

# Development of the information and communication sector as a factor in the evolution of fair vehicle insurance: From concept to determination of rates

**Vasiliy N. Shcherbakov**

*MSc Program Student, Department of Data Processing Automation  
Tomsk State University of Control Systems and Radioelectronics  
Address: 40, Lenina Prospect, Tomsk, 634050, Russian Federation  
E-mail: sherbakovasilii@gmail.com*

**Anatoly A. Sidorov**

*Associate Professor, Department of Data Processing Automation  
Tomsk State University of Control Systems and Radioelectronics  
Address: 40, Lenina Prospect, Tomsk, 634050, Russian Federation  
E-mail: astroasregion@gmail.com*

## Abstract

The paper describes the features of auto insurance services in Russia, including the factors affecting the cost of insurance products. A review of existing legislation in the field of car insurance is presented: according to the Law “On the State Information System ERA-GLONASS, manufacturers of categories B and C vehicles will be required to implement this tracking system for all cars produced in Russia. This fact was a prerequisite for research aimed at exploring the possibility of adapting the foreign system of “smart insurance” to the Russian market. Modern processes of car insurance and related technologies for determining the insurance policy value used in such countries as the US, UK and Australia rely on telematics sensors that determine individual performance and driving style. Some of components of the ERA-GLONASS system may be applied as such sensors.

In this paper, we present different models of participant interaction during implementation of a new technology for the process of delivering CASCO insurance products in Russia. Such models include the public-private model, independent-private model, as well as industry and outsourcing models. We identify the main mechanisms for improving the competitiveness of insurance companies through general introduction of a “smart insurance” approach: reducing the policy rates in case of safe driving, and expanding the functionality of IT services for drivers. A survey of vehicle owners and interpretation of the results are presented: the purpose of the survey was to identify readiness of drivers for transition to the proposed model of car insurance, and identification of functionality of appropriate mobile services.

Relying on an analysis of the methodology for calculating policy rates for risky types of insurance approved by order of Rosstrakhnadzor, a model of insurance rate calculation is proposed using special discounts applied in recognition of careful driving.

**Key words:** car insurance, smart driving, telematics sensor, mobile service, insurance rate, calculation method.

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### Introduction

The development of the vehicle insurance market in foreign countries demonstrates that the factors affecting the tariff formation of the CASCO insurance policies in Russia are not in correlation with the frequency of occurrence of insured events. The USA, United Kingdom and Australia are rapidly moving to an improved system of determining the insurance value which takes into account individual data on motor vehicle driving quality of the given driver through installation of telematic sensors on the motor vehicle.

The technology under consideration has been applicable in some foreign countries since 2010. It makes it possible to quantify the client's driving habits (speed, braking power, observance of traffic rules, etc.). As a result, due to the potentially low hazard he presents by virtue of his conduct, a careful driver pays much less for insurance coverage [1]. Such a method is called "smart insurance" or "pay-as-you-drive". Therefore, the merit index of driving lays the foundation for determining the value of insurance services.

It seems obvious that such an approach is of interest both for insurance companies and drivers [2]. "Smart insurance" enables the insurance companies to select

their customers, efficiently manage insured events and improve road safety. For the customer, "smart insurance" is, on the one hand, a discount for proper driving, and on the other hand, gives real-time ability to monitor the vehicle, as well as prevent critical driving errors through the use of mobile services [3].

The USA and Great Britain have been using this approach for nearly five years. For example, Snapshot developments have been introduced in 43 states (which points to large-scale technology penetration). The maximum discount for the customers who have used the services under consideration was 30%, and additional corporate revenue was more than 1 million dollars. In Illinois, Ohio and Arizona the principle is being used by Allstate Drive Wise. In Great Britain approximately 100,000 devices are activated, and at present there is a monthly influx of 6,000 new customers. Planned total sales revenue of "smart insurance" services in the USA and Great Britain in 2015 is estimated at 2 billion 600 million dollars [4, 5].

However, the introduction of "smart insurance" in Russia is constrained by a number of factors of organizational, legal, methodological and psychological nature. They are the subject matter of this paper.

