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ФОРМУВАННЯ, РАНЖУВАННЯ ТА ОЦІНЮВАННЯ ЦІЛЕЙ УПРАВЛІНСЬКИХ РІШЕНЬ

FORMATION, RANKING AND EVALUATION THE GOALS OF MANAGEMENT SOLUTIONS

Анотація. У статті викладено теоретичні засади та інструментарій формування, ранжування та оцінювання множини цілей у процесі генерування альтернативних варіантів управлінських рішень в умовах ризику. Формування множини цілей розглядається як ключовий етап у процесі

генерування та оцінювання альтернативних варіантів управлінських рішень. Наведено узагальнене визначення мети як головного напряму дій організаційної системи, що забезпечує досягнення конкретних результатів, які передбачається одержати після реалізації цього рішення за певних умов у фіксованому періоді часу. Обґрунтовано необхідність формування множини цілей і наведені вимоги до них. Схарактеризовані такі властивості цілей, як комплексність, системність, узгодженість, досяжність, конкретність, гнучкість, спадкоємність, чіткість, вимірність, вмотивованість, сумісність, формалізованість, якими вони мають володіти для забезпечення процесу генерування альтернативних варіантів управлінських рішень. Описано процедуру оцінювання і ранжування цілей за різними критеріями, яка виконана за допомогою лінгвістичних оцінок, бальних шкал (п'ятибальної і трибальної) та за двома процедурами — за середнім балом і за правилом Борда. Для ранжування за середнім балом за трибальною шкалою використано оцінки: ризик прийнятний, ризик небезпечний, ризик неприйнятний. У разі п'ятибальної шкали оцінками є: ризик мінімальний, ризик невеликий, ризик є, ризик суттєвий, ризик надзвичайний. Всі обчислення щодо оцінювання і ранжування цілей виконано на конкретному прикладі для п'яти цілей (виробництво нового виду продукції, введення нової технологічної лінії, збільшення прибутку, зростання обсягів виробництва, збільшення частки ринку) і чотирьох видів ризиків (ставлення влади, соціальні загрози, загрози конкурентів, ринкові ризики).

Ключові слова: мета, оцінювання, ранжування, критерій, ризик, шкала, метод, бал.

Annotation. The article presents the theoretical principles and tools of formation, ranking and evaluation of the set goals in the process of generating alternatives of management solutions under risk. Formation of the set goals is seen as a key step in the process of generating and evaluating alternative options for management solutions. The generalized definition of the goal as the main direction of action of the organizational system is provided, which ensures the achievement of concrete results, that is expected to be obtained after the implementation of this decision under certain conditions in a fixed period of time. The necessity of forming a set of goals and the requirements for them is substantiated. Authors determined properties for such purposes as complexity, systematicness, coordinateness, achievement, concreteness, flexibility, acceptability, preciseness, measurability, motivation, compatibility, formalization that they have to ensure the process of generating alternatives making. The procedure of evaluation and ranking of goals according to various criteria, which is performed by means of linguistic assessments, mark assessments (five-point and three-point) and two procedures, is based on the mean score and the Bord's rule. For the average ranking score scale used by three-point evaluation: acceptable risk, risk dangerous risk is unacceptable. In the case of a five-point scale, the estimates are: the risk is minimal, the risk is small, the risk is, the risk is significant, the risk is extraordinary. All calculations for the purpose of evaluation and ranking are made on a concrete example for five purposes (production of a new type of product, introduction of a new technological line, increase of profit, increase of volumes of production, increase of market share) and four types of risks (attitude of authorities, social threats, threats competitors, market risks).

Keywords: objectives, evaluation, ranking, criteria, risk, scale, method score.

Introduction. Formation of the set goals is a key stage in the process of generating and evaluating alternative options for management solutions (MS). According to the chosen purpose strategy for the

development of the organizational system (OS) and its tactics are formed, forecasts and action plans are developed, the results of implementation of the decisions are evaluated.

Highlighted that overall contained in diverse definition of "objective" given in the literature, the purpose of management solution will be called the main direction of the OS, which ensures the achievement of concrete results expected to be received after the implementation of this solution under certain conditions in a fixed period of time. Indeed, the work of the OS is aimed at achieving certain results that would change its state. This may be the creation of new production, and the conquest of the market, and increased profitability, etc.

