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THE USE OF THE INTEGRATED ASSESSMENT MECHANISM IN THE STUDY OF THE STRATEGIC BEHAVIOR OF MANAGERS OF SHOPPING CENTERS

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The external source of this uncertainty is ***consumer preferences*** that affect the choice of visiting a shopping and entertainment complex.
In addition, high uncertainty is associated with the ***complexity of forecasting*** the results of management and business activities.

The significance of the consequences of wrong management decisions puts forward the requirement for the development and implementation in practice of quantitative methods of forecasting and management with high accuracy and reliability properties.

The internal parameters characterizing the shopping centre for the consumers are include:

x_1 – square,
x_2 – range of goods,
x_3 – transport availability,
x_4 – aesthetic parameter,
x_5 – promotions and discounts,
x_6 – quality of goods,
x_7 – availability of brands,
x_8 – events

here are the results obtained by sociological (marketing) survey of the shopping centers in the Perm city

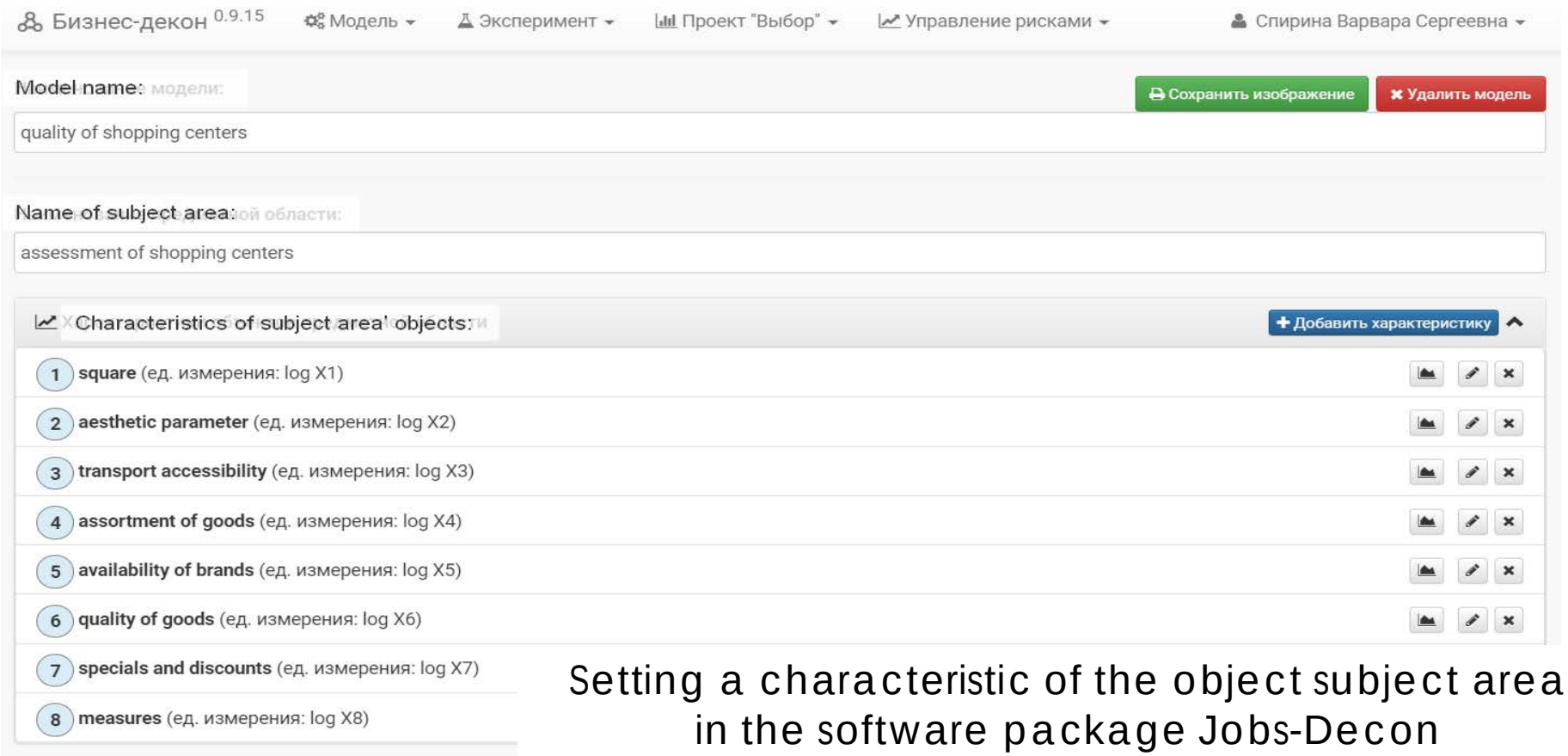
To predict the attendance of the commercial real estate object, the modified Huff model can be used, which allows to estimate the consumer attractiveness of the commercial property:

$$A_{ij} = \frac{Q_j}{T_{ij}^{\lambda_k}},$$

i – the number of the buyer (the i-th consumer means the consumer located in the point of i);
j – number of the commercial property;
A_{ij} – the attractiveness of the j-th property for the i-th consumer;
Q_j – the quality of the property;
T_{ij} – time spent by the i-th consumer on the road to the j-th property;
$\lambda \in [0;1]$ – parameter reflecting the effect of different types of objects on the perceived time spent (this parameter is empirically).

