4B \$ into a large plant next to Berlin. At the plant of Grunheide, Germany, up to 150 thousand electric cars are going to be produced and up to 500 thousand – in the long run. According to the Bild am Sonntag newspaper, Model Y cars will be the first to roll off the production line. After getting a consent from the German government and the European Union, Tesla can expect the state subsidy of about 300m euros [4].

Tesla is known to have opened its first plant outside the USA in Shanghai. In the early January 2020, the company started mass supply of Model 3 electric cars produced at Gigafactory 3 [4].

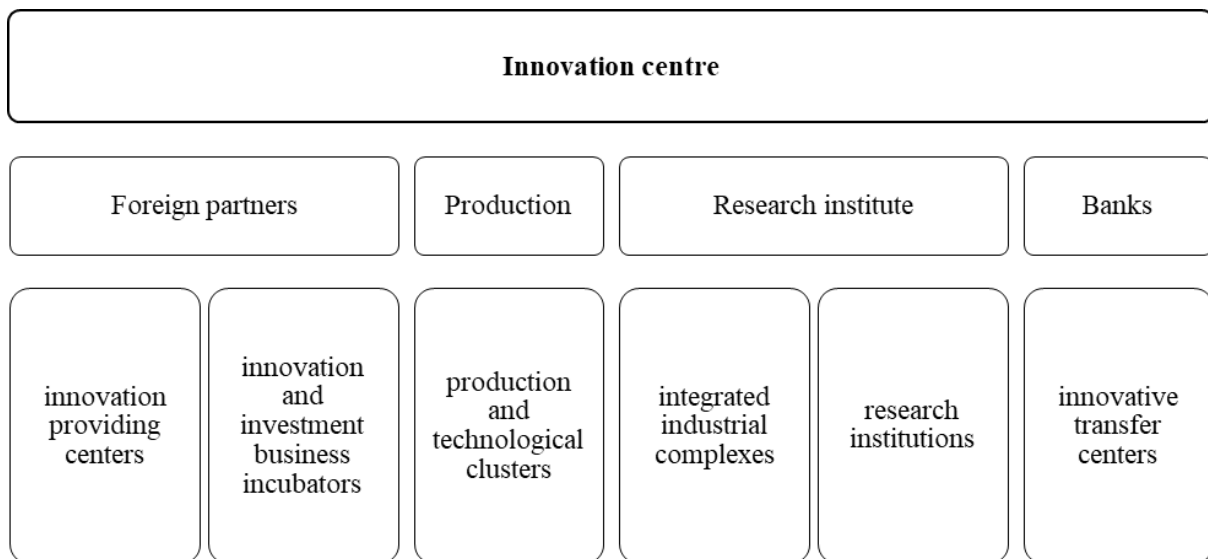
The European Commission approved Germany’s and six EU countries’ plans to provide a 3.2 B euro-subsidy for creation a European centre producing car battery elements [4].

Production of electric vehicles enables combination of two profitable economic factors – product innovation and its mass production, thus obtaining an economic effect from novelty, great unsatisfied demand and scale economy.

Ukraine and Uzbekistan possess a certain potential to make electric cars. In Ukraine, there are great reserves of iron ore to supply metallurgy, available deposits of lithium to produce car batteries and labour force to partially make provision for car production.

At the same time, there are some negative factors capable of constraining electric mobility in the country including absence of relevant experience of designing and producing world-competitive electric cars of any class, car batteries of great capacity, car electric engines, chargers intended for the above-mentioned purposes of engineering and labour staff, systems of their training, a great loss of workers potentially qualified for such jobs and leaving abroad, extreme insufficiency of investment resources and lack of enterprises producing special car equipment, its elements and chargers [5].

To develop electric car production in our country, it would be reasonable to create an innovation centre to coordinate efforts of various structures and provide interaction with foreign partners (Fig. 1).

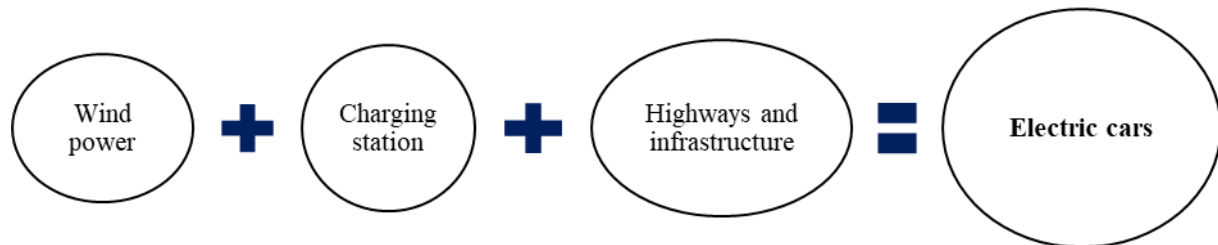


**Fig. 1.** Electric mobility innovation centres

The centre is able to provide interaction of foreign partners embodied in producers and designers of electric cars, their elements and chargers; research institutions, individual professionals from various fields as well as representatives of Ukrainian research institutes, universities, banks, industrial subjects and other structures aimed at providing favourable conditions to develop electric mobility.

