

# The Impact of Changes in Consumer Behavior on the Development of Insurance Company Risk Models

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**Abstract**—The article discusses the specifics of building mathematical and analytical insurance company risk models when changing consumer behavior. The concept of a model is given. Various types of models for consumer market analysis developed abroad and in Russia are described in order to conduct marketing activities to stimulate demand. A comparative analysis of the methods of gathering information is carried out. The factors that influence changes in demand are displayed. On the basis of Ansoff's matrix, an algorithm is proposed for the insurance company to choose a development strategy based on the factors identified. The universal structure of the algorithm allows to determine the strategy of any company in the developing insurance market of the insurance sector of the economy.

**Index Terms**—risk modelling, insurance company, financial technologies, risk model, scenario method, consumer behavior

## I. INTRODUCTION

All the processes taking place in modern society are connected with the development and implementation of new technologies. Technologies improve the quality characteristics of the goods and services provided, they transform the interaction between consumers and suppliers. New technologies expand opportunities and create the need to establish new relationships for insurance organizations as subjects of economic relations. Acting on the economy as a whole, new technologies describe different insurance conditions and determine their future directions.

Insurers as well as other participants of economic relations actively adapt business to the new conditions and requirements of the modern market. The Digital Economy program has already defined digital insurance, which is interpreted as a way to meet the need for insurance coverage through digital technology [1], [2]. However, with the advent of information infrastructures, there is a need for a rapid change of priorities in the insurance sector [3]. Choosing the right strategy for the development of the insurance organization determines the relevance of creating mathematical models for performance assessment and risk management in the digital economy. Since the activities of insurance companies are directly dependent on the desire of the person to use the insurance protection to minimize their damage in the event of certain events, the purpose of the study is chosen to analyze the impact of consumer behaviour on the development of assessment and analytical risk models using applications. The analysis of consumer behavior in the insurance market is carried out in order to minimize the risk induced by its change. Assessing

various factors that affect the consumer when deciding on the need for insurance protection and the choice of insurance products is also important. After identifying and assessing the impacts, consumer behaviour is modelled. The results of the evaluation or analysis are used in the future to conduct marketing activities to stimulate demand.

## II. THEORETICAL FOUNDATIONS

Any insurance company is the subject of economic relations. In this regard, it should offer insurance products that meet the needs. Armstrong and Saunders emphasize the need to build a long-term relationship between the insurer and the policyholder [4].

As a term for economic theory, consumer behavior is defined by the preferences that shape demand and is the decisive factor in shaping the volume of services offered [5].

We rely on the definitions of the distinctive features of psychological dependence of consumers on public opinion offered by the founders of various concepts of consumer behavior – T. Veblen, M. Weber, V. Zombart, G. Simmel, K. Marx, etc. An attempt has been made to substantiate wealth as a consequence of hard work, and the concept of "class status" has been introduced. In later works, the term is used as the basis for building a consumer behavioral model. On the basis of psychological characteristics of consumers possible ways of choice are considered, such as buying, refusing to buy, considering additional options [5], [6].

The development of economic theories of consumer behavior is influenced by both personal characteristics of the authors and the level of economic development at the time of the model. Under the influence of these components the following models of consumer behavior can be listed as follows:

- model of consumer behaviour based on rationality,
- modeling by finding emotional consumers,
- model of consumer preference formation through persuasion,
- model of consumer preferences based on social affiliation,
- model of consumer behavior based on impulse purchases,
- model of consumer behavior, taking into account time constraints and tight cash resources.

In the 20th century, theories emerged based on mental differences, age, gender and consumer residence. The series of industrial revolutions that have already changed the

possibilities of people have also had an impact on their consciousness. However, with the advent of information and digital technologies, the process of transformation of human consciousness continues. As a result, consumer behavior changes, creating new needs and a special dependence. Theories of dependence on computer technology, mobile phones and the global Internet network are emerging. Factors affecting consumer behavior are the basis of economic modelling.

