

## ANALYSIS OF BARRIERS TO PROMOTION OF ELECTRIC CARS ON RUSSIAN MARKET

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**Abstract.** Automobile transport is traditionally considered to be one of the sources of environmental pollution. In Russia, this source of air pollution becomes the main one in big cities. The head of the Rospotrebnadzor (Federal Service for Supervision of Consumers Protection) Anna Popova states that according to the atmospheric air research 2011-2015 the main contribution to the pollution of big cities is not made by industry, but by road transport. The proportion of such pollution reaches 80 %. The significant factor in the development of such a trend is the growth of passenger transport fleet. Over the past decade the number of cars in Russia has almost doubled. According to the Ministry of Natural Resources, the use of environmentally friendly fuels does not save from the carbon monoxide emissions, only the use of electric vehicles and bicycles can principally help. The latter type of transport does not take hold in the majority of natural and climatic zones of Russia. The objective of the research is to identify the main factors that create obstacles to the spread of environmental innovations in the field of personal passenger road transport. The research is based on the competition theory by M. Porter, in particular the creation of barriers to market penetration and consumer behavior theory. The following methods of market research are used: online survey of potential consumers at age of no more than 30 years, interviews with experts directly related to the car trade. The first target group for the study was chosen because the younger generation of car owners will promote the growth of the electric vehicle market in the next decade. The second research target group has the ability to track the current priorities of car buyers and is able to assess the commercial potential of electric vehicles.

**Keywords:** ecomarketing, sustainable development, electric cars, automotive market.

### Introduction

Automobile transport is traditionally considered one of the sources of environmental pollution. In Russia, this source of air pollution becomes the main source in large cities. The head of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare (Rospotrebnadzor) Anna Popova, according to the atmospheric air research 2011-2015, argues that the main contribution to the pollution of large cities is not made by industry, but by road transport. The share of such pollution reaches 80 %. A significant factor in the development of this trend is the growth of the passenger transport fleet. Over the past decade, the number of cars in Russia has almost doubled. According to the Ministry of Natural Resources, the use of environmentally friendly fuels does not save from carbon monoxide emissions, in principle only the use of electric cars can help. The latter type of transport does not take root well in most natural and climatic zones of Russia [1].

The aim of the research is to identify the main factors that create obstacles to the spread of environmental innovations in the field of personal passenger motor transport.

The initial hypothesis was the assumption that the barriers to the spread of electric cars on the Russian market are related both to the factors of market competition and to the peculiarities of acceptance of innovative goods by consumers.

The research is based on M. Porter's theory of competition in terms of creating barriers to market penetration and consumer behavior theory.

Studies of competitive forces in the industry conducted by the authors earlier allowed to establish the market forces of competition that determine the development of the market of electric cars in Russia in competition with substitute products – cars with internal combustion engines (ICE). The presence of market barriers is a deterrent to the influx of new producers to the market. M. Porter formulated the main factors affecting entry barriers: economies of scale, product differentiation, capital requirements, high fixed costs, access to sales channels, public policy [2].

It is obvious that the size of the Russian market of electric cars is not able to provide the manufacturer with economies of scale. In Russia, according to the analytical agency "AUTOSTAT" on July 1, 2017, there are only 1,1 thousand electric cars [3]. Compared to 2016, the volume increased

1.7 times. For 2018, the upward trend has continued [4; 5]. Despite the steady growth, the volume is very small in absolute terms and is not comparable to the number of Russian motorists.

With small volumes of the market, producers do not have economies of scale, so differentiation is possible as a competitive strategy.

Differentiation makes it possible to create a significant feature for consumers, which is difficult to copy or surpass. Tesla was able to create a reputational barrier, so new players needed significant resources to overcome consumer loyalty, in order to introduce more budget models on the market. The Russian manufacturer of electric cars offers Russian consumers a budget model for the electric car ELLADA, but does not have such a reputation asset. When buying an innovative product, the consumer feels a risk. The reputation of the manufacturer can reduce this risk. In the case of the Russian manufacturer, this does not happen.

However, the main advantage of an electric car is its environmental safety for the environment. In Russia, this barrier requires further research.