The procedure for **assessing the quality of a property** is based on the ***Jobs-Decon*** software package. This tool for integrated assessment of objects based on hierarchical linear convolutions is the following sequence of steps:

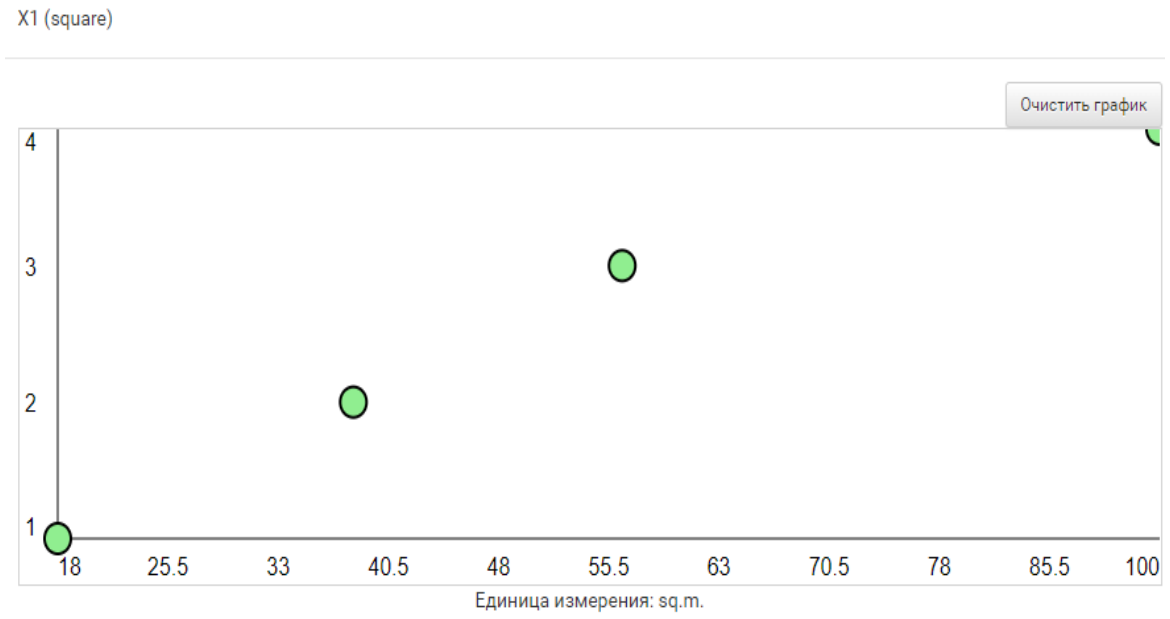
1. Selection of significant (essential for the subject) characteristics of the object (based on the knowledge base or independently).



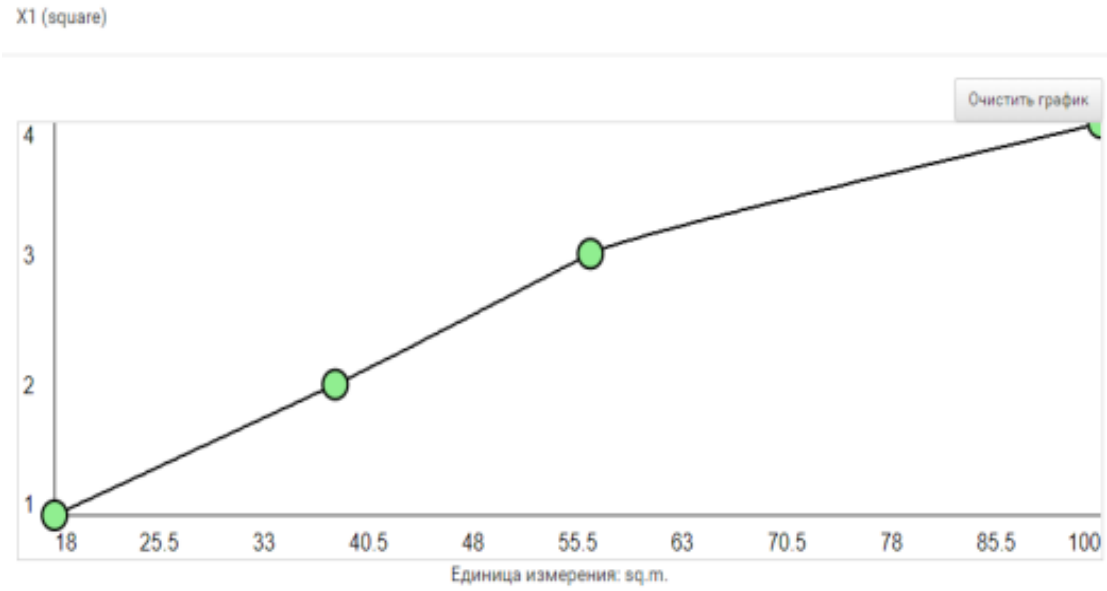
Setting a characteristic of the object subject area in the software package Jobs-Decon