### III. THE MODELS AND METHODS

Based on the data provided by economic dictionary, we will define the concept of the model. The model is a copy or analogue of the process under study. It is purposefully given the properties of the simulated object [8]. In today's economy consumer preference analysis and consumer behavior modeling are conducted using sophisticated mathematical models and modern software: Predictive Analytics SoftWare (PASW); models with Chi Squared Automatic Interaction Detection; analysis and modeling using a tool that includes mathematical and software methods for intelligent processing of historical and statistical data (Discovery-driven data mining).

Method using a computer program Statistical Package for the Social Sciences (SPSS) is very common today in the field of commercial statistical products for applied research in the social sciences.

Forecast Analytics Software (formerly Statistics Social Sciences Statistics) processes data for further use in applied economic research based on the principle of applying the criterion of chi-square. This method is widely applied by analysts to assess the relationship between multiple variables.

For this study, this method is interesting in the gradual exclusion of all inappropriate options from the set of available consumer preferences. At the second stage of analysis the program forms the best combinations of the "demand-offer" of the chosen factor. The program then selects the following factors and the services offered, following a given sequence: first, unacceptable solutions, then the most appropriate. Based on an exceptional sample, the program forms a network with the formation of different interest in insurance services groups of consumers.

CHAID (Chi Squared Automatic Interaction Detection) analysis is based on the classification of the characteristics of the proposed insurance product, taking into account the reaction of consumers. At the same time, the consumer reaction to the proposed product is taken for a variable. As a result, this model analyzes customer satisfaction. The results are used to develop marketing activities to move consumers out of a position of indifference to a position of interest.

The Data Mining (Discovery-driven data mining) tool includes several methods [9]. It allows you to find extraordinary solutions because it does not contain clear models and uses intelligent search patterns when choosing an insurance product. The first method is based on association. Thus, in the case of auto insurance, it allows to determine the effect of a discount on voluntary vehicle insurance or an extended voluntary insurance package OSAGO. The second

method is based on the consistent acquisition of insurance services. An example of this sequence is the purchase of an insurance policy when purchasing a car on credit, accompanied by the further purchase of the OSAGO policy. The third method allows to classify consumers of insurance services on the basis of predetermined preferences. The latter method involves grouping consumers without prioritizing. As a result, the program determines promising areas of the company's activities in the field of development of insurance products rather than groups of customers [10].

### IV. THE STUDY

The effectiveness of modeling depends on the availability of sufficient quality data and the functional content of application modules. As the object of the study, the collection and systematization of information on consumer behavior is carried out using the method of analysis of the research environment [11].

Considering the impact of modern technology on the information-gathering process, to date, the way to obtain information has been greatly expanded. Both paper media and new technological capabilities are used for these purposes. When choosing technology and method of collecting information, you need to consider both positive sins and possible problems. The distinctive features of the information-gathering methods outlined in [Table 1] are factors that influence the construction of analytical models at the preparation stage.

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Now, we will look at the factors that affect the creation of application packages. In order to build a modeling process, algorithms are developed and selected. To program the algorithm itself, the simulation object is carefully analyzed. The results of the analysis are laid in the software module [12].

Since the object of the study is the risk of changing consumer behavior, the author conducted the analysis of the insurance market in the digital economy. The work was carried out in several directions: analysis of consumer behavior in the insurance market and the impact of digital technologies on its change. Empirically the study is based on:

- the model of consumer behavior [13], [14];
- European Motor Insurance Study [15];
- the poll of the population of Moscow and the Moscow region (conducted by the author).

As the result of the study, the following key aspects were revealed.