The need for capital for the Russian market of electric cars is great. Capital is needed not only for production, consumer lending, creation of service support, but also the organization of an extensive network of electric-charging stations. The company Tesla, in order to successfully compete with cars with ICE, built a “supercharging” network, providing coverage for the stations for recharging in the territory of the United States, Western Europe and Japan. Given the growing interest in environmental modes of transport in these countries, Tesla Motors’ own infrastructure now provides a significant advantage. In Russia, the problem of infrastructure development has yet to be solved.

Cost barrier advantage is based on the “learning curve” (the effect of experience) and is a consequence of the use of advanced technologies, access to the best sources of raw materials, government subsidies. The Russian manufacturer of electric cars does not have such advantages.

The system for the sale of electric cars does not require any special conditions in comparison with the sale of cars with ICE, however, the network of auto dealers may not be interested in selling an innovative product [6].

The state policy does not limit access to the market and does not offer substantial support to the domestic producer. It is obvious that the Russian market of electric cars does not have artificial barriers to penetration into the industry, but the advantages of innovative goods do not allow to overcome the barriers created by substitute goods. Therefore, the key problem can be called the attitude of consumers and car dealers to an innovative product that can ensure the success of electric cars on the Russian market.

### **Methods of research**

Investigations of the reasons for the success of new products, conducted earlier by different authors, made it possible to determine the main factors that determine the diffusion of innovation: innovation itself; communications; the duration of the decision to purchase; social environment. In the process of research, the authors relied on the work of E. Rogers, revealing the process of making a decision to purchase an innovative product. The model includes five stages of decision making: cognition, opinion formation, decision, mastering, confirmation.

At the initial stage, both the initial conditions and the characteristics of the consumer are important. The initial conditions include: past experience, perceived needs and problems, innovation, norms of the social environment. The characteristics of the consumer itself are considered in terms of socio-economic and personal characteristics, as well as the activity of communications. At the second stage, the consumer evaluates the characteristics of the innovation itself: its relative advantage, compatibility, complexity, testability, visibility. After this, in the third stage, innovation takes place or is rejected. The initial decision to accept an innovative product is not final, since the consumer can change his mind later. A consumer who rejects an innovative product, if he receives additional knowledge or changes in social norms, can change his perception of the characteristics of innovation and decide to buy. At the same time, a consumer who has decided to accept innovation, at the fourth stage in the process of developing novelties, can both confirm its acceptance of innovation and reject it, stopping using an innovative product. Active rejection means abandoning the use of innovation by people who have studied the novelty, perhaps even tried it. Passive aversion is manifested in the fact

that people do not even think about the possibility of using innovation, they are not aware or unwilling to change patterns, expecting more weighty evidence of the usefulness of innovation. The stage of mastering innovation is also important because it is at this stage that a change in behavior is required from the consumer. The experience of using an innovative product and the corresponding support of the environment determine the consumer's confidence in his choice, which in turn determines the further spread of the innovation [7].

E. Rogers presents the diffusion of innovation as a cumulative process of individual decisions of consumers regarding the adoption of innovation. The diffusion of innovation as a process involves elements: innovation itself, communication about it, time and the social system. The process of diffusion begins with the dissemination of information to potential consumers and the decision-making process for the adoption of innovation.

The objectives of this study are to determine, which type of innovation the electric car belongs to in terms of the consumer's decision-making process; specify the specifics of the decision and give a description of the factors that determined this state.

The following methods of marketing research are used in the work: online survey of potential consumers aged no more than 30 years, interviews with experts directly related to the trade in cars in Russia. The first target group for the study was chosen because it is the younger generation of car owners who will determine the growth of the electric car market in the next decade. The study involved 350 people.

In total the questionnaire contained 8 questions linked with identification of initial conditions of the car using, the felt need for the vehicle, the relation to the car as a source of air pollution, regulations of the social environment. 4 questions registered the characteristics of the respondent in terms of socio-economic and personal characteristics.

$$N = p \times (1 - p) \times z^2 / d^2, \quad (1)$$

where  $N$  – the desired sample size;  
 $p$  – the variation of the characteristic ( $p = 0.5$ );  
 $z$  – the confidence level coefficient ( $z = 1.96$  – for 95 %);  
 $d$  – the accuracy level (0.05).

$$N = (0.5 \times 0.5 \times 3.84) / 0.0025 = 384. \quad (2)$$

Total 34 questionnaires were rejected because of age-related inconsistencies in the sample, which did not impact on the accuracy level.