The need to form a set of goals is conditioned by the following circumstances:

the goal is the core around which management is formed. In accordance with the chosen purpose the strategy of OS development and tactics are formed, forecasts and action plans are being developed, the results of the implementation of management solutions and measures taken are evaluated;

the formulation of goals allows to determine the desired results of the decision;

sometimes an analysis of the problem situation may reveal the need to change the formulation of the objectives of the activity. In this case, the formation of solution goals coincides with the formation of the OS objectives;

forming a plurality of objectives to solve the problem concentrates on finding a comprehensive multi-solution.

The purpose is always outside the system. It reflects the environment response on the system. The quality of the purpose determines the success or failure of the OS.

Since the purpose is the main system-forming factor in the OS, then the process of forming MS should be focused on achieving this purpose, i.e. the primary is the purpose of the OS and the secondary — the purpose of management solution, which reflects the development of any kind of activity in its formation.

The objectives of MS should be complex, systematic, coordinated, achievable, concrete, flexible, inherited, precise, measurable, motivated, compatible (non-contradictory), formalized.

Complexity of purpose means that it should cover all aspects of the problem situation. Systematicness foresees that the state of the OS to which it aims is provided by appropriate management mechanisms at all stages of management. Coordinateness means that the goals should not contradict each other. If there are competing goals, the sequence

of their implementation must be determined. If there are conflicting goals among the objectives, then a compromise solution should be found. Achievement means that the state of the OS to which it seeks should be really realistic for the current situation and the current trends in its change. Concreteness foresees that the process of achieving the goal should be ensured by a sequence of concrete measures. Flexibility means that the chosen target should be formulated in such a way that the possibility of its adjustment remains if the external or internal conditions under which it was intended to be achieved are changed. Acceptability should be considered as a requirement according to which the selected goals should be acceptable for the main subjects that determine the activities of the OS, as well as for those who must ensure their achievement. Preciseness foresees that the goals should be unambiguously formulated and understood by the executants. The measurability of the goal ensures the development of quantitative and qualitative criteria and parameters for assessing the degree of its implementation. Motivation involves linking the objectives of the OS with the reward system of performers. Compatibility means that the multiple objectives of the OS and its units, different categories and groups of staff and individual employees must be compatible and uncontroversial. Formalization of the goal ensures the formation of a system's criteria for evaluating the effectiveness of a managed system.

The difficulty in formulating the goals of the MS is due to the presence of a large number of contradictory requirements to them, errors in determining their priorities, ambiguity in the evaluation of problems. In addition, in the information society [1; 8] the emergence of new original and complex problems has led to an increase in the number and complexity of managerial tasks due to the increasing number of factors, which characterize a variety of economic and informational goals and should be considered when solved by them, which prompts the person who forms the MS (PFMS), to multi-criteria assessment of alternative solutions. In this regard, the generation of alternative variants of the MS presupposes the mandatory formation of a plurality of their goals.

The purpose of the article is to outline theoretical foundations and tools for the formation, ranking and evaluation of a set of goals in the process of generating alternative management solutions.

Analysis of publications on the problem. Despite the importance of the process of forming MS goals, most authors in the literature on the theory of decision MS considered a matter of setting the system purposes [11], the importance of goals and their measurement [4],

goal-setting in the management activity, the properties of goals and their priorities in the formation and implementation of MS [5], target orientation MS [9] and more. Instead, little attention is paid to the formalized description of this procedure.

Formulation of the problem. When forming a goal solution two situations are possible:

PFMS wants to choose one of the standard set of goals in this situation, for example, maximize income derived from operating activities of OS to increase the captured market share etc. In this case, the task of the PFMS is to determine the possibilities for realizing the objectives in the database and to search for better strategies for achieving the goal;

PFMS wants to select several goals from the standard set in the given situation, for example: simultaneously increase profits, increase market share, improve the quality of manufactured products, etc. In this case, the task of the PFMS is to determine the possibilities of realizing the goals, possible combinations of parameters for their implementation and better strategies for achieving goals.

It is important to have an idea of the desirable state of the system for a substantiated formulation of goals. A convenient tool for forming a set of goals is the method of writing a script as a way to describe the present and future state of the OS [2]. It allows you to determine the moment when the timely accepted MS may still affect the equilibrium state of the OS.

Usually the purpose is not one but in a group with many others, that is, the set of possible purposes is formed. Correspondingly, there is a problem of their interaction on the same level (horizontal links) and in the hierarchy (vertical links), as well as evaluation of their importance.

The assessment of the importance of the goals (their priorities) should be carried out by the PFMS, since person is responsible for the prevailing solution and its consequences. The PFMS can engage experts to evaluate the importance of goals, so that by comparing the differences in the estimates more clearly articulate their preferences. Goal priorities are usually measured in ordinal scale or ratio scale [3].

