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V.M. KOZEL, Ye.A. DROZDOVA
Kherson National Technical University

FORMING THE QUEUE OF INFORMATION FLOWS DEPENDING ON THE INDICATORS OF INFORMATION, TIMELINESS AND COMPLETENESS

In this work we consider ways and methods for obtaining an estimation of quantitative and qualitative characteristics of information.. The property of timeliness of awareness is analyzed. This property stems from the concept of "lack of timeliness of awareness", as it is the opposite. In the process of functioning of the information system under the influence of a set of uncontrolled risk factors, the regular situation can turn into a critical, extraordinary or catastrophic. Such a transition may take place over a period of time, the duration of which is a priori unknown, and which depends on the number, properties and duration of the factors. The main risk factors that influences the transition of the ordinary situation to a critical, emergency or catastrophic situation are considered: reducing the number of staff, reducing the number of candidates, license rejection, accreditation rejection, reducing the number of doctors and others. Using systems analysis to determine the transition time of one state to another allows you to identify in the control system the flows of information that can cause emergency situations in the functioning of a higher educational institution. Further analysis of the steps of information flows using the time of transition from one state to another, and the time required for its processing, allows you to re-form the steps of information flow to exclude the possibility of an emergency.

Keywords: Completeness, informative, information system, timeliness, information analysis.

В.Н. КОЗЕЛ, Е.А. ДРОЗДОВА
Херсонский национальный технический университет

ФОРМИРОВАНИЕ ОЧЕРЕДИ ИНФОРМАЦИОННЫХ ПОТОКОВ В ЗАВИСИМОСТИ ОТ ПОКАЗАТЕЛЕЙ ИНФОРМАТИВНОСТИ, СВОЕВРЕМЕНОСТИ И ПОЛНОТЫ

В работе рассмотрены пути и методы получения оценки количественных и качественных характеристик информации. Анализируется свойство своевременности. В процессе функционирования информационной системы под воздействием множества неконтролируемых факторов риска регулярная ситуация может превратиться в критическую, чрезвычайную или катастрофическую. Такой переход может происходить в течение периода времени, продолжительность которого неизвестна априори и зависит от количества, свойств и продолжительности факторов. Рассмотрены основные факторы риска, влияющие на переход обычной ситуации в критическое, чрезвычайное или катастрофическое положение: сокращение числа сотрудников, сокращение числа кандидатов, отказ от лицензии, отказ от аккредитации, сокращение числа врачей и других лиц. Использование системного анализа для определения времени перехода одного состояния в другое позволяет идентифицировать в системе управления потоки информации, которые могут вызвать чрезвычайные ситуации в функционировании высшего учебного заведения. Дальнейший анализ шагов информационных потоков с использованием времени перехода из одного состояния в другое и времени, необходимого для его обработки, позволяет повторно сформировать очередь потока информации, чтобы исключить возможность возникновения чрезвычайной ситуации.

Ключевые слова: полнота, информативность, информационная система, своевременность, информационный анализ.

В.М. КОЗЕЛ, Є.А. ДРОЗДОВА
Херсонський національний технічний університет

ФОРМУВАННЯ ЧЕРГ ІНФОРМАЦІЙНИХ ПОТОКІВ В ЗАЛЕЖНОСТІ ВІД ПОКАЗНИКІВ ІНФОРМАТИВНОСТІ, СВОЄЧАСНОСТІ ТА ПОВНОТИ

У даній роботі розглянуто шляхи та методи отримання оцінки кількісних і якісних характеристик інформації. Аналізується властивість своєчасності. В процесі функціонування інформаційної системи під впливом безлічі неконтрольованих факторів ризику регулярна ситуація може перетворитися в критичну, надзвичайну або катастрофічну. Такий перехід може відбуватися протягом періоду часу, тривалість якого невідома апріорі і залежить від кількості, властивостей і тривалості факторів. Розглянуто основні фактори ризику, що впливають на перехід звичайної ситуації в критичне, надзвичайне або катастрофічне становище: скорочення числа співробітників, скорочення числа кандидатів, відмову від ліцензії, відмову від акредитації, скорочення числа лікарів та інших осіб.