In our country, taking into account low efficiency and great wear of equipment at thermal power stations as well as advanced world trends (in Denmark, by 2020, the share of wind power stations had

grown up to 50%, that in Germany had reached 25%), it would make sense to combine development of electric mobility with accelerated production and introduction of wind power stations within the country. Besides, attention should be paid to building highways and speedways and relevant infrastructure (Fig. 2).



**Fig. 2.** Factors for developing electric mobility

Similar measures could be especially useful if taken in cooperation with producers of wind-generators, i.e. Vestas Wind Systems (Denmark), General Electric (the US), Enercon GmbH and Nordex (Germany), and Gamesa Corporacion Tecnologica (Spain). Wind power stations could supply green primary power which by means of a network of charging stations would be provided to a large number of electric cars.

Application of solar power stations can be reasonable when it does not result in loss of farming lands, so they are not appropriate for Ukraine and Uzbekistan. Elements of solar batteries can be installed on building roofs instead.

Poor state of Ukrainian highways has become an all-national problem. In spite of the fact that in recent years, expenditures for road construction and maintenance have essentially increased, problems accumulated in this area require great investments for many years ahead. In the next 5 years, we are going to bring 24000km of principle highways into service.

The governments of Ukraine [6] and Uzbekistan [7] continue constructing new highways. If there is a wide network of high-quality highways, electric mobility will have better chances for development in the country. The problem mostly concerns rates of road construction, that requiring relevant infrastructure.

COVID-19 became a serious factor affecting the usual course of the world economy development at the beginning of 2020, aviation being one of the most vulnerable fields. There are some fears as to the current condition of today's aviation. Similar issues may appear to different extents in other types of transport [8].

Analysis of COVID-19-caused vulnerability of various transport types has revealed the following. As is shown in Table 1, private and electric mobile vehicles have undoubted advantages over many other transport types in terms of safety issues caused by the virus. Besides, electric vehicles possess essential environmental and economic pros, especially when receiving primary power from wind and solar power stations.

COVID-19 has strongly affected not only the present-day transport and the global economy, but also their future. The COVID-19 vaccine will no doubt be developed.

At the same time, the psychological effect from appearance and fast propagation of the virus worldwide will keep affecting passengers' behaviour. It concerns the fear to travel by air, train, sea and other means of transport associated with crowds of people around.

Besides, the following idea is urgent. If the COVID-19 virus had appeared so unexpectedly, why couldn't any other new virus as dangerous as that one appear in the same way? In the nearest and the most distant perspective, there will remain a tendency to develop such types of transport that would exclude human contacts. With this respect, private electric vehicles seem most promising.

**Table 1.** Influence of the corona virus on some transport types

No	Transport	Significant features and vulnerability to the virus
1	Aircraft	It is mass transport with some unique properties. It is the fastest and the most essential transport for transporting over big distances, especially for transatlantic links, being quite expensive at the same time. It greatly depends on weather conditions. There are risks of virus infection among passengers during flights and at crowded public places like airports.
2	Railway	It is mass transport with unique properties. It is slower than aircraft, yet there are some speedy trains like TGV (France) and ICE (Germany) capable of moving fast, yet slower than planes. Transoceanic shipping is impossible. It is an important kind of transport for large distances, which is less dependent on weather conditions and therefore the most reliable one. There are risks of virus infection both during trips and at crowded places like railway stations.
3	Public automobile and bus transport, electric transport	It is a widely spread mass transport type frequently used for short distances. It plays an important role in cities and towns. There are risks of virus infection during trips on buses, trams, underground carriages, trolley buses, taxis and at crowded places like underground tunnels and platforms, bus station buildings.
4	Marine and river	It is an important transoceanic transport type used at seas and navigable rivers. It is quite slow. There are risks of virus infection during voyages and at crowded public places like sea/river stations.
5	Private automobile and electric transport	It is the most important transport, especially in developed automobile countries. Private transport is more comfortable than the public one as it does not depend on timetables, routes and distances. It is quite fast, especially in the countries with high-speedways. Electric mobile transport also has some serious environmental benefits. Due to its private nature, the risk of being infected is very low.
6	Bicycle	It is not used for long distances. It is the slowest transport type. Being green and promising, it is wide-spread in many European countries, China, and to various extents worldwide. It is very convenient in rural areas and nature reserves, for tourism. Due to its private and out-of-doors nature, there are almost no risks of infection.