Formulation of goals is usually carried out in conditions of uncertainty and the presence of the associated risk (quantitative characterisation of the degree of danger and the size of its consequences), since the environment creates a situation of risk because of the inability to predict the development of events with the necessary accuracy. Therefore, risk assessment is a prerequisite for choosing a goal. Risk assessments are carried out in a way to determine the size of individual

risks and multi-criteria risk assessment in general. Different methods are used for this purpose: expert, statistical, method of "decision tree", method of using analogues, combined method. These methods are described in [10]. By using some of them, we describe the methodology for evaluating each goal in terms of risk.

Presentation of main content. One of the easiest ways to evaluate the importance of goals is to calculate the coefficients of their importance by the dual comparison method. According to this method, the results of pairwise comparison of goals by their importance are reflected in the form of a matrix

$$A = \left\| \alpha_{jj'} \right\|,$$

in which element $\alpha_{jj'} = 1$, if the goal A_j no less important than the goal $A_{j'}$, and $\alpha_{jj'} = 0$, if the goal A_j strictly prevails over the importance of the goal $A_{j'}$, i.e.

$$\alpha_{jj'} = \begin{cases} 1 \text{ при } A_j \stackrel{\sim}{\succ} A_{j'} \\ 0 \text{ при } A_j \succ A_{j'} \end{cases}, \ j, j' = \overline{1,J}.$$

The coefficient of importance of *j*-th goal is calculated by the formula

$$\Re_j = \frac{\sum\limits_{j'=1}^{J} \alpha_{jj'}}{\sum\limits_{j=1}^{J} \sum\limits_{j'=1}^{J} \alpha_{jj'}} = \frac{\alpha_j}{\sum\limits_{j=1}^{J} \alpha_{jj'}}, \ j = \overline{1,J}.$$

These coefficients can be calculated by other methods [6; 7].

Suppose that the PFMS has appointed such objectives of the MS, aimed at

1) production of a new type of product;
2) the introduction of a new technological line;
3) increase in profit;
4) increase in production volumes;
5) increase in market share.

At the same time, the experts identified the following risks for achieving the goals: attitude of the authorities; social threats (crimes, sabotage, etc.); threats of competitors; market risks.

Obviously, the first and last type of risk can lead to both negative and positive results.

In order to assess each goal with regard to the danger of risks, they are ranked. We will assume that this assessment is carried out by experts using linguistic scores and scales as shown in Table 1.

LINGUISTIC RISK ASSESSMENTS

Linguistic assessment	Mark assessment
The risk is minimal	5
The risk is small	4
There is a risk	3
The risk is significant	2
The risk is extraordinary	1

Consider two grading scales (five-point and tribal) and two evaluation procedures (with an average score and according to the Bord's rule).

Taking into account experts' evaluations (Table 1), by a five-point scale calculate the estimation of each goal for each type of risk by the formula

$$X_{jr} = \frac{1}{e} \sum_{e=1}^{E} x_{jr}^e , \quad j = \overline{1,J} , \quad r = \overline{1,R} , \tag{1}$$

where x_{jr}^e — evaluation of r-th risk by j-th goal expert e.

Considering the completed calculations of goal evaluations, we give their results in the form of a Table 2.

RISK ASSESSMENT GOALS BY A FIVE-POINT SCALE

Goal number	Name of risk				
	Attitude of the authorities	Social threats	Threats of competitors	Market risks	Average score
1	The risk is minimal	The risk is small	The risk is minimal	The risk is small	4,7
2	The risk is small	The risk is small	The risk is minimal	There is a risk	4,0
3	There is a risk	The risk is small	The risk is minimal	There is a risk	3,7
4	The risk is small	The risk is small	The risk is significant	The risk is significant	3,0
5	The risk is significant	The risk is small	The risk is small	There is a risk	3,5

The results of the ranking by the average score are given in Table 3.

Table 3

GOAL'S RANK

Goal	Rank
Growth of production volumes	1
Increase in market share	2
Increase in profit	3
The introduction of a new technological line	4
Production of a new type of product	5

We will conduct a ranking by the average score using a tribal scale by estimates:

risk is acceptable;

risk is dangerous;

risk is unacceptable.

The results of calculating by the average score for each goal using a tribal scale are shown in Table 4.