Використання системного аналізу для визначення часу переходу одного стану в інший дозволяє ідентифікувати в системі управління потоки інформації, які можуть викликати надзвичайні ситуації в функціонуванні вищого навчального закладу. Подальший аналіз кроків інформаційних потоків з використанням часу переходу з одного стану в інший і часу, необхідного для його обробки, дозволяє повторно сформувати чергу потоку інформації, щоб виключити можливість виникнення надзвичайної ситуації.

Ключові слова: повнота, інформативність, інформаційна система, своєчасність, інформаційний аналіз.

Problem statement

The main functions of the university are the quality of education, which directly depends on the information support, timeliness and reliability of the information. Formation of orders, directives, requests and other management documents takes a rather long period of time. The procedure for processing this information is often carried out in an arbitrary mode as it receives or uses time-based priorities. However, such an approach to document orders does not take into account the risk factors that can lead to a critical state of the system.

In this regard, there is a need for quantitative and qualitative assessment of information flows, and their impact on emergencies. As the main indicators, we consider the indicators of completeness, reliability and timeliness of information..

Analysis of recent research and publications

The purpose of information analysis, as a part of one of the procedures of systems analysis, is: to establish the basic properties and concepts, to determine the quantitative and qualitative characteristics of the information from the position of system analysis. Consider ways and techniques for obtaining estimates of quantitative and qualitative characteristics of information.

The study of the peculiarities of the functioning and needs of organizational systems and information modelling in the field of study of risks and the dependence of production goals of organizations on the problem of security is carried out by N.D. Pankratova [1,2], V.A. Koss [3], O.M. Serebrovsky [4], A.B. Kaczynski [5].

However, despite the accumulated experience, in the aspect of defining the conformity of the information model with the needs of the enterprise, there are still many problematic issues. Informational modelling of traffic flow in universities is not well-researched.

The presentation of the basis material

Quantitatively, the completeness of awareness will characterize the indicator of completeness of awareness [2]: $I_П$

$$I_П = \frac{П - П^-}{П^+ - П^-} \quad (1)$$

where, , $П^+$, $П^-$ - respectively, the most expedient and the minimum allowable amount of information needed to make a decision under certain conditions; $П$ - the amount of information received by person making decision (PMD) in the present situation.

The value of the $I_П$ determines the level of completeness of awareness in the sense that it shows how much the relative volume of received information exceeds the minimum allowable volume for the decision, that is, this indicator quantifies the level of completeness of PMD awareness, based on the minimum permissible amount of information $П^-$.

The relationship between the quantities characterizing the completeness of $I_П$ awareness can be represented in the form of a scheme (see

Fig. 1**. Scheme of the relationship of quantities characterizing the completeness of awareness**).

In fig. 1 the following notation is introduced: $П = П_m^-$ - the level of complete absence of information on the factors of a given set of situations; $П = П^-$ - the level of the minimum allowable amount of information for making a decision under certain conditions; $П = П^+$ - level of the most expedient amount of information for decision making under certain conditions; $П = П_m^+$ - level of maximum full information on the factors of a given set of situations; $П= П_k$ - the level corresponding to the *k*-th situation of the given set. It also highlights the following areas:

- area I corresponds to the level of information in the range [$П_m^-$, $П^-$], which determines the area of inadequate information about PMD;

- region II corresponds to the level of information in the range [$П^-$,$П^+$], which determines the area of rational completeness of PMD awareness;

- area III corresponds to the level of information in the range [$П^+$, $П_M^+$], which determines the area of excessive completeness of PMD awareness.