2. Creating a phase-qualimetric coordinate system for each characteristic. Phase coordinate - abscissa axis in the required dimension and scale. The quantimetric ordinate axis is loaded from the knowledge base for all characteristics in the form of a scale [1, 4].

3. The step-by-step construction of the certificate of the cast function for each characteristic of the object.



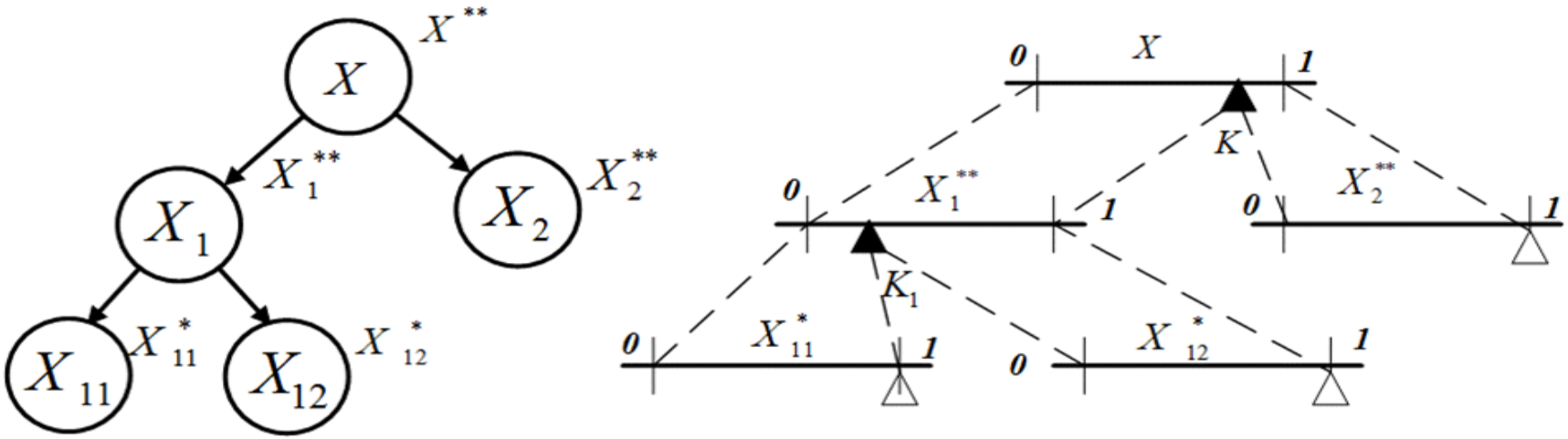
a)



b)

Setting discrete (a) and continuous (b) reduction functions for the characteristic of object X_1 in the software package Jobs-Decon

4. Formation of a hierarchical binary tree of criteria from an established set of characteristics of an object using the top-down method. The standard procedure for this method consists of two steps, which are repeated until there are two or more characteristics in one subgroup.