Table 1.

Factors having an impact on the policy value

s.n.	Factor	Motor insurance product			Remark
		OSAGO	DSAGO	KASKO	
1.	Type of vehicle	+	+	-	Category of vehicle is taken into account
2.	Year of manufacture of vehicle	-	-	+	
3.	Cost of vehicle	-	-	+	
4.	Make and model of vehicle	-	-	+	
5.	Method of buying the vehicle	-	-	+	Credit or own funds
6.	Presence of anti-theft alarm system	-	-	+	
7.	Type of amount of coverage	-	-	+	Aggregate or non-aggregate insurance coverage
8.	Intended use of vehicle	+	+	-	Private use, taxi-driving and others
9.	Insurance holder	+	+	-	Legal entity or private individual
10.	Place of vehicle registration	+	+	-	
11.	Record of persons approved to drive the vehicle	+	+	-	Presence / absence of a fixed record of persons approved to drive the vehicle
12.	Age and length of driving experience of persons approved to drive the vehicle	+	+	+	
13.	Power of vehicle's engine	+	+	-	For trucks a Gross Vehicle Weight Rating is accounted, for buses a number of seats is accounted.
14.	Seasonality of vehicle use	+	+	-	
15.	Insured history	+	+	-	Number of previous years of insurance and occurrence of vehicle accidents due to the fault of the insured person.
16.	Driving habits	-	-	-	

## 1. Specifics of the Russian motor insurance market

The rapid development of the modern motor insurance market in the Russian Federation started in 2002 with adoption of Federal Law No.40-FZ dated 25.04.2002 “On compulsory public indemnity insurance of vehicle owners” [6]. The current regulations oblige drivers to take third party liability insurance. In addition, issues relating to providing additional services – DSAGO and CASCO are predetermined.

Policy value depends on various factors. Table 1 provides a comparison of three major vehicle insurance products from the perspective of conditions taken into account when setting rates.

As the table shows, when setting the insurance rate for OSAGO and DSAGO the type of vehicle, its intended use, the age and driving experience of all its drivers are mainly taken into account, and when setting the CASCO insurance rate, the characteristics and equipping of the vehicle, age and driving experience of a driver are mainly taken into consideration. It should also be noted that driving habits are not taken into account for any of the products under consideration in the cost calculation.

## 2. Prerequisites for including driving habits as a factor determining the policy value and model for managing interaction of participants

The State Duma of the Russian Federation passed the law No. 395-FZ of 12.28.2013 “About the National Automated Information System ERA-GLONASS” [7], which obliges manufacturers of vehicles in categories B and C to equip vehicles produced in Russia with the tracking system ERA-GLONASS. In the first phase, the equipment will only act as an emergency button. Beginning in 2017, the system shall start to transmit information on accidents in automatic mode. In this case, if the system detects a road traffic accident, an accident signal is automatically sent to the dispatcher, and he, in his turn, communicates with the driver via a speaker phone.

If no response from people in the car ensues, a medical emergency team will be sent to the scene of the accident. Authors of the ERA-GLONASS system maintain that after the system is fully operational the rate of mortality on roads should be reduced by 30—40%. In addition, according to the document, as from 2017 installation of the emergency response system will be mandatory on passenger and freight transport [8].

The leading insurance companies have put forward an initiative to get access to data coming from the system sensors via a single server to determine the rate of vehicle insurance based on individual telematic indicators of driving style. In this case, in each region data centers will be established, which will form, store and process huge data arrays from all sensors. The establishment of such organizations pursues such objectives as improving road safety, increasing traffic capacity of highways, managing traffic signs and traffic lights and setting coordinated traffic lights.

It is expected that these data centers will be government institutions. However, it is unknown how relevant information is going to be used, and who will have access to it. This does not make it possible to determine the final list of participants of relations under consideration (the state, insurance companies, customers), the scheme of their interaction and, as a consequence, the institutional design of this system and the cost of providing motor insurance services in a new format. In this regard, there can be several models of participants’ interaction when implementing the new technology of providing services.