In spite of the corona virus, the situation with electric mobility in the world looks quite optimistic. In the first seven months of 2020, sales of electric vehicles in Western Europe exceeded those in China after some European countries (including Germany and France) increased state subsidies to encourage buyers' demand ruined by the pandemic. According to Matthias Schmidt, the independent automobile expert from Berlin, about 500 thousand electric cars and plugin-hybrids registered in Europe in the first seven months of 2020 exceeded sales in China by about 14 000. Norway takes the first place as to the number of electric cars sold (43.9% of this year market), followed by the Netherlands (11.3%) and Iceland (10.3%). Over 1m electric cars and plugin-hybrids are expected to be sold this year as Tesla is supplying more electric cars to the region, while Volkswagen is starting to supply its ID.3 electric car [9].

In spite of the crisis, Germany is increasing financial stimuli announced before to provide affordable electric cars and hybrid vehicles and develop the industry [10]. The government will raise subsidies up to 6000 EUR for all buyers of electric car no less than 40000 EUR worth. Together with the 3000 EUR bonus from car producers, total stimuli for buying electric cars will reach 9000 EUR.

The active policy of encouraging electric mobility is conducted in France as well. The French President Emmanuel Macron has announced about 8B EUR investments to make France the leading producer of green vehicles in Europe and urged French producers to make cars in their own country.

The similar attitude towards electric mobility shown by the most influential world leaders arouses nothing but approval and inspires optimism about the future of this strategic innovative sphere.

The question is in what economic medium, in its global sense, the electric car industry will be evolving considering the relentless effects of the corona virus.

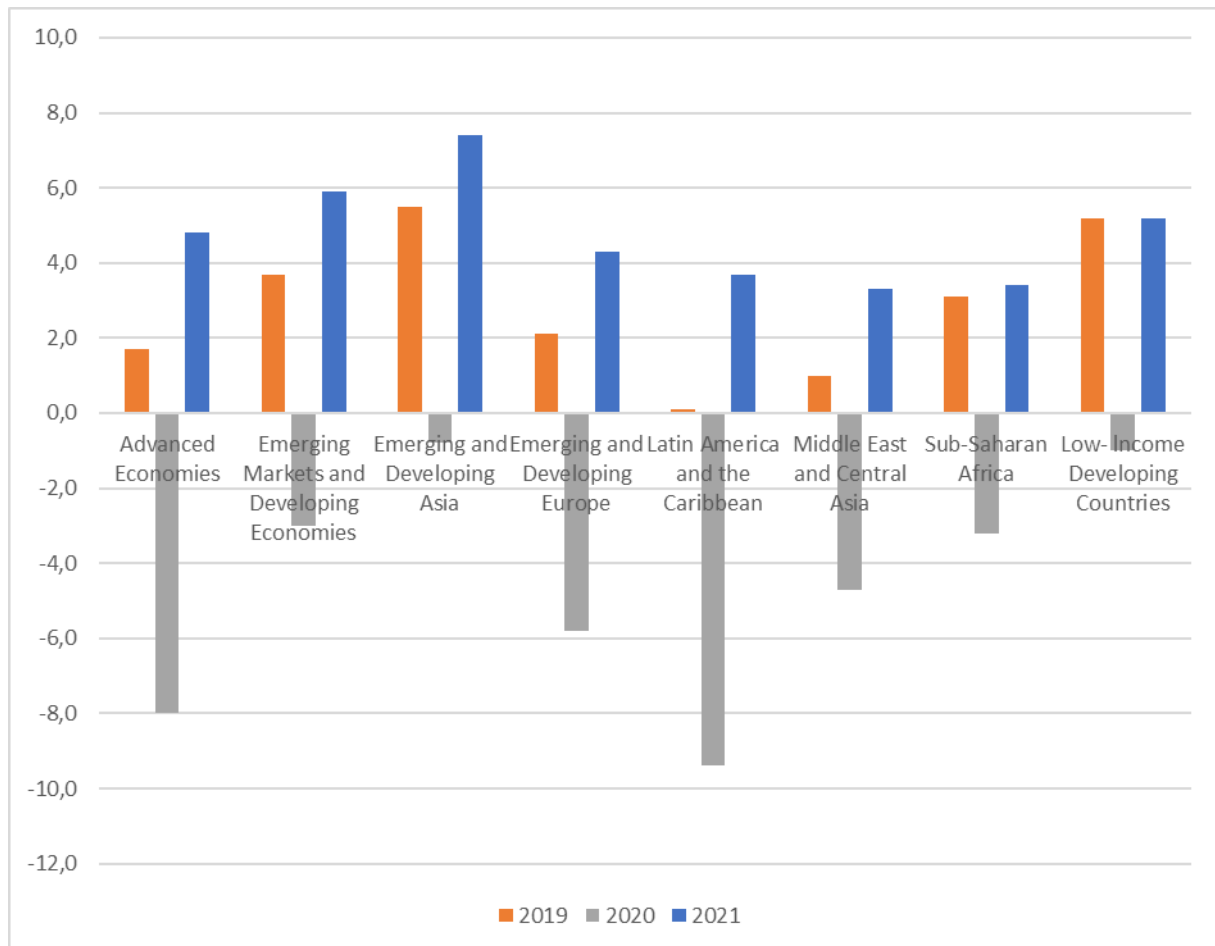
The International Monetary Fund (IMF) has updated the forecast (Table 2) of the global economy decline in 2020 up to 4.9% against 3%. In the first 6 months of the year, the pandemic had more negative effects on economic activity than it had been anticipated. The World Economic Outlook Update from the IMF indicated that fact in June. Restoration of the economy will be more gradual than it has been predicted [11].

