

Automated Underwriting Control in a Regional Insurance Company

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Abstract— The paper deals with an approach to the organization of automated underwriting control in a Russian regional insurance company, which ensures the reduction of the human factor impact on the accuracy of the underwriting decision. The loop and the algorithm of automated underwriting control based on combined decision-making by the underwriting management information system (UMIS) and by a human underwriter are described. In the course of the UMIS building, the methodology of object-structural modeling of management accounting information systems was used. The adoption of the proposed approach in an insurance company of Samara Region (Russia) ensured a reduction in loss ratio for some types of non-life insurance by 28% with insignificant expenses for the development and implementation of the UMIS.

Keywords— *Automated Control, Underwriting, Non-life Insurance, Regional Insurance Company.*

1. INTRODUCTION

Underwriting is one of the key business processes of the insurance company operational activities. As a mechanism of financial stability support, underwriting contributes to the formation of a well-diversified and profitable insurance portfolio for the insurer [1]. At the same time, underwriting is the only operational business process of insurance activities, where the human factor still has a great impact on the accuracy of risks identification and decision-making as to whether accept or reject an insurance application from a potential client [2]. In these cases, the underwriter employing the guidelines adopted by the insurance company should make an administrative decision to accept the risk on special terms (the underwriter may, for example, recommend the use of an incremental coefficient for the insurance tariff calculation) or refuse to conclude (prolong) the insurance contract with the client [3,4]. The underwriter guidelines are developed on the basis of the actuarial mathematics apparatus taking into account such parameters of the clients as attitude to risk, probability of the insured event occurrence and the loss ratio [5,6]. However, even the methods and approaches, that are well justified theoretically and practically, cannot guarantee the prevention of possible errors made by the underwriter as a decision-making person due to the human factor.

Its particular importance the problem of ensuring effective control of the underwriting process acquired in connection with the increase in the share of loss-making types of non-life insurance within the portfolios of Russian regional insurers (primarily motor insurance) [6]. One of the obvious ways to increase the effectiveness of the underwriting process is to

organize its automated control [4]. However, to solve this problem, it is necessary to take into account the specifics of conducting operational insurance activities not only in a particular country, but also in a particular region.

Thus, an approach to organizing automated underwriting control of non-life insurance in a Russian regional insurance company is of particular interest.

2. BACKGROUND

Let N and A be the total number of stages and the number of automated stages of the underwriting process, respectively.

Then the optimization task of automated underwriting control can be formalized using the expression [5]:

$$\begin{cases} A \rightarrow N \\ t_u \leq T, \end{cases}$$

where t_u , T – the length of the underwriting process and the maximum permissible time limit for the underwriter's contract decision-making established by the rules for a particular type of insurance, respectively.

In the course of practical work with automated underwriting control, scoring systems are used for informational support of analysis, optimization and monitoring of the client's insurance portfolio, as well as to assess the likelihood of a fraud occurrence [1]. In Russian regional insurance, this approach is rarely applied due to the lack of a joint regional database of insurance companies containing reliable information on contracts and losses of non-life risk insurance of a voluntary type for an extended period of time. Another popular approach to automate the underwriting is the employment of decision-making systems based on data mining methods, fuzzy logic and pattern matching algorithms [1, 2]. However, the implementation of such systems into operational insurance activities requires considerable expenditures, which, subject to the economic crisis, can only be afforded by major federal insurers and insurance groups that have an extensive branch network.

It should also be noted that regional insurance companies specialize mainly in selling typical insurance products that do not utilize any methods based on a complex mathematical apparatus to carry out risk assessments and decision support. In addition, the underwriter guidelines and conditions for concluding (prolonging) contracts on non-life insurance of voluntary types can significantly differ among the companies

conducting insurance business within the Russian regional insurance system.

This explains the relatively low effectiveness of automated underwriting for identifying high-risk insurance applications [3].

3. SOLUTION APPROACH

We propose an approach to the implementation of automated underwriting control in a regional insurance company based on combined decision-making carried out by the underwriting management information system (UMIS) and a human underwriter.

Fig. 1 shows a loop of automated underwriting control in a regional insurance company.

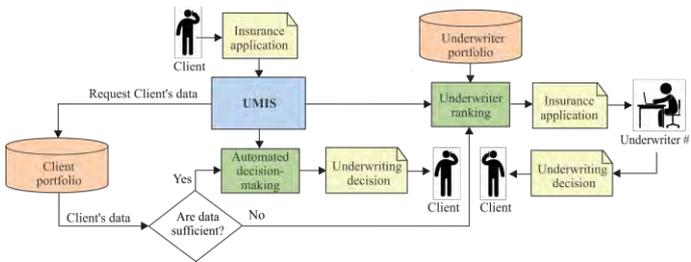


Fig. 1. A loop of automated underwriting control in a regional insurance company.

The control is organized according to an algorithm that consists of the following steps.

Step 1. A potential client submits an insurance application through the UMIS online.

Step 2. The UMIS checks the data sufficiency condition for determining the next action. It is usually checked whether the client is on the black list and the existence of any completed client's insurance contracts in the data bank of the insurance company for a particular period of time.

Step 3. Underwriting decision-making. If the client is not on the black list of the insurance company, and the currently available data are sufficient, the UMIS provides automated decision-making based on the guidelines adopted by the particular insurance company, for example, using the function of insurance risk assessment:

$$U = f(Q, K), \text{ where:}$$

U – the risk assessment indicator;

Q – the loss ratio of the client's insurance portfolio for a specific type of insurance calculated using the formula [4]:

$$Q = L/P, \text{ where:}$$

L, P – total incurred losses and total collected insurance premiums of completed client's contracts, respectively;

K – the total number of insurance events of completed client's contracts.

