Disaster Insurance Decision Support System

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Abstract. The article is devoted to the improvement of the system of support for decision-making in the insurance of jams against emergencies. The article pays special attention to the application of the Housing Insurance Act. Information on the number of insured dwellings provided. The algorithm of integral evaluation of the protection object proposed, which allows the insurance company to calculate the cost of the insurance policy.

1. Introduction
In modern conditions of the increasing risks need of elaboration of modern and operational approach to the choice of rational option of actions at threat of emergence and mitigation of the consequences of emergencies of natural and technogenic character is more and more important [1–5].

Development of new methods, mathematical models of the choice of such actions based on adaptation to specific conditions of a situation at threat of emergence of emergencies and development of the problem-oriented software is necessary for their planning [6].

When developing model of action it is necessary to use the principle of a combination of systematic approach, a strategic and tactical initiative, operational adjustment in the conditions of emergencies.

Implementation of this principle in the course of the analysis of actions focuses attention on development of a system of the measures directed to support of decision-making in insurance upon emergencies.

Considering growth of emergencies number, accidents and cases of people death observed recently in the world and in Russia, in particular, the role of policies of assurance of housing of emergencies should raise. Now the indicator of insurance of housing in Russia does not exceed 7.3%. At the same time, the corresponding indicator in Europe and the USA makes up to 90%. Such low interest of penetration of such type of insurance caused by the following factors. First, weak awareness of citizens on the existing protection programs of property and their opportunities and low level of insurance culture in general. Secondly, failure of insurers to work in so-called "toxic" regions, for example, in flood zones. Thirdly, lack of a uniform method of support of decision-making of establishment of an insurance rate.

2. Special features of insurance against emergencies
The Law on Insurance of Housing against Emergency Situations came into force on August 4, 2019. The All-Russian Union of Insurers has identified a number of regions in which in the pilot mode there will be their own programs of insurance of housing against emergencies - fires, floods and hurricanes.
within the framework of the new law. At the same time, the preliminary cost of insurance policy only risk of emergency can amount to 300-350 rubles per year. However, the liability limit of insurance companies will be 300-500 thousand rubles. That is, in case of an insurance event, the citizen who purchased insurance policies will receive compensation under the following scheme: payments for 300-500 thousand rubles - from insurance companies, and damage in excess of these amounts - from regional authorities [7].

This fact makes it urgent for regions to develop their own, including original, insurance programs. Any insurance program is impossible without a methodology for calculating the cost of the insurance policy and the amount of monetary compensation corresponding to it. All this makes it important and necessary to develop such methodologies.

It is necessary to remember the fact that each real estate object is individual. The main problem in determining the value of the insurance policy is to obtain an objective multicriteria assessment, taking into account the safety of each protection object, for which purpose it is necessary to carry out an analysis of the existing state of the object at the time of evaluation [8-10].

3. Insurance object condition estimation algorithm

It is proposed that this analysis presented in a consistent manner through the next set of phases.

Stage 1. The flow of damaging factors formed \( \lambda \).

\[ \lambda(t), \lambda_2(t), \ldots, \lambda_n(t) \] - Intensity of impact factor occurrence,

Where \( \lambda_i(t) = \frac{1}{t_{ip}/t_{ip}} \cdot t_{ip} \) - Average time of occurrence of the \( i \)-th affecting factor,

\( n \) — Number of impact factors.

Stage 2. Identification by information subsystem of dangerous damaging factors with efficiency \( v_1, v_2, v_3, \ldots, v_n \).

Where \( v_i = \frac{1}{t_{ip}/t_{ip}} \cdot t_{ip} \) - The average time required to identify the \( i \)-th striking factor.

Step 3. The data of the information subsystem on the detected damaging factors go to the control subsystem. The actions of the control subsystem when providing elimination of identified damaging factors are performed with intensity \( v_{prof}, v_2_{prof}, v_3_{prof}, \ldots, v_n_{prof} \). Where \( v_{prof} = \frac{1}{t_{ip}/t_{ip}} \cdot t_{ip} \) - The average time required neutralizing the identified \( i \)-affecting factor.

In the process of interaction of opposing sides, the following generalized indicator of functioning efficiency is formed, which is a certain combination of corresponding functions (space and time) - intensities of the corresponding components \( \lambda(t), v_{n}(t), v_{prof}(t) \).

In this case, the state probabilities of the emergency prevention system can indicated as follows.

P 00 - Information system (IE) and control system (CS) eliminating detected factors are free from negative factors servicing;

P 01 — IE is busy receiving information on one factor (phenomenon), CS is free from maintenance;

P 01 — IE is free, and CS is busy processing factor information and making decision on the use of forces and means;

P 11 — both systems are occupied.

It is necessary to draw up differential equations of fire risk management system states. Accordingly, the system states are indicated: A 00, A 10, A 01, A 11.

A general system of equations describing all possible states of a risk management system presented in the following form of four differential equations:

\[
\begin{align*}
\frac{d}{dt} P 00 (t) &= -P 00 (t) \lambda + P 01 (t)v_{prof} \\
\frac{d}{dt} P 01 (t) &= -P 01 (t)(\lambda + v_{prof}) + P 11 (t)v_{n} + P 10 (t)v_{n} \\
\frac{d}{dt} P 10 (t) &= P 00 (t)\lambda - P 10 (t)v_{n} + P 11 (t)v_{prof} \\
\frac{d}{dt} P 11 (t) &= P 01 (t)\lambda - P 11 (t)(v_{n} + v_{prof})
\end{align*}
\] (1)
Under limitation conditions: \( P_{00}(t_0) = 1, P_{10}(t_0) = P_{01}(t_0) = P_{11}(t_0) = 0 \).

4. Conclusion
The developed tool allows to estimate efficiency of holding actions for prevention of emergence of emergency in the territory of the set subject (or subjects) the Russian Federation and to prove tariffs for insurance.

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