Table 4

ASSESSMENT OF GOALS' RISK

The type of risk	Score	The number of experts			
		3	3	4	2
		Goal			
Risk is acceptable	1	Production of a new type of product	The introduction of a new technological line	Increase in profit	Growth of production volumes
Risk is dangerous	2	The introduction of a new technological line	Production of a new type of product	Production of a new type of product	Increase in profit
Risk is unacceptable	3	Increase in market share	Increase in market share, Growth of production volumes	Increase in market share	Growth of production volumes

The results are shown in the Table 2 and 4 do not match. Therefore, an additional target risk assessment should be carried out by any other method.

Consider the procedure for ranking purposes using the Bord method [12] by a tribal scale. By this method each goal is assigned with a rank which corresponds to the points in the Table 1 and calculate the sum of ranks in the Table 4 for each goal according to the formula

$$\rho_j = \sum_{l=1}^{L} \rho_{jl} e_l, \quad j = \overline{1, J}, \tag{2}$$

where ρ_{jl} — rank of j-th goal in the l-th group of experts;

e_l — the number of experts in the l-th group.

Results of the ranking are shown in Table 5.

Table 5

RESULTS OF GOALS' RANKING USING THE BORD METHOD BY A TRIBAL SCALE

Goal	Sum of ranks	Place
The introduction of a new technological line	15	1
Increase in profit	17	2
Production of a new type of product	19	3
Growth of production volumes	29	4
Increase in market share	34	5

For the possibility of comparison we consider the results of ranking by the method of Bord, using a five-point scale. The sum of ranks for each goal is calculated by the formula (2) and the goals' ranks are determined by Table 6.

Table 6

RISKS BY GOALS

Type of risk	Goal
The risk is minimal	Production of a new type of product
The risk is small	The introduction of a new technological line
There is a risk	Increase in profit
The risk is significant	Growth of production volumes
The risk is extraordinary	Increase in market share

The results of the ranking using the Bord method by a five-point scale are given in Table 7.

Table 7

**THE RESULTS OF THE RANKING USING
THE BORD METHOD BY A FIVE-POINT SCALE**

Goal	Sum of ranks	Place
Production of a new type of product	23	1
The introduction of a new technological line	24	2
Increase in profit	25	3
Growth of production volumes	38	4
Increase in market share	38	5

The summarized results of the goals' ranking by all the methods discussed are given in Table 8.

Table 8

SUMMARY RESULTS OF GOAL RANKING

Goal number	Average score metod		Bord's method		Sum of ranks
	five-point scale	tribal scale	five-point scale	tribal scale	
1	1	3	3	1	8
2	2	2	1	2	7
3	3	1	2	3	9
4	5	4	4	4	17
5	4	5	5	5	19

The data in Table 8 indicate that the results of the ranking on different scales differ in the same methods. In addition, the risk for the first three goals is almost the same and other goals have significant risk.

It should be emphasized that «in general different methods of ranking on the same scales in most cases give incompatible results, so, in the subjectivity of assessments and methods, it is often useful to compare several variants of ranking and «averaging» them» [8, p. 224–225].

Since the ranks used in the described methods were determined on the basis of risk categories, it is quite legitimate to turn them into a risk category (Table 9).

Table 9

THE CORRESPONDENCE BETWEEN THE RANKS AND RISK CATEGORIES

Goal	Place	Sum of ranks	Risk categories
Production of a new type of product	1–2	8	The risk is minimal
The introduction of a new technological line	1–2	7	The risk is small
Increase in profit	3	9	There is a risk
Growth of production volumes	4	17	The risk is significant
Increase in market share	5	19	The risk is extraordinary

The current goal should be consistent with the current situation. Therefore, it is necessary to evaluate the possible goals in accordance with this situation, then ranking them according to the pre-formed by PFMS list of criteria.

Criteria and parameters agreed by experts are presented in the form of a Table 10.

Table 10

CORRESPONDENCE BETWEEN CRITERIA AND PARAMETERS

Parameter's number of internal state	Criterion	Parameter's ID of external environment
1 — 4	Balance	A – D
2	Competence	D
1 — 5	Synergy	A – D
2, 4, 5	Financing	A– D
5	Information environment	A – D

Values of the criteria are evaluated by different methods. To illustrate this process, consider method for evaluating the criterion «Synergy» in [8].

The evaluation of the criteria is carried out by experts for which they fill out the prepared tables, example is given in Table 11 and 12, where the sign «+» means an increase in integral efficiency from the interaction of two parameters, the sign «–» is a decrease and the sign «0» is a lack of influence. Considering the sign «+» for + 1, the sign «0» for 0 and the sign «–» for — 1, calculate the weighted average of

each sign considering the «weight» of the expert, and the results are placed in Table 11 and 12.