1) Based on the behavior of insurance users, factors that influence the choice of a particular product or service are highlighted. We will designate some of them:

- the consumer's desire to consume presupposes a lot of benefits that should be of an individual purpose;
- the consumer seeks more goods than he has;
- the choice of insurance service is similar to the classification of judgments on the basis of the "logical square";

TABLE I  
COMPARATIVE CHARACTERISTICS OF INFORMATION-GATHERING METHODS

Technology and method	Positive characteristics	Problems and difficulties
<b>Methods without the use of innovative technologies</b>		
Paper questionnaire	1. Survey Used in the absence of technical support	High cost The need to accompany Inconvenience in processing
Agent sales monitoring	2. Observation Ability to make individual measurements	large time costs Personality factor
Reproduction of the economic process within the framework of the analytical and mathematical model	3. Experiment Visibility of the process	High probability of influence of personal factors of participants on the course of the experiment
<b>Methods with the use of innovative technologies</b>		
Survey using technical devices	1. Survey No costs Reaching more respondents The convenience of processing information	Impossible in the absence of technical means
Monitoring with online sales	2. Observation The ability to conduct research in multiple branches with automatic analysis of results Fixing results around the clock	Lack of uniform coverage of Russia by the Internet
Computer simulation	3. Experiment The ability to automate the data processing process The ability to re-create real economic conditions with new or additional parameters The possibility of multiple experiments The possibility of a comprehensive experiment	Difficulty identifying and analyzing errors  Unlimited data received Risk of receiving disparate indicators

- the possibility of the consumer to abandon the chosen product in favor of the same insurance coverage, but of lower cost or containing additional options.

2) The European Motor Insurance Study considered the hypothesis that digitally supported auto insurance products can provide insurers with an excellent opportunity to increase the number of contact with their customers and significantly improve understanding of their needs. The study was conducted using a survey of clients from Austria, Belgium, France, Germany, Ireland, Italy, Poland, the Netherlands, Spain, Switzerland, and the United Kingdom. The survey program's work issues were: respondents' ability to switch to digital insurance products, customer willingness to share data, and projected level of customer outflows in each country.

As a result of the study, consumers were divided into two age groups: 18 years to 45 and over 45 years. Each group then split into subgroups based on customers' willingness to take new digital technologies into insurance and provide data to the insurer.

The group of 18 to 45 year-olds included clients who:

- more than usual are focused on telematics (since younger

drivers typically pay higher premiums, getting data on their behavior at the wheel will help insurers choose the most attractive risk factors among this group of customers);

- remain with their insurer, but are reluctant to share their data with the insurance company;
- pay higher premiums.
- are more likely to switch to digital insurance products, representing an interesting segment, mainly because they are not usually targeted consumers of telematics products;
- regular customers who on average do not change their insurer. They tend to have a lower annual income. These customers are less willing to transition, although they would be willing to share their data with the insurance company. If the insurer manages to attract these customers, it will keep them. Digital-coated auto insurance can also help insurers better retain these customers;
- do not exhibit any behavior in terms of churn. When asked if they want to share their data with an insurance company, they refuse;
- premium segment, mature customers with expensive cars.

TABLE II  
RESPONDENT SURVEY RESULTS, %

Questions		Issue 2: In the event of the possibility of registration of OSAGO on the website of public services			Percentage of people wanting to use mobile apps and websites			Total
<b>Question 1: Is your life or property insured at the moment?</b>	<b>3: Want to know more about insurance?</b>	you'll always take advantage of this opportunity	it is better to provide the possibility of such a purchase of any insurance service	towards insurance will not change	you'll always take advantage of this opportunity	it is better to provide the possibility of such a purchase of any insurance service	towards insurance will not change	
Yes	Yes	80	30	20	53	75	20	130
	No	70	10	80	47	25	80	160
		<b>150</b>	<b>40</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>290</b>
No	Yes	110	100	10	85	100	11	220
	No	20	0	80	15	0	89	100
		<b>130</b>	<b>100</b>	<b>90</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>320</b>
<b>Total</b>		<b>280</b>	<b>140</b>	<b>190</b>				<b>610</b>

The size of the premium market varies by country. These customers are willing to share their data with the insurance company, but their potential as a target market depends on their number.