**Table 2.** Latest World Economic Outlook Growth Projections [11]

<b>Real GDP, annual percent change</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>
<b>World Output</b>	<b>2.9</b>	<b>-4.9</b>	<b>5.4</b>
<b>Advanced Economies</b>	<b>1.7</b>	<b>-8.0</b>	<b>4.8</b>
<b>United States</b>	<b>2.3</b>	<b>-8.0</b>	<b>4.5</b>
<b>Euro Area</b>	<b>1.3</b>	<b>-10.2</b>	<b>6.0</b>
Germany	0.6	-7.8	5.4
France	1.5	-12.5	7.3
Italy	0.3	-12.8	6.3
Spain	2.0	-12.8	6.3
<b>Japan</b>	<b>0.7</b>	<b>-5.8</b>	<b>2.4</b>
<b>United Kingdom</b>	<b>1.4</b>	<b>-10.2</b>	<b>6.3</b>
<b>Canada</b>	<b>1.7</b>	<b>-8.4</b>	<b>4.9</b>
<b>Other Advanced Economies</b>	<b>1.7</b>	<b>-4.8</b>	<b>4.2</b>
<b>Emerging Markets and Developing Economies</b>	<b>3.7</b>	<b>-3.0</b>	<b>5.9</b>
<b>Emerging and Developing Asia</b>	<b>5.5</b>	<b>-0.8</b>	<b>7.4</b>
China	6.1	1.0	8.2
India	4.2	-4.5	6.0
ASEAN-5	4.9	-2.0	6.2
<b>Emerging and Developing Europe</b>	<b>2.1</b>	<b>-5.8</b>	<b>4.3</b>
Russia	1.3	-6.6	4.1
<b>Latin America and the Caribbean</b>	<b>0.1</b>	<b>-9.4</b>	<b>3.7</b>
Brazil	1.1	-9.1	3.6
Mexico	-0.3	-10.5	3.3
<b>Middle East and Central Asia</b>	<b>1.0</b>	<b>-4.7</b>	<b>3.3</b>
Saudi Arabia	0.3	-6.8	3.1
<b>Sub-Saharan Africa</b>	<b>3.1</b>	<b>-3.2</b>	<b>3.4</b>
Nigeria	2.2	-5.4	2.6
South Africa	0.2	-8.0	3.5
<b>Low- Income Developing Countries</b>	<b>5.2</b>	<b>-1.0</b>	<b>5.2</b>

Compared to April forecasts, growth of the global economy in 2021 will be 5.4% (against 5.8%). It is reported that similar to April forecasts, there is a high level of ambiguity in forecasting. Economies of market-forming countries and those developing will drop by 3% (forecast 1% before), while they will rise by 5.9% (against 6.6%) in 2021. In particular, the US GDP decrease will make 8% in 2020, its restoration in 2021 – 4.5%; in Germany, the GDP will drop by 7.8% in 2020 and rise by 5.4% in

2021 (Fig. 3). The most abrupt fall is expected as before – in Italy and Spain – by 12.8% with the corresponding 6% increase of the economies in 2021. In France, the decline will make 12.5% with the corresponding growth by 7.3% in the following year. Britain’s GDP will drop by 10.2 %, though the IMF expected a 6.5% decrease before. It will increase by 6.3% in 2021 [11].