**The public-private model** is based on the fact that stand-alone subdivisions of the federal data center ERA-GLONASS will be organized in the territorial subdivisions (subjects) of the Russian Federation. They will collect and process the vehicle sensor information which can then be accessed by insurance companies (*Figure 1*).

The autonomous-private model is based on the assumption that access to ERA-GLONASS information data-centers will be closed, and the intentions of the insurance companies to transfer the process of provid-

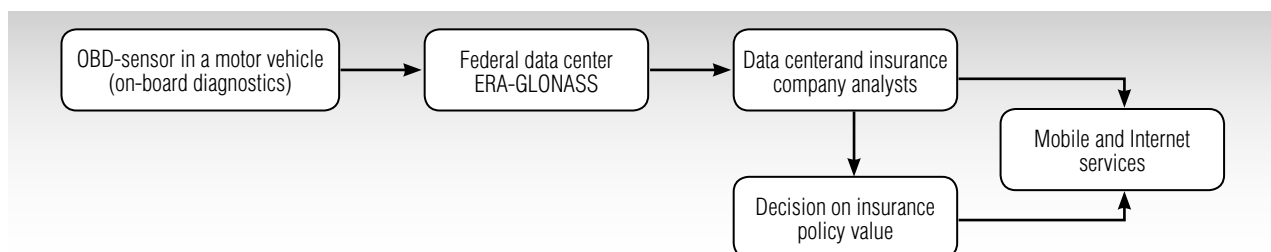


Fig. 1. Public-private interaction model

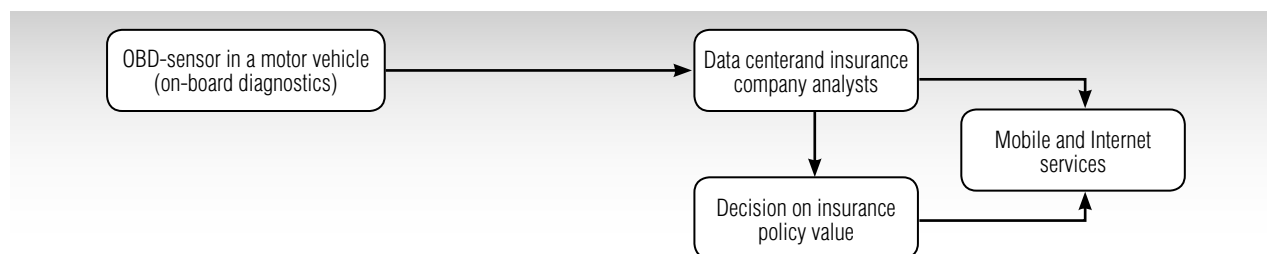


Fig. 2. Autonomous private interaction model

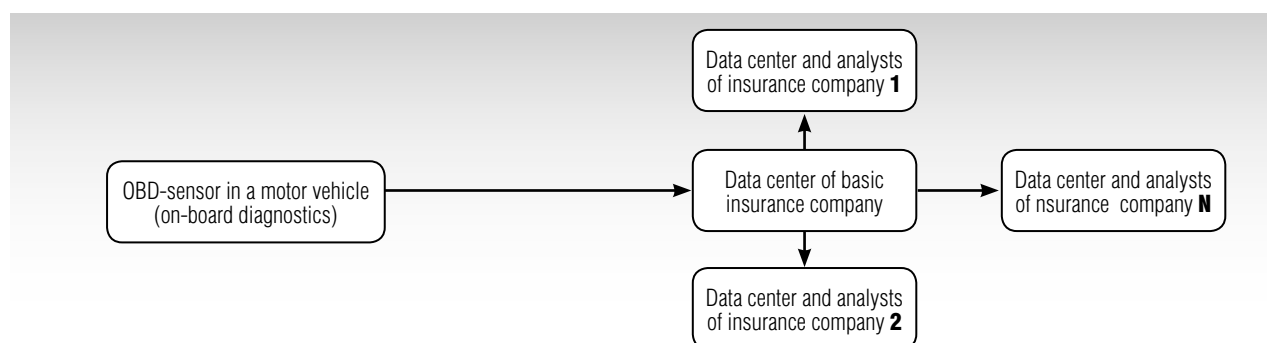


Fig. 3. Industrial interaction model

ing services to a new format will remain unchanged. The state shall be excluded from the proposed model. Each insurance company will need to revise its approaches to providing services: develop or acquire their own sensors (similar to those used in the ERA-GLONASS project), install them in customers' motor vehicles, and then collect and process data by the efforts of their engineering, information and analytical services (Figure 2).