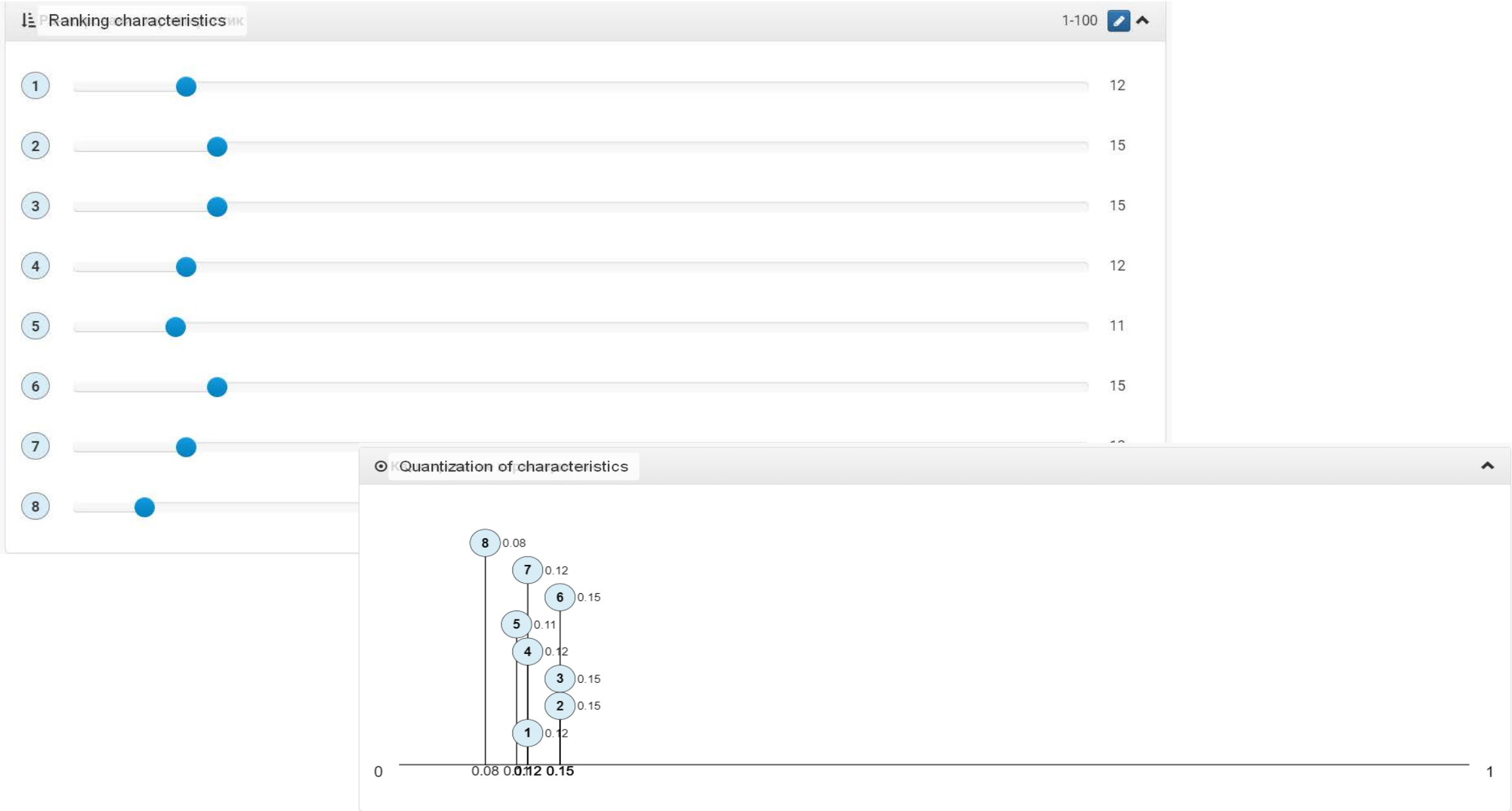


Hierarchical trees of object characteristics and convolution coefficients

Calculation of complex assessments of objects:

$$X_i^{**} = k_i X_{i1} + (1 - K_i) X_{i2},$$

ranking, selecting the best of the object according to the value system of the subject took the form of models.



Procedure of characteristic ranking in the software package Jobs-Decon

The resulting comprehensive assessment of the quality of the property is the convolution of criteria:

$$\max g_1(x), g_2(x), \ldots g_m(x), x \in G$$

In this task, this internal parameters characterizing the shopping center for the consumers. A linear convolution of criteria will take the form $\sum_{k=1}^{m} \lambda_k \frac{g_k(x)}{\max g_k(x)} \to \max,$ **where** λ_k **>0;**