The second research target group belongs to the category of “influential persons”, has the ability to influence the consumer choice and track the current priorities of car buyers, so it is able to assess the commercial potential of electric cars. The experts were 20 members of companies engaged in the car sale and service in Russia.

## Results

The electric car is an innovative commodity for Russia. From the point of view of marketing theory, an innovative product is any product or service perceived by the potential consumer as new. However, the degree of novelty is different. An objective criterion for classifying innovations is the nature of the change in patterns of consumer behavior (patterns). Innovations, the emergence of which leads to a radical change in behavioral patterns, are characterized as intermittent innovations. Often such innovations are called world or genuine novelties. Their adoption is hampered by a weak consumer awareness of the availability and value of a new way of satisfying the need, advantages in comparison with substitute products, the lack of experience in consumption and social approval. Continuous innovation does not change the established behavioral patterns radically. Such innovations often represent modifications to existing products. In this case, consumers are able on the basis of existing experience and additional information to understand and evaluate the benefits obtained from the consumption of a new product, which speeds up the process of adopting innovation. Dynamically continuous innovations are characterized by more significant changes in the way of satisfaction, but they do not require a radical change in behavioral patterns. Dynamic continuous innovations are more understandable to consumers, but they need additional explanations for the formation of knowledge.

The electric car refers to dynamically continuous innovations. From this it follows that the mechanism of acceptance of an innovative product by consumers is not too complicated. Consumers understand, what needs are met by this product, how it is applied. However, the influence of other factors on the choice is not so obvious and requires more detailed studies.

Table 1 shows the structure and description of the main factors that determine the process of acceptance of the novelty.

Table 1

**Structure of the factors that determine the decision-making process about the novelty**

<b>Subject of analysis</b>	<b>Studied aspects</b>
Baseline conditions	Past consumer experience: ideas about the utility and principles of the novelty
	Sensible needs and problems
	Innovation - the individual characteristics of consumers regarding acceptance or rejection of novelty
	Norms of the social environment: attitudes and patterns that emanate from reference groups
Characteristics of consumers	Socio-economic characteristics
	Personal characteristics
	The activity of communications (receiving and processing information)
Perceived characteristics of innovation	The relative advantage is the extent to which consumers perceive the benefits offered by innovation to be more meaningful than the usual options
	Compatibility - the compatibility of the novelty with habits, values, needs and past experience
	Complexity is the degree of difficulty in understanding, acquiring and using novelties
	The possibility of testing - the ability of the consumer to assess the benefits of innovation in the course of its testing
	Visibility is the degree of approval of innovation by the social environment
Duration of the decision	Time required to complete the purchase

The factors listed in Table 1 have certain characteristics from the point of view of the process of adopting electric cars in Russia. First of all, the initial conditions and perceived characteristics of the innovative product are of interest. The characteristics of potential consumers seem to be the most predictable factors. In particular, the paying capacity of the population will be of decisive importance. For the Russian consumer, a difference of 10,000 USD in the price of a car is a significant barrier to the choice of an electric car.

Table 2 shows the hypotheses regarding the initial conditions for the perception of electric cars in Russia.

From the point of view of the adoption of innovation, five classification groups are distinguished: innovators, first users, early majority, later majority, lagging behind. Each subsequent group takes more time to accept the novelty than the previous one. It should also be noted that the development of innovation by each subsequent group depends on the success of acceptance of innovation by the representatives of the previous group, since satisfied consumers become sources of additional information in support of innovation. To successfully spread innovation, it is important that it be adopted by the first two groups. Therefore, the features of their behavior are considered in more detail.

Innovators (i.e. consumers who accept the product first) have a risk appetite, have an education level above the average, use multiple sources of information, look for new mental (cognitive innovators) or sensory (sensory innovators) sensations. Often they are “experts” in the eyes of other consumers. According to researchers, this segment is 2.5 % of potential consumers. The first users are able to influence the opinions of other people and are role models because of their status or authority, account for 13.5 %. The number of electric car owners in Russia is currently very small (clearly less

than 2.5 % of the population of large cities), which indicates the initial stage of diffusion of innovation.