<div align="center">

Table 11   *Table 12*

</div>

ESTIMATES OF PARAMETERS   **ESTIMATES OF PARAMETERS' ID**

Parameter's number	1	2	3	4	5
1	0	–	–	–	0
2	+	0	+	+	–
3	0	–	0	–	0
4	+	+	+	0	–
5	0	–	0	–	0

Parameter's ID	A	B	C	D
A	0	+	+	0
B	+	0	+	+
C	–	–	0	–
D	–	–	–	0

Table 11 shows the influence of the parameters in the table rows on the parameters in the columns, determining the internal state of the OS, and Table 12 — influence of parameters that determine the external environment. Thus, Table 11 shows that the condition of the equipment and product quality positively affect the status of personnel and financing, but the condition of the equipment and product quality negatively affect the financing and the state of personnel. After evaluating all the criteria, experts determine the significance of all the criteria for the goals and fill in the Table 13.

<div align="right">

Table 13

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LINGUISTIC ASSESSMENTS OF THE SIGNIFICANCE OF THE GOAL CRITERIA

Goal number	Evaluation of the significance of the goal criterion					Sum of ranks
	Balance	Competence	Synergy	Financing	Information environment	
	1	2	3	4	5	
1	high	very high	average	high	very high	21
2	very high	high	very high	high	high	22
3	average	high	high	average	average	17
4	high	very high	very high	high	high	22
5	low	average	high	average	very high	17

We will provide linguistic assessments, given in Table 13, mark assessments (Table 14).

Table 14

LINGUISTIC AND MARK ASSESSMENT OF GOALS' CRITERIA

Linguistic assessment	Mark assessment
Very high	5
High	4
Average	3
Low	2

According to Table 13 and 14, calculate mark assessments of the significance of the goals' criteria z_{hj} and effectiveness of goals W_j using the formulas:

$$z_{hj} = \frac{c_{hj}}{\sum\limits_{h=1}^{5} c_{hj}} , \qquad W_j = \sum\limits_{h=1}^{5} z_{hj} c_{hj} , \quad j = \overline{1,5} ,$$

where c_{hj} — mark assessment, which corresponds to a linguistic assessment of the significance of the h-th criterion of j-th goal Table 13.

The results of calculations are shown in the Table 15.

Table 15

MARK ASSESSMENTS OF THE SIGNIFICANCE OF THE CRITERIA AND THE EFFECTIVENESS OF THE GOALS

Goal number	Бальна оцінка значущості критерію мети (z_{ij})					W_j
	Balance	Competence	Synergy	Financing	Information environment	
	1	2	3	4	5	
1	0,19	0,23	0,14	0,19	0,23	4,24
2	0,23	0,18	0,23	0,18	0,18	4,46
3	0,17	0,23	0,23	0,17	0,17	3,37
4	0,18	0,23	0,23	0,18	0,18	4,46
5	0,12	0,17	0,23	0,17	0,29	3,63

According to Table 15 the highest score received goals «Introduction of a new technological line» and «Growth of production volumes», the lowest — «Increase in profit».

The examples show that the evaluation and ranking of goals by different criteria may be contradictory.

Conclusions. The following conclusions can be drawn from the results of the use of the described methods of risk assessment of goals and the assessment of goals in accordance with the situation: according to the first method, the least dangerous goals are «Production of a new type of product» and «Introduction of a new technological line» and to the second — «Growth of production volumes» and «Introduction of a new technological line». Of course, this is not enough to obtain an integrated assessment, which determines the election goals. With regards to the above examples, they are merely illustrative of the possible approaches for integral estimation, and the selection ranking purposes of their existing set.

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ОЦІНЮВАННЯ ВПЛИВУ МАКРОЕКОНОМІЧНИХ ФАКТОРІВ РОЗВИТКУ ЕКОНОМІКИ НА ДІЯЛЬНІСТЬ РИНКУ СТРАХУВАННЯ

THE IMPACT ASSESTMENT OF MACROECONOMIC FACTORS IN ECONOMIC DEVELOPMENT ON THE INSURANCE MARKET

Анотація. У статті здійснено аналіз впливу макроекономічних факторів розвитку економіки на діяльність страхового ринку України з використанням кореляційно-регресійного аналізу. Проаналізовано та здійснено порівняння динаміки рівня макроекономічних показників і показників страхової діяльності за період 2006–2016 рр. Здійснено попередню сегментація макроекономічних факторів за внутрішньою економічною сутністю. Виокремлено фактори торговельної діяльності, промислового виробни-