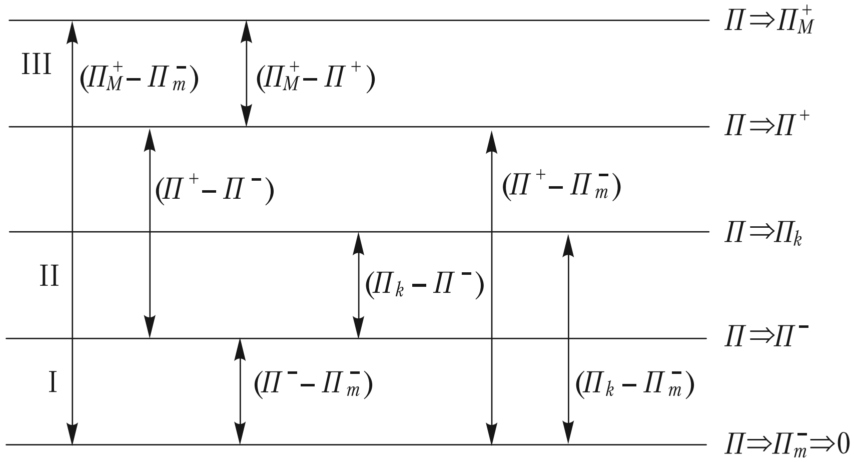

Fig. 1. Scheme of the relationship of quantities characterizing the completeness of awareness

In general, the level of completeness of PMD awareness will depend on which of these three areas corresponds to the level of information Π_k (for k-th particular situation analyzed), which is the probability of "hit" of each situation in a given set of situations.

We analyze the property of timeliness of awareness. This property stems from the concept of "lack of timeliness of awareness", as it is the opposite.

In fig. 2 the following notation is used: t_0 - the moment of receipt of information; t^- is the moment when the decision-making procedure is completed, provided that the duration of this procedure is T^-; t^+ - the moment of completion of the decision-making procedure provided that the duration of this procedure is T^+; t_{rk} - the moment of implementation of the solution for the k-th situation; t_{fn} - the beginning of the decision formation for the k-th situation; t_{fk} - moment of completion of the decision making for the k-th situation; T^- - the minimum possible duration of the formation of a solution for a given set of situations; T^+ - maximal possible duration of the decision-making period for a given set of situations; T_{rk} - the duration of the period from the moment of the beginning of the decision-making up to the moment of its realization for a particular k-th situation; T_M^+ - maximum possible for a given set of situations the duration of the period from the moment of the beginning of the formation of the solution to the moment of its implementation, that is, T_M^+ - the maximum of T_{rk} in the set of situations; T_m^- - the minimum possible for a given set of situations, the duration of the period from the moment of the beginning of the formation of the solution to the moment of its implementation, that is, T_m^- - the minimum T_{rk} on a plurality of situations; T_{fk} - duration of the period from the moment of the beginning of the formation of the solution k-th situation until its completion.

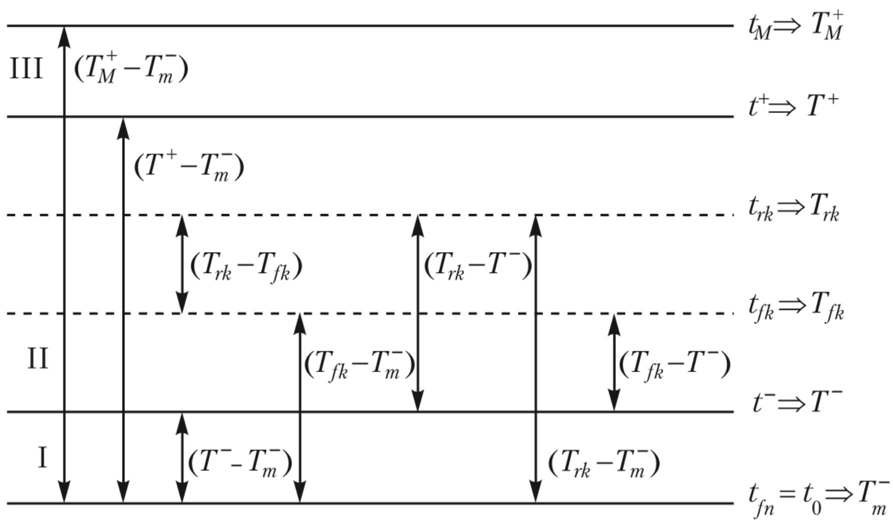

Fig. 2. Scheme of the relationship of quantities characterizing the timeliness of I_T awareness

For area I, in which for any *k*-th situation, the moment of implementation of the solution occurs earlier than it can be formed, since $T_{rk} < T^{-}$, you can enter an indicator of late timing PMD awareness. We define it by the formula [1, 2]:

$$I_T^{'} = \frac{T_{rk} - T_{fk}}{T^{+} - T^{-}} \quad (2)$$

Reliability is the awareness of the property that characterizes the compliance of the received PMD with the information of the true state of the emerging situation. Indicator of reliability of information [2]:

$$И_Д = \frac{Д_К - Д^{-}}{Д^{+} - Д^{-}} \quad (3)$$

where – $Д_к$ is the level of reliability of information about the situation under consideration; $Д^{+}, Д^{-}$ - therefore, the theoretically expedient maximum and practically expedient minimal, at which one can make decisions, the level of reliability of information in a given set of situations.