Table 2

**Results of the study of the initial conditions for the formation  
of the perception of electric cars in Russia**

<b>Studied aspects</b>	<b>Features of the initial conditions of consumer perception</b>	<b>Percentage of respondents</b>
Past experience of the consumer	<p>Representations of the consumer about the utility and principles of the action of an electric car are made up of his experience of using cars with ICE and various devices working on batteries.</p> <p>The consumer does not need to radically change the behavior patterns when choosing and operating an electric car. The experience of using electric cars in most consumers is absent or associated with a city trolley and a children's attraction.</p>	71 % have a car with ICE.
Perceived needs and problems	<p>The perceived needs are related not only to movements in space (including distant ones), but also to the demonstration of social status.</p> <p>Also trips are made outside the city and to other cities of Russia.</p> <p>Consumers tend to change the car every 5-7 years, but for many, this purchase takes place once in a lifetime. Consumers focused on changing vehicles more often are concerned about the liquidity of electric cars.</p> <p>Ecological problems cause consumer anxiety, but the environmental aspect is not taken into account when buying a vehicle.</p> <p>Growing prices for gasoline and diesel fuel force consumers to pay attention to the economy of the vehicle. A great concern is the high cost of repair of electric vehicles.</p> <p>There is also a trend towards a healthy lifestyle.</p>	<p>78 % use private vehicles daily.</p> <p>More than 50 % use the car to move around the city.</p>
Innovation	<p>The determining opinion when choosing a vehicle is the man who, as a rule, is interested in technological innovations. The acceptance of innovation is determined by the authors in terms of the degree to which the possibility of buying an electric vehicle can be made in the future.</p>	11 % are almost confident in the possibility of own purchase of an electric car in the future.
Norms of social environment	<p>Many are aware of European trends of environmentally responsible behavior. However, about 30 % of respondents do not consider cars a serious source of air pollution.</p> <p>The interpretation of potential benefits from the use of environmental innovation is ambiguous. Consumers do not have confidence that the transition to electric transport can radically change the ecological situation.</p>	<p>37 % associate trend environmental responsible behavior with the introduction of electric cars.</p> <p>About 30 % do not consider cars a serious source of air pollution.</p> <p>About 15 % see electric cars as a fashion trend.</p> <p>23 % are focused on protecting people's health.</p> <p>12 % are focused on economy.</p>

The propensity for innovation was assessed by the question: “Do you allow the possibility of buying an electric car in the future for yourself?”. In the structure of the question the Thurstone scale (0-10) was used. Answers are provided in Fig. 1.

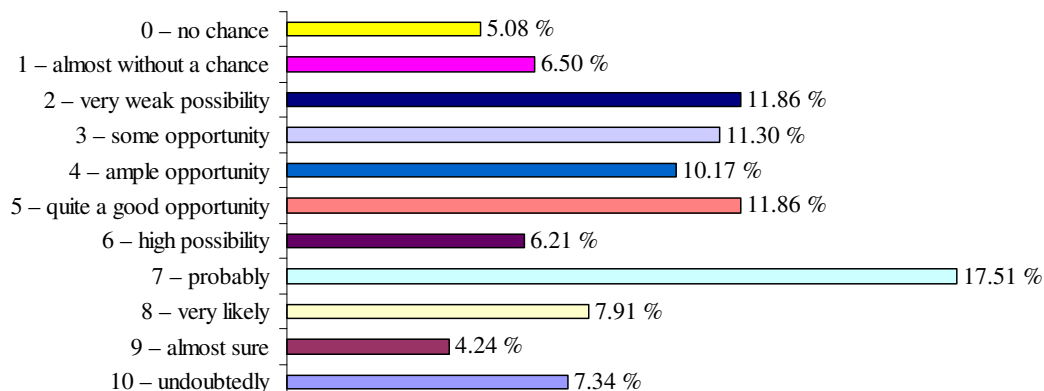


Fig. 1. Possibility of buying electric car in future by respondents, %

The distribution of answers cannot be considered statistically reliable, since the sample is not random. In addition, it should be remembered that in the formation of the sample, distortions were intentionally made in favor of young respondents aged 17-30. Obviously, young people are more inclined to accept innovation. The percentage of confident in the possibility of buying an electric car is clearly higher than the estimate of the share of innovators in 2.5 %, determined by the research of consumer behavior.