Table 1 presents function U as a risk assessment scale.

Table 1. An example of the risk assessment scale for the conclusion (prolongation) of non-life insurance contracts.

Q	K	U
1.0 – 2.0	≤ 3	It is recommended to use a coefficient of 1.2-1.4 for the insurance tariff calculation
2.1 – 3.0	≤ 3	It is recommended to use a coefficient of 1.5-1.7 for the insurance tariff calculation
> 3	or > 3	It is recommended to reject the insurance application

If the client is on the black list of the insurance company, or there is not enough data for automated decision-making, the UMIS switches the underwriting process to the individual client service mode controlled by a human underwriter. In this case, the underwriters ranking procedure within the insurance company is performed, for example, with the use of the following function:

$$R = v(I, E), \text{ where:}$$

R – the underwriter rank;

I – the loss ratio of the underwriter's insurance portfolio that is calculated for each type of insurance according to the formula:

$$I = W/S, \text{ where:}$$

W, S – total incurred losses and total collected insurance premiums of completed contracts, respectively, the decision on which was made by a certain underwriter;

E – underwriter's experience with a particular type of insurance.

Function R can be defined according to Table 2.

Table 2. An example of an underwriter ranking scale

I	E	R
0.1 – 0.3	> 3 years	#1
0.31 – 0.5	> 3 years	#2
0.1 – 0.5	≤ 3 years	#3

With the client's application, an e-mail is automatically sent to the human underwriter who has the best rank for a specific type of insurance at a given time. In case if this underwriter is busy or inactive, the application is transferred to the next one in the ranking list, etc. The underwriter makes a decision based on the guidelines, personal knowledge and experience. A certain probability of engaging lower rank underwriters may impact the quality of the underwriting decision. At the same time, individual underwriting services will allow the insurance company to attract new conscientious clients, which seems problematic in case of refusal to consider their applications.

Step 4. The client receives an e-mail with an underwriting decision on his insurance application. Underwriting process is finished.

4. UNDERWRITING MANAGEMENT INFORMATION SYSTEM

Fig. 2 presents a block diagram showing the UMIS structure.

The key module of the UMIS is the underwriting decision-making control module that ensures automated decision support and switches the underwriting process to the individual client service mode controlled by a human underwriter. In the course of the UMIS development, the object-structured modeling methodology for problem-oriented management accounting information systems centered around the integration of ontological, automata and object-oriented approaches was used [5]. In this methodology, design patterns created based on the technological ontology of operational insurance activities are used. Thus, as an executive mechanism of the automated decision-making control module, an object created on the basis of “Insurance Inspector” design pattern simulating actions of a typical underwriter is used. This object is realized with the use of a finite state automaton, the transition function of which is defined by the earlier described function of insurance risk assessment [6].

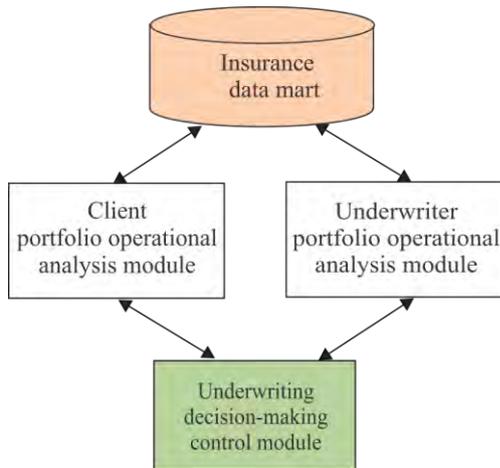


Fig. 2. Block diagram of the UMIS structure.

The insurance data mart is built on the basis of relational OLAP (ROLAP) technology using the “star” schema that provides better query performance in the decision support systems (shown on Fig. 3, where Client portfolio, Underwriter portfolio are fact tables; Date, Client, Underwriter, Type of insurance are dimension tables) [17].

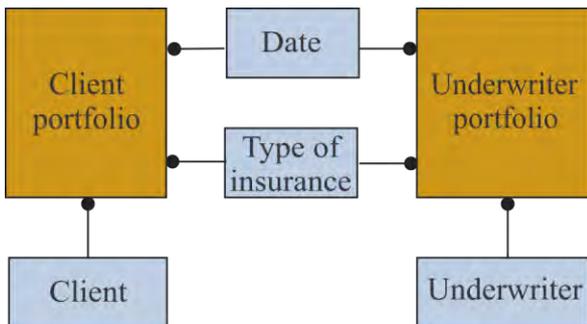


Fig. 3. Architecture of the insurance data mart

Fact tables of the insurance data mart are developed by transforming corresponding objects of the UMIS logical model created on the basis of the “Insurance Portfolio” design pattern that simulates the repository of insurance documents. The presented solution provides an easy adaptation of the UMIS to the specificity of operational activities in a particular regional insurance company as well as the flexible reconfiguration of the system modules’ parameters.

5. CONCLUSION

In our paper, we proposed an approach to the organization of automated underwriting control in a Russian regional insurance company, which ensures the reduction of the human factor impact on the accuracy of underwriting decisions. In this approach, an algorithm of automated underwriting control based on the combined decision-making carried out by the UMIS and by a human underwriter is employed.

The use of the automated underwriting control solution built on the basis of the proposed approach in the insurance company of Samara region (Russia) ensured a reduction in the loss ratio for some types of voluntary non-life insurance by 28% with insignificant expenses for the development and implementation of the UMIS.

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