In the process of information systems functioning under the influence of a set of $Ф_j \in Ф$ of uncontrolled risk factors $Ф_j$, the regular situation S_i can turn into a critical, extraordinary or catastrophic one. Such a transition can take place over a period of time, the duration of which is a priori unknown, and which depends on the quantity, properties and duration of the influence of the factors $Ф_j \in Ф$.

It is necessary to determine such a permissible time period T_0 for the formation and implementation of a solution for which the probability of transition of the situation S_i to a critical, emergency or catastrophic will not exceed the given value $\eta = \eta_d$.

The number of risk factors and situations are given in table. 1, where the sign "+" means that under the influence of the relevant factor, the regular situation becomes critical, extraordinary or catastrophic, and the sign "-" - the risk factor does not affect the situation. Note that the method and algorithm for solving the problem are applicable to the finite values *i* and *j*.

The probability of an event in which under the influence of a factor the situation can turn into an extraordinary depends on the completeness of awareness. This dependence is written in the form:

$$\eta^{1}_{ij} = 1 - \lg(1 + a_{ij} I_П^{ij}), \quad i = \overline{1,4}, \quad j = \overline{1,7} \quad (4)$$

where a_{ij} - coefficient (table 2), $I_П^{ij}$ - completeness of awareness (table 3)).

Table 1

Risk factors affecting the transition of the ordinary situation to a critical, emergency or catastrophic situation

$S_i \setminus Ф_j$	Reducing the number of staff	Reducing the number of candidates	License rejection	Accreditation rejection	Library Fund	Reducing the number of specialized councils	Reducing the number of doctors
Lack of orders	+	+	+	+	–	+	+
Lack of learning outcomes	–	–	+	+	–	–	+
Lack of work programs	–	–	+	+	+	+	+
Lack of methodical support	–	–	+	+	+	+	–

Table 2

Coefficient A

$S_i \backslash \Phi_j$	1	2	3	4	5	6	7
1	0.51	0.62	0.65	0.51	-	0.72	0.61
2	–	-	0.61	0.71	–	-	0.41
3	-	-	0.71	0.71	0.41	0.55	0.65
4	–	–	0.75	0.61	0.41	0.51	-

Table 3

The completeness of awareness

$S_i \backslash \Phi_j$	1	2	3	4	5	6	7
1	0.61	0.72	0.41	0.80	-	0.71	0.63
2	–	-	0.51	0.63	–	-	0.52
3	-	-	0.42	0.41	0.41	0.81	0.61
4	–	–	0.61	0.31	0.35	0.62	-

To solve this problem, we need:

- to determine the probability of a transition of the situation to an emergency under the influence of one of the factors;
- to determine the probability of a transition of a situation to an emergency under the influence of at least one of a given set of factors;
- rank according to the level of danger of the situation under the influence of at least one of a given set of factors;
- solve the problem, provided that the probability of an event in which under the influence of the factor situation can turn into an extraordinary depends on the completeness and authenticity of awareness. This dependence is written in the next form:

$$\eta_{ij}^2 = 1 - \lg\left(1 + a_{ij} \cdot I_{П}^{ij} \cdot I_{Д}^{ij} 10\right), i = \overline{1,4},\ j = \overline{1,7}$$

The matrices $I_{Д}^{ij}, I_{П}^{ij}$ are determined by the experts and give preliminary estimates of the relevant indicators (table 4).

