STOCHASTIC MODELING OF THE TRAINING DEVELOPMENT PROCESS AT THE ENTERPRISE

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Summary. The article proposes a stochastic model of the training development process based on W-functions and the theory of closed flow graphs, which allows to take into account the probabilistic nature of the process, the possibility of various problems and risks, and to assess the probability of obtaining the desired result. The use of such modeling can increase the effectiveness of decision-making during the planning and implementation of training programs for employees.

Keywords: employees learning, stochastic modeling, training, closed flow chart, W-functions.

The last decade has been characterized by dynamic changes in the external environment of enterprises, which leads to the need for their rapid adaptation and ability to respond to challenges. Under such conditions, companies are increasingly faced with the need to introduce continuous employees’ learning, for the timely updating of knowledge and skills, the time of obsolescence of which is becoming shorter. In addition, the spread of automation processes and the development of artificial intelligence increases the need for retraining. Thus, according to a study by Deloitte, 38% of companies expect that some jobs will be reduced due to automation, and some of them will be transformed [1]. Therefore, the use of innovative and modern teaching methods has become increasingly important in recent years.

At the same time, enterprises are faced with the constant need to develop or acquire new training programs, which are quite complex and multi-stage projects, the implementation of which is influenced by a large number of factors. It is needed to have a clear idea of the duration of such a project and the probability of obtaining the desired result.

A significant number of scientists and researchers have tried to uncover the issues of creating and conducting effective training of employees. In particular: K. Argyris, J.B. Quinn, C. Lindblom, J. Lempel, J. March, R. Sayert, P. Sange, D. Shen. Modern teaching methods were considered by: O. Hetman, D. Johnson, I. Kifyak, M. Matsyshyn, I. Martinchenko, O. Lyzunova, B. Omelyanenko, J. Bishop, K. Kasemsap, L. Fink. Despite the significant number of publications that address this issue, the spread of modeling methods to solve such problems is not typical. Stochastic modeling is mainly considered in terms of the strategic management of enterprises.
Therefore, the aim of the article is the use of the tools of stochastic analysis (closed flow graph theory) for training development process modeling for the increasing of employees’ learning effectiveness.

There are several methods of employees’ learning. However, training is one of the most common and effective. The advantage of the training is that it combines theoretical lectures and practical training of skills in a short period. Besides, the acquired skills are quite stable. Conducting training allows: to acquire new knowledge; discover new qualities by changing places; master several professions; increase the level of motivation of employees, cope with stress [2].

Typically, trainings can be purchased and maintained by another company or developed in-house. It is very important to choose the most economical and efficient way. Therefore, to better understand and evaluate the process of developing training programs, the method of stochastic modeling based on W-functions and the theory of closed flow graphs was used. Because it allows visualizing all stages of the project, take into account the probabilistic nature of the training development process, as well as the impact of various factors, identify possible problems and risks, estimate the duration of individual stages and the project as a whole, and assess the probability of obtaining the desired result [3].

It should be noted that two types of nodes with deterministic and probabilistic output functions are used to take into account the stochastic nature of the process. And each operation is characterized by a certain probability and execution time, which can then be transformed into a single parameter W-function, which takes into account the type of probability distribution of the operation [4].

Accordingly, the stages of the training development process were identified for the calculations, the time required for the implementation of each operation and the establishment of their probabilistic characteristics were determined. The corresponding data are shown in table 1.

| Operation | Description                                      | Distribution | Probability | Time  |
|-----------|--------------------------------------------------|--------------|-------------|-------|
| (1;2)     | Determining the need for training                | Normal       | 0,7         | m=7   |
|           |                                                  |              |             | σ=1,5 |
| (2;3)     | Formation of a training group                    | Degenerate   | 1           | m=2   |
| (3;4)     | Defining the goals of the training               | Normal       | 0,45        | m=1   |
|           |                                                  |              |             | σ=0,5 |
| (4;5)     | Formation of the budget necessary for carrying out training | Normal | 0,65 | m=3 |
|           |                                                  |              |             | σ=1   |
| (5;6)     | Determining the duration of training             | Degenerate   | 1           | m=0,5 |
| (6;7)     | Coach selection                                  | Normal       | 0,8         | m=3   |
|           |                                                  |              |             | σ=0,5 |
| (7;5)     | Budget adjustment                                | Degenerate   | 0,2         | m=1   |
| (7;8)     | Formation of training content                    | Normal       | 0,9         | m=8   |
|           |                                                  |              |             | σ=2   |
| (8;9)     | Obtaining approval and permission from management| Normal       | 0,55        | m=3   |
|           |                                                  |              |             | σ=1   |
| (9;4)     | Budget adjustment                                | Degenerate   | 0,15        | m=1   |
| (9;7)     | Finalization of the content of the training      | Degenerate   | 0,15        | m=1   |
An important element is a closed stochastic graph that shows the relationships between operations (Fig. 1). In order to obtain an open stochastic grid, it is only necessary to remove the additional arcs that connect the initial node with the corresponding end nodes.

This model has three alternative termination nodes for each of which it is necessary to make separate calculations. Thus, it will be possible to calculate the duration of the process for different scenarios.

For further calculations, it was necessary to write the Mason equation for each end node (Table 2.). Its general formula can be written as follows:

$$1 - \sum_{i} W(L(1)) + \sum_{j} W(L(2)) + ... + (-1)^{m} \sum_{p} (L_{p}(m)) = 0$$
The Mathematica program was used to calculate the parameters for each end node. As a result of the calculations, it is clear that the probability of obtaining a training program that would not require refinement is quite low. It takes 48 days to get a finished product that can be used. The first variant of events (abandonment of the training program) has the shortest duration of 29 days, which is quite understandable, as the process is interrupted in the early stages. The most attractive variant of the ending C, which has a mean variance and a standard deviation that are not critical. The lowest these parameters are in the first alternative, but it is undesirable for the company. The company should keep in mind that the development of a training program has a quite long duration and several iterations might be needed before the desired result will be obtained.

A stochastic model of the training development process can be used for improvement of the decision-making process regarding the planning and
implementation of training programs for employees at the enterprise. Based on W-functions and the theory of closed flow graphs it helps to clearly and fully present the stages of such a project, take into account its stochastic nature and estimate the duration of in-house development. Further research can be aimed at improving the proposed model, taking into account not only the development of a training program in-house but also the possibility of purchasing ready-made training and conducting it at the company by third-party trainers.

References:
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