The industry model is based on the idea that the insurance company, which first will be able to develop and implement a new approach to the delivery of motor insurance services without the state participation can make their data center common for several (or most) insurance companies, and act as a provider of data from each vehicle (Figure 3).

In the outsourcing model, the "intelligent" approach can be implemented by an organization outside the in-

surance industry that offers OBD-sensors, installation services, information acquisition and transmission to the analytic insurance centers of insurance companies for further use (Figure 4).

The public-private model will be possible only if the insurance companies get access to information of federal centers of ERA-GLONASS. Otherwise the companies will have to independently develop their own telematic system, install their own sensors in the customers' motor vehicles and establish their data center (in the case of the autonomous private model) or use data centers of other insurers (industry model). Another option that is being considered is outsourcing services of an organization external to the insurance industry.

It should be noted that currently there is no agreed position of the Government of the Russian Federation and the Russian Association of Motor Insurers concerning

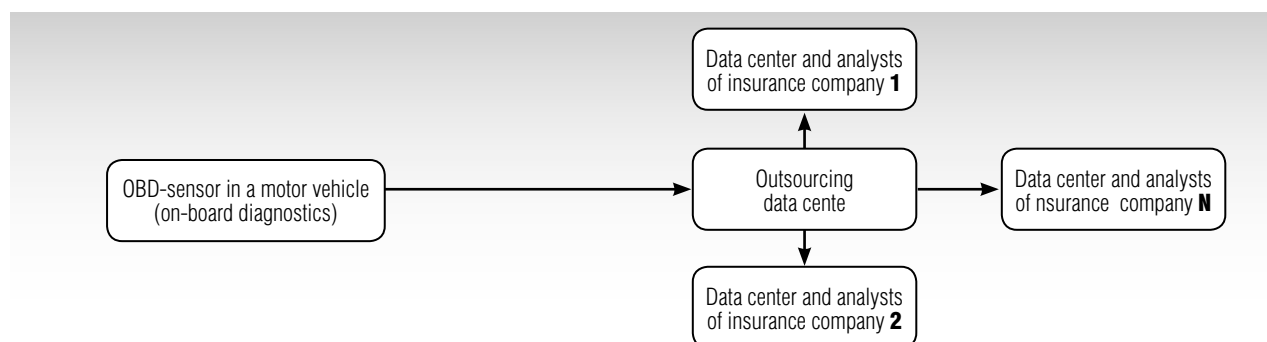


Fig. 4. Outsourcing interaction model

the applicability of data received from the ERA-GLO-NASS system to the insurance companies or the level of their access. This imposes restrictions on a clear choice of institutional model. Only after the interaction format is determined will it be possible to study the practical implementation and costs for implementing and maintaining the “smart insurance”.

### 3. Consumer expectations from “smart insurance”

As already noted, “smart insurance” allows the customer to receive a discount for safe driving, to monitor the vehicle by means of mobile services in real time and to prevent driving errors. During a widespread introduction of the insurance model by Russian insurance companies using telematic sensors, a new strategy should be developed for competitive recovery to attract more customers. Two actuators become apparent: a more attractive discount rate (decrease of CASCO rate value) for careful and safe driving, or an expansion of IT-services functionality for drivers.