**Fig. 3.** Dynamics of World Economic Outlook Growth Projections

It is evident that the corona virus crisis has caused serious problems never seen before. Meanwhile, according to the IMF, the world economy will be able to overcome most challenges next year and continue its advance, especially in the field of electric car production and corresponding structures. Innovations are sources of human development as they used to be throughout the world history.

### 3. Conclusions

Thus, analysis of development of innovative processes, design and production of electric vehicles and associated factors including infrastructure enables the following conclusions.

Development of electric mobility is evidently gaining attention in many countries, especially economically developed ones. This trend aims to make this kind of transport dominating in the coming 15-20 years that will replace conventional combustion cars almost entirely.

Some countries’ interest in electric cars is conditioned by environmental concerns (Norway and Sweden) and is not associated with any acute economic need. Of course, these very concerns will be of essential and global character in future. There appear some electric car producers among the large and respectful companies that did not produce cars before, e.g. Sony, and their interest in this trend is



probably caused by great innovative potential and financial profits, this making their entry into the market quite certain.

Key players on the world market of electric cars include both traditional car producers like the USA, Germany, France, Japan and China whose dynamic advance involves many areas including innovative one in recent years. From the technical point of view, electric cars are much simpler than combustion ones as there are no ordinary car units and mechanisms, while the key element of an electric car is a battery noted for its high price, but it is being actively improved in recent years.

Many advanced electric-car producers, European ones in particular, are experiencing problems with producing car batteries, while China and Southern Korea are staying ahead here.

The corona virus has greatly affected the world economy. Analysis of the corona influence on the state and development of various transport branches reveals that electric cars used as private vehicles are not infection channels, this fact making them very promising from this viewpoint.

Both Ukraine and Uzbekistan can become world players on the electric car market through producing lithium, the essential raw material for car batteries, as well as some car units, devices, charging stations or even vehicles themselves. The latter is naturally better, but realizable only in cooperation with the world leading car concerns.

## References

- [1] Case Study Report: The Norwegian EV initiative (Norway) 2018 Luxembourg: Publications Office of the European Union DOI:<https://doi.org/10.2777/003670>
- [2] Sharma A, Zanotti Ph, Musunur L 2019 Enabling the Electric Future of Mobility: Robotic Automation for Electric Vehicle Battery Assembly. IEEE Access. 1-1. DOI: <https://doi.org/10.1109/ACCESS.2019.2953712>
- [3] Simon Á F, Frances S, Till G, Patrick P 2019 How much charging infrastructure do electric vehicles need? A review of the evidence and international comparison, Transportation Research Part D: Transport and Environment vol 77, 224-242 DOI: <https://doi.org/10.1016/j.trd.2019.10.024>.
- [4] Tesla 2020 Official website URL <https://www.tesla.com/>
- [5] Kharin S and Purii H 2020 Innovative management of projects for electric mobility development: foreign experience and Ukraine Economics. Finances. Law DOI: <https://doi.org/10.37634/efp.2020.5.4>
- [6] Government portal: Infrastructure Reform 2020 Official website URL <https://www.kmu.gov.ua/en/reformi/ekonomichne-zrostannya/reforma-infrastrukturi>
- [7] Uzbekistan's Transformation: Strategies and Perspectives 2020 SWP Research Paper 2020/RP 12 32 DOI: <https://doi.org/10.18449/2020RP12>
- [8] Air travel in the time of COVID-19 2020 The Lancet Infectious Diseases vol 20 (9) DOI: [https://doi.org/10.1016/S1473-3099\(20\)30647-2](https://doi.org/10.1016/S1473-3099(20)30647-2)
- [9] Xiaoshuo H, Ping L 2020 Whose Legitimacy? China's Drive for Electric Vehicles. *Sociology of Development* vol 6 (1) 66–90. DOI:<https://doi.org/10.1525/sod.2020.6.1.66>
- [10] Tsakalidis A, Krause J, Julea A, Peduzzi E, Pisoni E, Thiel C 2020 Electric light commercial vehicles: Are they the sleeping giant of electromobility? Transp Res D Transp Environ 86 102421. DOI: <https://doi.org/10.1016/j.trd.2020.102421>.
- [11] World Economic Outlook Update June 2020 International Monetary Fund URL <https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020>