Table 4

Relevant indicators

$S_i \backslash \Phi_j$	1	2	3	4	5	6	7
1	0.71	0.81	0.41	0.721	-		
2	0.72	0.71					
3	–	-	0.31	0.81	–	-	0.81
4	-	-	0.32	0.82	0.41	0.61	0.61

Under the influence of many uncontrolled risk factors, the situation may turn out to be extraordinary. The transition depends on a certain set of factors (table 5):

Table 5

The transition depends on a certain set of factors

$S_i \backslash \Phi_j$	1	2	3	4	5	6	7
1	1	1	1	1	0	1	1
2	0	0	1	1	0	0	1
3	0	0	1	1	1	1	1
4	0	0	1	1	1	1	0

We construct a matrix of coefficients A

$$A = \begin{bmatrix} 0.51 & 0.61 & 0.65 & 0.5 & 1 & 0.7 & 0.6 \\ 1 & 1 & 0.6 & 0.7 & 1 & 1 & 0.4 \\ 1 & 1 & 0.7 & 0.7 & 0.4 & 0.55 & 0.65 \\ 1 & 1 & 0.75 & 0.6 & 0.4 & 0.5 & 1 \end{bmatrix}$$

Matrix of indicators of completeness of informatization $I_{П}^{ij}$

$$I_{П}=\begin{bmatrix}0.6 & 0.7 & 0.4 & 0.8 & 1 & 0.7 & 0.6\\ 1 & 1 & 0.5 & 0.6 & 1 & 1 & 0.5\\ 1 & 1 & 0.4 & 0.4 & 0.4 & 0.8 & 0.6\\ 1 & 1 & 0.6 & 0.3 & 0.35 & 0.6 & 1\end{bmatrix}$$

Matrix of reliability of information $I_{Д}^{ij}$

$$I_{Д}=\begin{bmatrix}0.7 & 0.8 & 0.4 & 0.7 & 1 & 0.7 & 0.7\\ 1 & 1 & 0.3 & 0.8 & 1 & 1 & 0.8\\ 1 & 1 & 0.3 & 0.8 & 0.4 & 0.6 & 0.6\\ 1 & 1 & 0.5 & 0.7 & 0.3 & 0.7 & 1\end{bmatrix}$$

Determine the probability of a transition of a situation $S_i \in S$ to an extraordinary one under the influence of one particular risk factor $Ф_j \in Ф$. To do this we use the formula:

$$\eta_{ij}^{1}=1-\lg(1+a_{ij}I_{П}^{ij}),\ i=\overline{1,4},\ j=\overline{1,7}$$

$$H1=\begin{bmatrix}0.886 & 0.847 & 0.899 & 0.854 & 0 & 0.827 & 0.866\\ 0 & 0 & 0.886 & 0.848 & 0 & 0 & 0.921\\ 0 & 0 & 0.892 & 0.893 & 0.936 & 0.842 & 0.857\\ 0 & 0 & 0.838 & 0.928 & 0.943 & 0.886 & 0\end{bmatrix}$$

This matrix H1 sets the probability of a transition of a critical situation to an extraordinary one under the influence of one of the risk factors. As can be seen from the matrix of the probability of transition is significant (> 0.8).

Determine the probability of a transition of a situation $S_i \in S$ to an extraordinary one under the influence of at least one of a given set of factors. This probability is given by the dependence:

$$\eta_{i}^{1}=1-\left[\prod_{j=1}^{7}\left(1-\eta_{ij}^{1}\right)\right]$$

$$H11=\begin{bmatrix}0.999\\ 0.999\\ 0.999\\ 0.999\end{bmatrix}$$

We rank according to the level of danger of a situation that may arise under the influence of one of a given set of factors (table 6).

Table 6

Level of danger

Acronim	Qualitative Characteristic of the risk level	Quantitative Description
e.l.	Extremelly low	0.0-0.1
v.l.	Very low	0.1-0.25
l.	Low	0.25-0.4
a.	Average	0.4-0.6
h.	High	0.6-0.75
v.h.	Very high	0.75-0.9
e.h	Extremelly high	0.9-1.0

Table 7

The transition depends on a certain set of factors

$S_i \setminus \Phi_j$	1	2	3	4	5	6	7
1	v.h.	v.h.	v.h.	v.h.		v.h.	v.h.
2			v.h.	v.h.		0	1
3			v.h.	v.h.	e.h	v.h.	v.h.
4			v.h.	e.h	e.h	v.h.	