Cognitive innovators are focused on productivity, the search for new mental sensations. Sensory innovators – on uniqueness, complexity reduction, free additional benefits and service support of the manufacturer. Some innovators are aimed at combining different sensations.

An analysis of the baseline conditions allows us to state that consumers need to feel personal benefits from the use of innovation for the adoption of electric cars. Russian motorists are focused on new mental sensations from the application of environmental innovations, consumer organizations – on saving current expenses.

The probability of adopting an innovation is directly related to a high estimate of the perceived characteristics of electric cars. Perceived characteristics determine the user’s attitude to the utility of innovation and the degree of risk of purchase (including unjustified waste of time and money). Table 3 shows the features of the perception of electric cars by Russian consumers.

Table 3

**Structure and assessment of perceived characteristics of electric cars by potential consumers**

Subject of analysis	The nature of the impact on consumer patterns
Relative advantage	Do not consider as a full replacement for cars with ICE. The price is too high. Battery replacement is considered very likely, which creates problems and requires additional waste. The main advantage to potential consumers is seen in the novelty of mental sensations: “this has not happened yet”, “it is interesting to try”, “drive - the speed of electric cars is very high, and you do not even feel that you are going”. Also there is an opinion that the cost of daily operation is low.
Compatibility	The electric car is suitable for city trips of the inhabitants of suburbs. For taxi transport and public transport. The lack of convenient charging makes the electric car unacceptable in operation for urban residents.

Complexity	The process of buying an electric car at the moment is quite complicated for the disinterested buyer: in Russia, a preliminary order and a long wait is required. When buying abroad - difficulties with delivery and customs clearance. The complexity of operation is determined not only by the problem of recharging the battery in the absence of charging stations, but also by difficulties in servicing electronics.
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Table 3 (continued)

Subject of analysis	The nature of the impact on consumer patterns
Test capability	To familiarize consumers with the features of electric car operation, the traditional test drive is not enough, since the main problems of electric car operation are associated with the duration of the run without recharging the battery and the convenience of charging it. The offer of leasing programs can provide greater convenience for the consumer.
Visibility	The purchase of a new car will be noticed by the social environment. Social recognition of electric car owners is not guaranteed. There is also little support from government agencies (few benefits and subsidies).

### Discussion

The obtained results were discussed with experts of the automotive market. In general, the possibility of wide distribution in the consumer market is estimated by specialists as a very utopian perspective. The most realistic applications of electric cars are warehousing, manufacturing, and trade. Among the main barriers hampering the advancement of electric vehicles to the consumer market were the undeveloped system of refueling; the lack of specialists able to adapt electric cars to the Russian market; ambiguous positioning attributes (too high price for non-obvious benefits for consumers). When analyzing the strengths and weaknesses of electric cars, presented or planned for launch in the Russian market (E-mobile, Tesla, ELLADA), there was a clear advantage to the latter. So, among the strengths were named ecological compatibility, stylish design (Tesla), compactness (E-mobile), ease of evacuation. Weaknesses include the lack of adaptation to climatic conditions; high car price and service; short cord for charging; low ground clearance, which does not allow full-fledged exploitation of the car on Russian roads; dependence on a limited number of gas stations in conditions of permanent traffic jams. By the way, the problem of road quality is often raised in foreign studies [8]. Among other things, the question of the maximum period of operation of electric cars and the related issue of the possibility of recycling or eco-friendly disposal remains debatable.

### Conclusions

As experts in the field of promotion of electric cars to the Russian consumer market, the experts named the following.

1. Development of the concept of environmental marketing as a business philosophy, introduction of a culture of ecological consumption into the consumer consciousness.
2. Study of experience and analysis of the European market of electric cars.
3. Development of a network of gas stations for electric cars on the territory of the country.

The implementation of the above measures is possible, according to experts, only with the direct participation and support of government agencies. For most parameters, the perception of electric cars is low. According to the experts' forecasts, no significant changes are expected in the near future. Without government support, the barriers to the promotion of electric cars on the Russian market are insurmountable.

To accelerate the diffusion of innovations promotion programs are also needed to stimulate communication about the benefits of using electric cars. The Russian consumer has no unambiguous perception of electric cars. It is important to convey to potential consumers both personal benefits

(uniqueness, reduction of complexity, etc.) and social benefits that ensure environmental protection. It is necessary to create new patterns; state support will contribute to this.

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