3) In order to determine the factors affecting the interest of Russian consumers in insurance services and their willingness to use modern technologies to purchase an insurance policy, the author compiled a questionnaire and conducted the poll among the population of Moscow and the Moscow region. Table 2 presents the

contents of the questionnaire and the results of the survey.

The following categories of respondents are identified.

Category 1 – insured, including:

- active customers who are interested in new insurance products and ready to use new technologies (remain customers of the company);
- forced customers, ready to use new technologies, not interested in insurance products (can easily change the insurer or stop being insured);
- possible customers interested in new insurance products, but not yet ready to use new technologies (may remain customers of the company if there are interesting offers);
- outgoing customers who are not yet ready to use new technologies and are not interested in new insurance products (may remain customers of the company on the same terms);
- customers who are interested in new insurance products, but do not plan to purchase insurance;
- former customers, they are still insured, but are not interested in insurance products or new services. If there is no need for compulsory insurance (OSAGO) will not purchase insurance.

Category 2 – Uninsured, including:

- future active customers that are the target audience for digital product development and telematics technology;
- future forced customers that may be interested in a convenient online service to buy and maintain insurance;

- future customers that can become customers of the company if there are interesting offers;
- transient customers that can become customers when being offered a standard package of services;
- target customers that are interested in new insurance products and should be guided by marketing actions to convince them that they need to purchase insurance;
- shady customers that can become customers if necessary in compulsory types of insurance.

## V. RESULTS (DISCUSSION)

Based on the survey results, the following factors that influence the change in consumer behavior have been identified:

- Age;
- Individual income;
- Social status;
- Availability of technical and Internet resources in the study area;
- Level of innovation infrastructure development among competitors;
- Level and direction of economic development of the country of residence. The study also revealed the approximate effect of changes in consumer behavior on the development of mathematical models and software tools for modeling consumer behavior, such as:
  - the size and linearity of the information available for modeling,
  - the ability to adapt information to the chosen analytical model,
  - quality and complete analysis of consumer behavior,
  - the state of the insurance market,
  - customer reaction and expectations of the insurance company itself.

Further on, taking into account these factors, we can simulate consumer behavior to minimize the risk of loss of customers and justify possible directions of the insurance

**TABLE III**  
ANSOFF MATRIX STRATEGY CHOICE ALGORITHM

The state of the insurance market			
New	Developing	Stagnation	Recession
the insurance company's stable position in the market			
Yes	No		
	Determining competition within the insurance industry		
	High		Low
	opportunity to grow in the current market	opportunity to have new entrants	
	No	Yes	No
	Diversification	Yes	Product development
The product has a competitive advantage or the product is unique			
Yes			
The company has additional capital		No	
Yes		No	
Market development		Product development	

market development. Simulation is feasible with an Ansoff matrix [16]. As an old product, we designate insurance products that contain packages of insurance protection against existing and calculated risks. As an old market we accept the state of the insurance market where the attraction of customers takes place through an agent, the support of contracts – through the claim settlement offices. The new product will be considered insurance products offered to customers and designed to protect against man-made and cyber risks. The new market for the matrix is the use of mobile applications and the Internet to attract new customers and accompany existing contracts. Table 3 considers the algorithm of choosing a strategy for the insurance company in the developing insurance market of Russia.

**VI. CONCLUSION**

According to the algorithm, insurance companies in the current economic market will suit both the strategy of developing digital insurance products and the use of new technologies to offer services and their maintenance. In such conditions, they will have the opportunity to increase offers to protect against new risks and know their customers well. Alternatively, this ensures the possibility to choose a market development strategy. In this case, the company can occupy a niche in the new digital market. At the same time, it will have the expanding capabilities of online services and mobile applications.

The study found that new technologies in insurance products affect consumer behavior. They make adjustments to the existing information collection and analysis processes. Technology is transforming the way mathematical and statistical models work. However, at the moment the subjects of economic relations in the Russian insurance market are not yet ready for radical changes.

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