The OBD-connectors (telematic sensors) are designed to operate not only on unidirectional basis, transferring data to the data center of the insurance company. Information being transmitted can be used by the drivers, thereby correcting their behavioral driving habits to improve carefulness and safety all of which then influences the amount of future discounts. The information can be tracked and driving habits can be corrected via the mobile applications interface. In so doing, the functionality of a mobile service, as well as the content of the insurance product will not contradict consumer expectations. To identify these expectation, a survey of potential users was conducted. They were selected through a target sampling (400 respondents). The study results were as follows:

1. More than 60% of respondents know that the cost of full comprehensive insurance service in Russia is very high.
2. About 40% of respondents have for some time used or are currently using CASCO services.
3. The vast majority of respondents (about 90%) believe that CASCO service is expensive and inefficient.
4. The functionality of the mobile application synchronized with OBD-connectors to increase driver demand should include the following services (in declining order of priority):
  - ◆ navigation;
  - ◆ autologger;
  - ◆ online ransom payments;
  - ◆ monitoring fuel use;
  - ◆ car service center navigation;
  - ◆ handbook of driving regulations;
  - ◆ on-line recording for vehicle maintenance and washing;
  - ◆ vehicle structure and handbook to calculate repair costs;
  - ◆ search for the vehicle in a parking lot;

5. Over 60% of respondents prefer a single multi-function application.

In addition, the respondents were asked to make a five-grade-scale assessment of the effect of individual factors on the probability of an insured event occurring, and consequently, the insurance value (*Table 2*).

*Table 2.*

#### Assessment of the level of factors in the probability of an insured event occurring, as a percentage of the number of respondents

Factor	Assessment				
	1	2	3	4	5
Age of driver	18	14	29	18	19
Driving experience	5	6	15	20	50
Year of manufacture of the vehicle	38	23	18	6	11
Driving habits	10	15	16	21	34
Carefulness	5	14	23	25	31

As the table shows, for calculation of insurance rates the majority of drivers put emphasis on such factors as driving experience, skill and carefulness. At the same time the driver's age and year of the vehicle production are classified as minor items in terms of the probability of an insured event occurring.

#### 4. Method of calculating a discounted insurance rate

Today every Russian insurance company calculates its rates on a stand-alone basis, but as mentioned above, the product value for a consumer depends on the overall indexes defined by the values of parameters and characteristics of the vehicle and the driver. Their functional impact on the final cost and weighting is determined by the insurance company on a stand-alone basis. For a client or a casual observer such a model seems nothing more than a “black box” model (*Figure 5*).

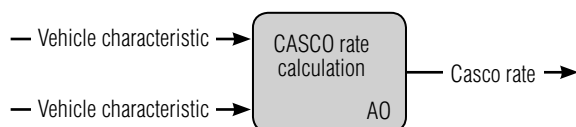


Fig. 5. The "black box" model: a traditional approach

Insurance companies which have implemented the "pay-as-you-drive" approach add another set of input characteristics to the final rate calculation – driving records (Figure 6).

The core issue in CASCO value is the rate, which essentially represents the insured risk price and other costs, and serves as an appropriate expression of the monetary value of the insurer's liabilities under the insurance contract that has been concluded. Insurance rates are determined by actuarial expectations – a system of mathematical and statistical regularities governing the relationship between the insurer and the insured. They reflect a mechanism for forming and spending from the insurance fund in long-term insurance operations related to the length of life of the population in the form of mathematical formulas. In a broad interpretation, the actuarial expectations include tariffs on any type of insurance. With their use, the participation share of each insurer in creation of an insurance fund is determined [9]. The rate at which an insurance contract is concluded bears the name of a gross premium. It consists of two parts: a net premium, expressing the price of the insured risk, and administrative overheads, covering the insurer expenses for organizing and carrying an insurance case, including contributions to reserve funds and profit elements.

Among the risky types of insurance are those which do not provide for insurer liabilities to pay the insured amount upon completion of the contract term (for example, life insurance) and which are not related to accumulation of the amount of coverage during the contract term. The method of calculating rates on risk-related types of insurance may be applied when statistics or other information is available. That makes it possible to calculate the probability of an insured event occurring, the amount of coverage and insurance benefit (amount of indemnity):

$$T_n = T_o + T_p, \quad (1)$$

where  $T_n$  is a tariff net premium;

$T_o$  is a key rate;

$T_p$  is a risk premium.