Determine the probability of η_{ij}^2 to a transition of a situation $S_i \in S$ to an extraordinary under the influence of one particular risk factor, taking into account the completeness and reliability of awareness. Use the formula:

$$\eta_{ij}^2 = 1 - \lg(1 + a_{ij} g_{ij} I_{П}^{ij} I_{Д}^{ij}); i = \overline{1,4}, j = \overline{1,7}.$$

g_{ij} - the coefficient, which is calculated in the presence of preliminary estimates and assumptions of the PMD about the probability of an emergency, even if the level of reliability is equal.

The matrix η_{ij}^2 has the form:

$$H_2 = \begin{bmatrix} 0.509 & 0.361 & 0.691 & 0.42 & 0 & 0.353 & 0.455 \\ 0 & 0 & 0.721 & 0.36 & 0 & 0 & 0.585 \\ 0 & 0 & 0.735 & 0.489 & 0.785 & 0.438 & 0.76 \\ 0 & 0 & 0.488 & 0.646 & 0.847 & 0.509 & 0 \end{bmatrix}$$

Determine the probability of a transition of a situation $S_i \in S$ to the extraordinary one under the influence of at least one of a given set of factors, taking into account the completeness and reliability of awareness. This probability is determined by the dependence:

$$\eta_i^2 = 1 - \left[\prod_{j=1}^{7} \left(1 - \eta_{ij}^2\right) \right]; i = \overline{1,4}$$

Vector H_{22}

$$H22 = \begin{bmatrix} 0.976 \\ 0.926 \\ 0.996 \\ 0.986 \end{bmatrix}$$

We rank according to the level of danger of a situation that arises under the influence of one of a given set of factors, provided that the completeness and authenticity of awareness are taken into account.

The completeness of PMD awareness increases in time and is determined as follows:

$$I_{П}^{ij}(t) = \begin{cases} I_{П}^{ij}(1 + \alpha_{ij} \cdot t),\ if\ \ I_{П}^{ij}(1 + \alpha_{ij} \cdot t) < 1 \\ 1\ ,\ if\ \ I_{П}^{ij}(1 + \alpha_{ij} \cdot t) \ge 1 \end{cases}$$

It is known that the completeness of PMD awareness increases in time and is determined as follows:

$$I_{Д}^{ij}(t) = \begin{cases} I_{Д}^{ij}\left(1 + \gamma_{ij} t\right), if\ \ I_{Д}^{ij}\left(1 + \gamma_{ij} t\right) < 1 \\ 1, if\ \ I_{Д}^{ij}\left(1 + \gamma_{ij} t\right) \ge 1 \end{cases}$$

At the same time, the timeliness of PMD awareness decreases in accordance with the next:

$$I_T^{ij} = \begin{cases} I_T^{ij}(1-\beta_{ij}\cdot t^2),\ if\ \beta_{ij}\cdot t^2 < 1 \\ 0,\ if\ \ \beta_{ij}\cdot t^2 \geq 1 \end{cases}$$

where I_T^{ij} - timeliness, α_{ij}, β_{ij}, γ_{ij} coefficients of communication, influence and priority.

The coefficients α_{ij}, $\beta_{,ij}, \gamma_{ij}$ are given dependencies:

$$\alpha_{ij} = \begin{cases} e^{a_{ij}}\cdot И_{П_{ij}}\cdot 0,5, if\ a_{ij} \neq 1 \\ 0, if\ a_{ij} = 1 \end{cases}$$

$$\gamma_{ij} = \begin{cases} e^{И_Д^{ij}}\cdot \alpha_{ij}\cdot 0,05,\ if\ \ \alpha_{ij} \neq 1 \\ 0,\ if\ \alpha_{ij} = 1 \end{cases}$$

$$\beta_{ij} = \begin{cases} \left(\alpha_{ij} + \gamma_{ij}\right)\cdot И_T^{ij}\cdot 10^{-4} \\ 0,\ if\ \ \alpha_{ij} = 1 \end{cases}$$