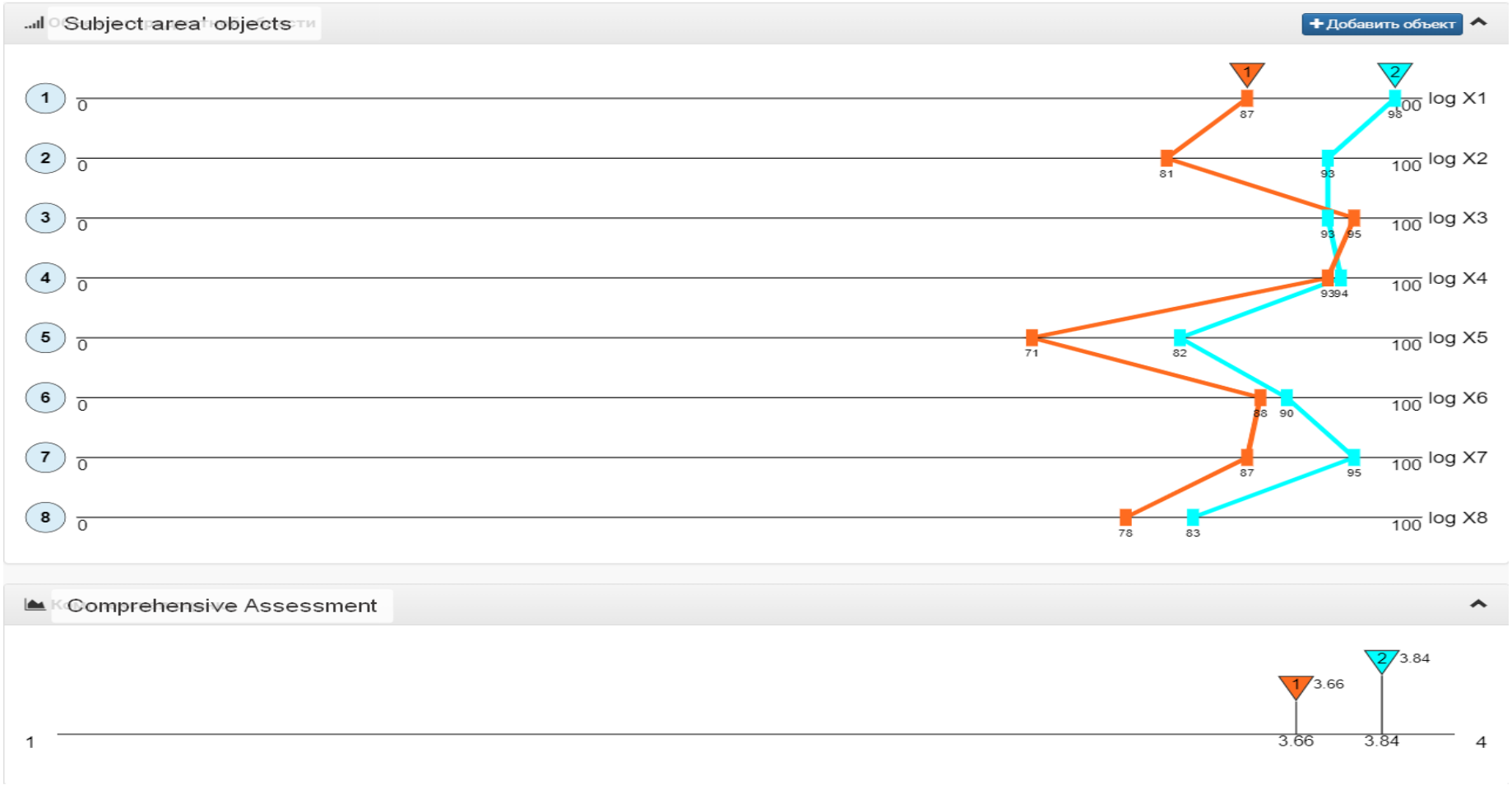
$\sum_{k=1}^{m} \lambda_k = 1$ **– weighting factors of significance of local criteria.**

Quality calculate by qualimetric model:

$$Q = \prod Q_m^{q_m},$$

***Qm* – quality of using parameters, *qm* – importance of using parameters.**

The result of using the described tool is the comprehensive evaluation standard scale integrated evaluation [1, 4] which are interpreted as 1 – «unsatisfactory», 2 – «satisfactory», 3 – «good», 4 – «excellent»



Procedure of the integrated assessment of characteristics in the software package Jobs-Decon

Consider the example of a flow simulation on the visitors' discrete cost control example for promotion of two malls.
Quality in this study calculate by qualimetric model:

$$Q = \prod \prod Q_m^{q_m} \cdot Q_o,$$

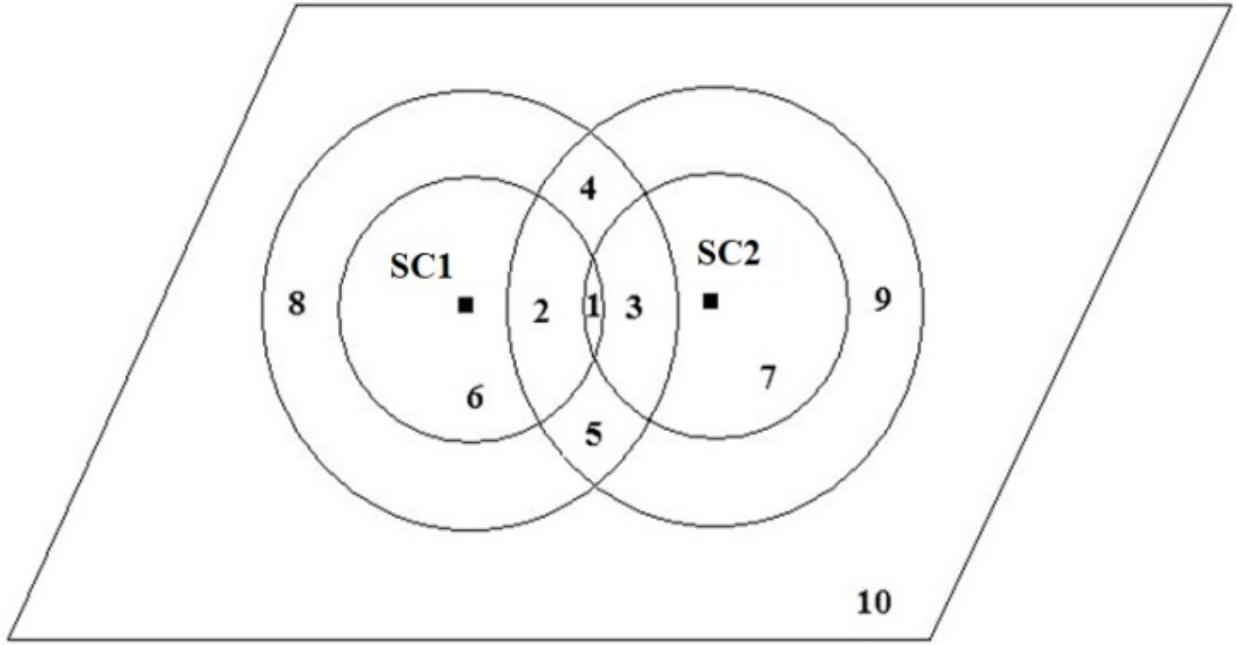
Q_m – quality of using parameters, q_m – importance of using parameters and Q_o – quality **of others internal parameters** with taking into account their importance.

These parameters are constant and don't depend on costs in development.

In this study Q_o have next values: $Q_{o1} = 0.885$; $Q_{o2} = 0.803$. These ones were calculated based on results of sociological (marketing) survey.

Table 1. Evaluation of quality parameters SC and values their importance, compiled by the authors based on the results of a survey of visitors SC, and brought to a scale [0; 1].

i	Parameter	Q_1	Q_2	q_i
1	Area	0.947	0.740	0.12
2	Range of goods	0.853	0.648	0.15
3	Transport accessibility	0.851	0.887	0.15
4	Aesthetic parameter	0.861	0.842	0.12
5	Promotions, discounts	0.660	0.516	0.11
6	Quality of goods	0.789	0.759	0.15
7	Availability of brands	0.884	0.748	0.12
8	Events, concerts	0.681	0.605	0.08



Allocation of sectors on the example of two shopping centres (SC).

$$A_{ij} = \frac{\{Q_j(x_l)\}}{\{T_{ij}\}^{\lambda_k}}$$

$$P_{ij} = \frac{A_{ij}}{\sum_{j=1}^{n} A_{ij}},$$

$$n = \sum_{k=1}^{K} (P_{ij}^{k} \cdot N_k),$$

P_{ij}^{k} – the probability of visiting the *i*-th visitor from the *k*-th sector of the *j*-th property;
N_k – number of residents of *k*-th sector;
K – number of sectors for the example with two shopping centres: *K=10*

Recommendation for corresponding parameters λ to commercial real estate objects:
for the first zone (from 45 to 80 min walk) – $\lambda = 0$;
for the second zone (from 80 to 160 min walk) – $\lambda = 0.5$;
for the third zone (over 160 min walk) – $\lambda = 1$.

The game-theoretical formulation of the competitive SC management problem corresponds to the zero-sum game, because the total number of visitors is constant $n_1+n_2=const$, in other words, managers entice visitors from each other by changing the quality of SC.

A series of **behavioral experiments with the game in three versions**:

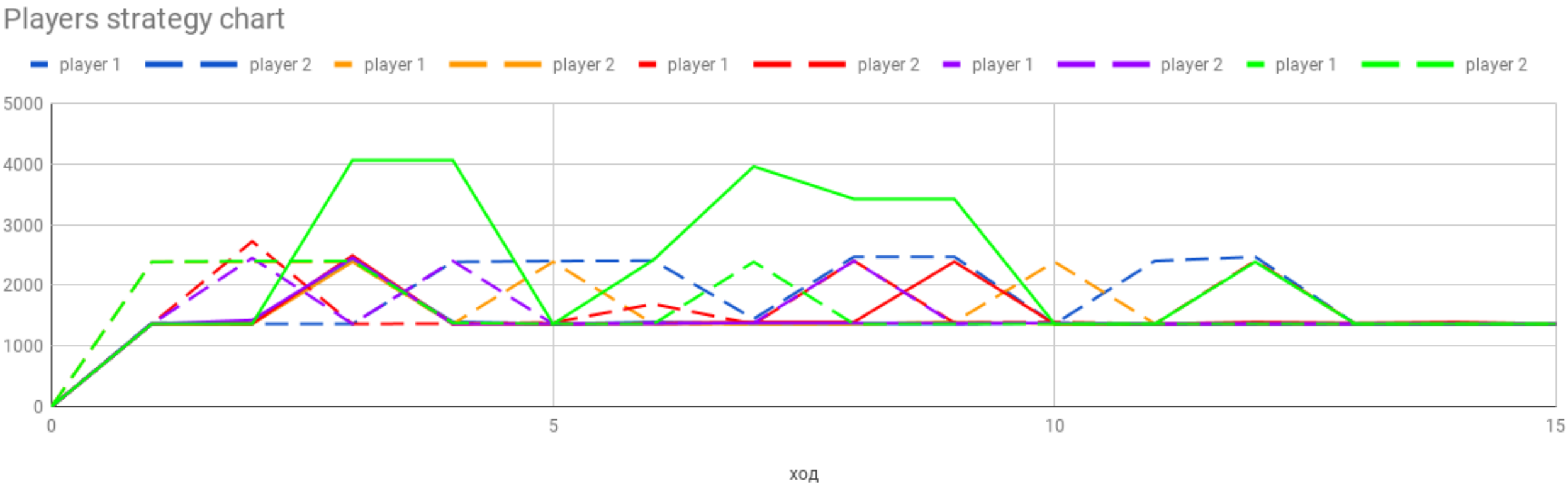
1. increasing the number of parameters for the development of shopping centers to six, which leads to an increase in the number of strategy options for the player to **1296**;

2. an increase in the number of cost options for improving each parameter, with the same number of parameters (four), which leads to an increase in the number of strategy options for the player to **4096**;

3. an increase in the number of parameters for the development of shopping centers to six, as well as an increase in the number of cost options for improving each parameter, which leads to an increase in the number of strategy options for the player to **46656**.

The results of the preliminary experiment with the second version of the game (4096 variants of possible strategies), showing the numbers of the strategies and the deviations of the players' answers during a series of experiments.

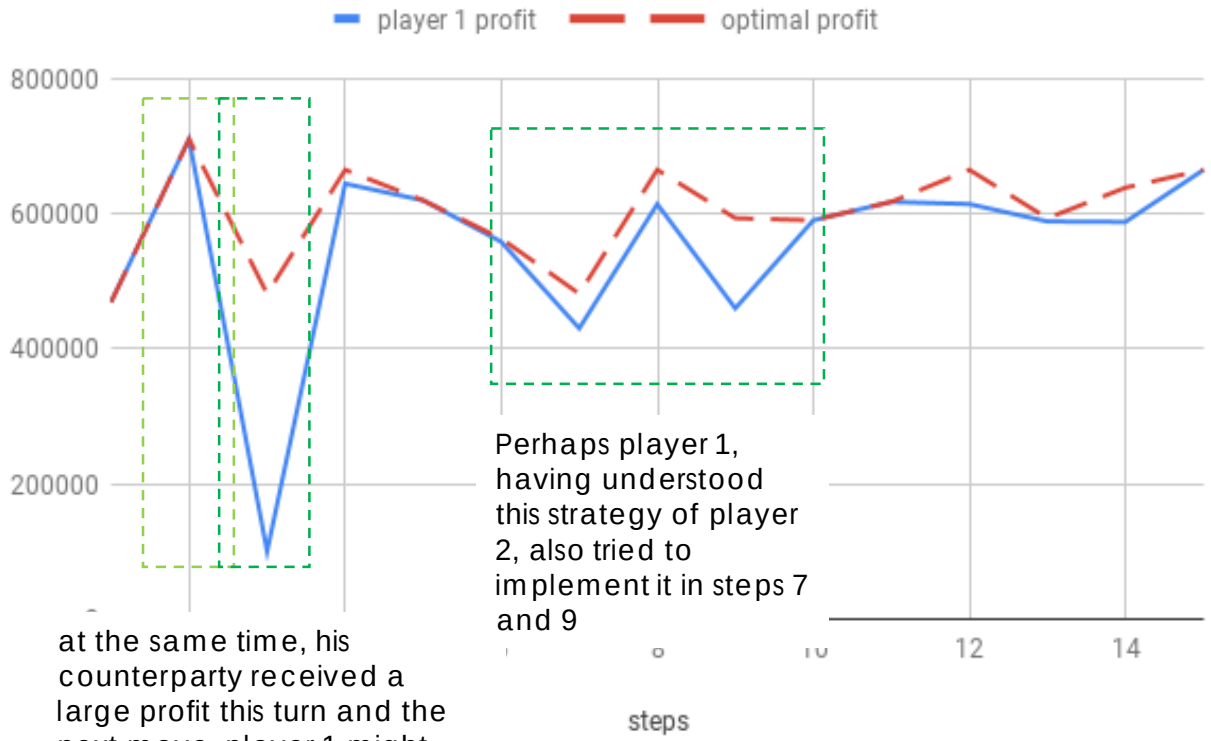
Most players, without using a "calculator", came to the optimal strategy for 10 moves. With the use of a "calculator", players arrived at the optimal strategy for 3-4 moves.