A lot of papers are dedicated to calculation procedures of each element of the net premium, for example, de-

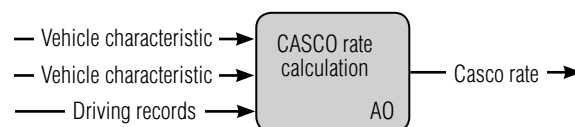


Fig. 6. "Black box" model: "intelligent" approach

tailed algorithms are presented in paper [10]. It is obvious that a discount provided to the driver for careful driving should impact only the key rate  $T_o$ . In this case, the risk premium  $T_p$  remains unchanged (see calculation procedures for rates on risk-related types of insurance approved by the Insurance Supervision Service decree of 08.07.1993 No. 02-03-36 [11]), i.e., its value for the purpose of this paper can be taken as a constant.

$$T_o = \frac{q \cdot S_b \cdot 100}{S}$$

where  $q$  is an estimate of probability of the insured event defined as a ratio of a number of insured events to the number of contracts for a certain period of time;

$S_b$  is an amount of insurance indemnification in insured events;

$S$  is the amount of coverage in the contracts.

In determining the discount rate, the following model is proposed to be used. Let us assume that it is affected by such telematic measured parameters as driving speed, hard braking, and frequency of lane changes. In calculations, it is reasonable to consider not the values of these parameters, but a ratio of the critical measurements (beyond the "red border")  $m_i$  to a total number of measurements  $n_i$ :  $q_i = m_i / n_i$ . Then the careful driving factor  $q$  can be calculated as a deviation from 1 amount  $q_i$ , each several value being adjusted for weight  $v_i$ :

$$q = 1 - \sum_{i=1}^4 q_i \cdot v_i \quad (2)$$

Depending on the obtained value  $q$ , it is reasonable to determine the discount rate  $k_c$ . An example of such a translation is shown in Table 3.

Table 3.

**Correlation between the careful driving factor and the discount rate**

$q$	<0.7	0.7–0.8	0.8–0.9	0.9–1
$k_c$	1.0	0.9	0.85	0.8
Discount rate, %	0	10	15	20

After updating, it is suggested that the net premium value determined by formula (1) be calculated as follows:

$$T_n = T_o \cdot k_c + T_p \quad (3)$$

It is reasonable to consider two examples of insurance rate calculation in the case of careful and aggressive driving as an illustration. The initial data (conditional) is shown in *Table 4*. For convenience, let us take a number of telematic measurements for each parameter equal to 100.

*Table 4.*

**Initial data for net-rate calculation**

s.n.	Telematically measured parameter	Careful driving		Aggressive driving	
		Number of measurements 'beyond the red line'	$q_i$	Number of measurements 'beyond the red line'	$q_i$
1	Driving speed	10	0,10	60	0,60
2	Acceleration speed	20	0,20	75	0,75
3	Hard braking	5	0,05	55	0,55
4	Lane change frequency	15	0,15	70	0,70

To simplify the calculations, let us take telematically defined parameters equivalent in calculations of the discount value. Then the careful driving factor is calculated by formula (2) as follows:

1) in case of careful driving:

$$q^{crf} = 1 - \left( \frac{0,10 + 0,20 + 0,05 + 0,15}{4} \right) = 0,875;$$

2) in case of aggressive driving: .

$$q^{agr} = 1 - \left( \frac{0,60 + 0,75 + 0,55 + 0,70}{4} \right) = 0,350.$$

Using rules of translating  $q$  to  $k_c$  at  $T_o = 100$  and  $T_p = 10$ , we get the following results by formula (3):

1) in case of careful driving:  $T_n^{crf} = 100 \cdot 0,85 + 10 = 95$ ;

2) in case of aggressive driving:  $T_n^{agr} = 100 \cdot 1,00 + 10 = 110$ .

As a result, in the first case the total discount was 13.6%, and in the second case the discount is not given. Projecting the calculation results to actual CASCO rates, we obtain a substantial economy for the consumer when purchasing the insurance product.