The probability of a transition of situation S_i to an emergency under the influence of factors Φ_j is determined by:

$$\eta_{ij} = 1 - \lg\left[1 + a_{ij} I_{ij}(t)\right],\ I_{ij}(t) = I_П^{ij}(t) I_T^{ij}(t) I_Д^{ij}(t)$$

In order to find the acceptable time, it is necessary to find a solution to the equation: $0 \leq 1 - \lg\left(1 + a_{ij} I_T^{ij} I_П^{ij} I_Д^{ij}(1+\alpha_{ij}t)(1+\gamma_{ij}t)(1-\beta_{ij}t^2)\right) \leq 0,5$ i.e. $T_0 = [t_1;\ t_2]$, where t_1, t_2 - respectively, the lower and upper bounds of the solution of the equation.

Matrix of the timeliness of awareness I_T^{ij}:

$$I_s = \begin{bmatrix} 0.8 & 0.8 & 0.6 & 0.8 & 1 & 0.8 & 0.9 \\ 1 & 1 & 0.7 & 0.9 & 1 & 1 & 0.6 \\ 1 & 1 & 0.5 & 0.8 & 0.5 & 0.7 & 0.75 \\ 1 & 1 & 0.8 & 0.75 & 0.55 & 0.8 & 1 \end{bmatrix}$$

We find the corresponding coefficients of $\alpha_{ij}, \beta_{ij}, \gamma_{ij}$

$$\alpha_{ij} = \begin{bmatrix} 0.494 & 0.637 & 0.383 & 0.66 & 0 & 0.705 & 0.547 \\ 0 & 0 & 0.456 & 0.604 & 0 & 0 & 0.373 \\ 0 & 0 & 0.403 & 0.403 & 0.298 & 0.693 & 0.575 \\ 0 & 0 & 0.635 & 0.273 & 0.261 & 0.494 & 0 \end{bmatrix}$$

$$\gamma_{ij} = \begin{bmatrix} 0.05 & 0.067 & 0.0495 & 0.050 & 0 & 0.070 & 0.06 \\ 0 & 0 & 0.040 & 0.078 & 0 & 0 & 0.045 \\ 0 & 0 & 0.047 & 0.078 & 0.03 & 0.05 & 0.062 \\ 0 & 0 & 0.062 & 0.060 & 0.027 & 0.05 & 0 \end{bmatrix}$$

$$\beta_{ij}\cdot 10^{-4} = \begin{bmatrix} 0.389 & 0.563 & 0.259 & 0.568 & 0 & 0.62 & 0.546 \\ 0 & 0 & 0.347 & 0.613 & 0 & 0 & 0.254 \\ 0 & 0 & 0.225 & 0.385 & 0.164 & 0.52 & 0.478 \\ 0 & 0 & 0.558 & 0.249 & 0.158 & 0.435 & 0 \end{bmatrix}$$

Table 8

Results table

$S_i \setminus \Phi_j$	1	2	3	4	5	6	7
1	[0; 31,2]	[0; 33,5]	[0; 36,3]	[0; 32,3]	-	[0; 27,2]	[0; 29,4]
2	-	-	[0; 39,5]	[0; 36,3]	-	-	[0; 42,3]
3	-	-	[0; 46,5]	[0; 36,4]	[0; 43,5]	[0; 28,2]	[0; 32,3]
4	-	-	[0; 31,3]	[0; 34,3]	[0; 30,1]	[0; 33,5]	-

Consequently, for the situation S_1 (absence of orders) the permissible time for the formation, adoption and implementation of the decision must not exceed T_2 = 27,2; for situation S_2 (Lack of learning outcomes) - T_2 = 36.3; for situation S_3 (Lack of working programs) - T_2 = 28,2; for situation S_4 (Lack of methodological support) - T_2 = 30,1. Time is measured in days.

By determining the time of transition from one state to another, it is possible to eliminate emergencies by sorting the order in the steps of information flows in the workplaces and departments.

Conclusions

Using systems analysis to determine the transition time from one state to another allows us to identify in the control system flows of information that can cause emergency situations in the functioning of a higher educational institution.

Further analysis of the steps of information flows using the time of transition from one state to another, and the time required for its processing, allows you to re-form the steps of the information flow to exclude the possibility of an emergency.

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