Results of preliminary experiments of 5 groups of players (2 players in each group) of the second version of the game

An example of competition between two players - the control of the shopping center (the second version of the game).

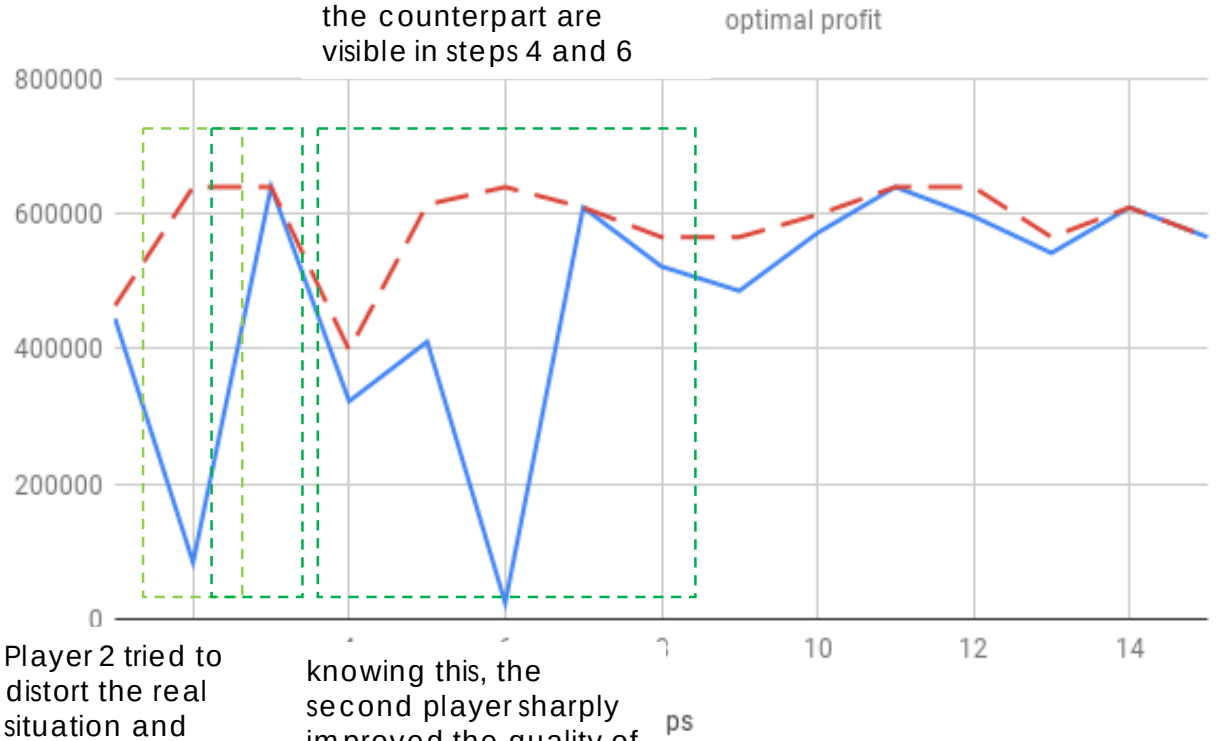
Presents the dynamics of profits that were received (continuous line) and could be obtained by implementing the optimal strategy (dashed line) players.



at the same time, his counterparty received a large profit this turn and the next move, player 1 might have thought that it was not advisable for him to make any strategically excellent decisions

Perhaps player 1, having understood this strategy of player 2, also tried to implement it in steps 7 and 9

Similar attempts by the second player to mislead the counterpart are visible in steps 4 and 6



Player 2 tried to distort the real situation and underestimate the quality of his SC (step 2)

knowing this, the second player sharply improved the quality of his SC and, as a result of his actions, made a big profit

CONCLUSIONS

It is worth recalling that the above results are preliminary and were performed to test the layout of the game.

In conclusion, it should be noted that it is advisable:

- conducting experiments with an increase in the number of controlled parameters of a SC, or with a simultaneous increase in the number of controlled parameters and cost options, which makes the simulated situation really cognitively complex;
- survey of participants in the experiment in order to identify the causes of their behavior;
- search for a continuous model of the situation studied to identify the conditions under which the independence of the players' strategies is also present, and is not a consequence of the discretization of the original problem.

Of course, it is important to conduct a full-fledged research with financial incentives for participants in the experiment and attracting carriers of subject-professional activities to its conduct.

Furthermore, an interesting experiment will replace the linear convolution to determine the quality of the layout in a matrix, which is a problem of further studies.

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THANK YOU FOR ATTENTION!

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