## Conclusion

This paper addresses basic aspects of insurance of motor vehicles in Russia, and it provides examples of a modern approach of foreign companies to calculating policy value. Modern foreign companies calculate the insurance rates on the basis of telematic data of the driver defining such individual indicators as acceleration and driving speed, hard braking and lane change frequency. Currently these indicators are not taken into account by domestic companies when calculating the insurance rate. According to interpretation of the data obtained, the majority of drivers consider that individual road skills and carefulness should be important factors in calculating the insurance rate. In addition, on the basis of the poll results, one can determine the required functionality of mobile services, by means of which a driver can individually adjust his driving habits, thereby having an impact on the size of a possible discount when concluding the motor insurance contract.

Global track records in vehicle insurance and passage of the Federal Law No.3 95-FZ of 12.28.2013 "On the National Automated System ERA-GLONASS" predetermined the emergence of several interaction models of parties concerned in the implementation of a new motor insurance technology: the public-private model, the autonomous-private model, the industrial and the outsourcing model.

At present, several domestic insurance companies are proposing that their clients install a telematic sensor in their vehicles and, in the case of careful driving, receive a discount on the insurance product. The discount offered is fixed. This paper describes the method of calculating a discounted insurance rate based on the calculation procedures approved by decree of Russian Insurance Supervision Service No. 02-03-36 of 08.07.1993. ■

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## Развитие информационно-коммуникационного сектора как фактор развития справедливого автострахования: От замысла к тарифу

**В.Н. Щербаков**

магистрант кафедры автоматизации обработки информации  
Томский государственный университет систем управления и радиоэлектроники  
Адрес: 634050, г. Томск, проспект Ленина, д. 40  
E-mail: [sherbakovasilij@gmail.com](mailto:sherbakovasilij@gmail.com)

**А.А. Сидоров**

кандидат экономических наук, доцент кафедры автоматизации обработки информации  
Томский государственный университет систем управления и радиоэлектроники  
Адрес: 634050, г. Томск, проспект Ленина, д. 40  
E-mail: [astroasregion@gmail.com](mailto:astroasregion@gmail.com)

### Аннотация

В работе рассмотрены особенности предоставления услуг автострахования в России, в том числе определены факторы, влияющие на стоимость страховых продуктов. Представлен обзор действующего законодательства в области страхования транспортных средств: согласно принятому закону «О государственной информационной системе «ЭРА-ГЛОНАСС» производители транспортных средств категорий В и С будут обязаны оснащать выпускаемые на территории России автомобили этой системой слежения. Данный факт явился предпосылкой к проведению исследований, ориентированных на изучение возможности адаптации зарубежной системы «умного страхования» на российском рынке. Современные процессы автострахования и технологии определения стоимости страхового полиса, применяемые в таких странах как США, Великобритания и Австралия, основаны на использовании телематических датчиков, определяющих индивидуальные показатели стиля вождения. Такими датчиками могут служить приборы системы «ЭРА-ГЛОНАСС».

Предложены различные модели взаимодействия участников при внедрении новой технологии в процесс предоставления страхового продукта КАСКО в России: государственно-частная модель, автономно-частная модель, отраслевая и аутсорсинговая модели. Определены основные механизмы повышения конкурентоспособности страховой компании при повсеместном внедрении «умного страхования»: уменьшение стоимости тарифа КАСКО за аккуратное и безопасное вождение и расширение функционала ИТ-сервисов для водителей. Проведен опрос и представлена интерпретация результатов анкетирования владельцев транспортных средств, целью которого являлось выявление готовности водителей к переходу на предлагаемую модель автострахования и определение функционала сопровождающих мобильных сервисов.

На основании анализа методики расчета тарифных ставок по рисковым видам страхования, утвержденной распоряжением Росстрахнадзора, предложена модель расчета страхового тарифа с учетом предоставляемой скидки в случае аккуратного вождения.

**Ключевые слова:** автострахование, умное вождение, телематический датчик, мобильный сервис, страховой тариф, методика расчета.

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