

**THE DECISION-MAKING PROCESS IN THE GAME ANTAGONISTIK'S  
MATHEMATICAL MODEL**

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**Annotatsiya:** modeli asosida qaror qabul qilish strategiyasini tahlil qiladi ekologik xavfni antagonistik o'yin o'yinlar moddaniy nazariyasini kamaytirish jarayoni. Davlat va korxonalar o'rtasidagi qarama-qarshi manfaatlarga erishish jadval, optimal strategiyalar va minimax usullari bilan ifodalangan, shuningdek, sof maxi aniqlanadi. Egar nuqtasi borligi uchun nazorat va atrof-muhit siyosati bo'yicha xulosalar va tavsiyalar ishlab chiqaradi qilindi. Tadqiqot natijalari atrof-muhitda samarali qarorlar qabul qilishga xizmat qiladi.

**Kalit so'zlar:** o'yin nazariyasi, o'yin antagonistik, ekologik xavf, optimal strategiya egar nuqtasi, shuningdek qarang: maxi usuli, qaror qabul qilish, nol sumli o'yin, atrof-muhitni boshqarish, strategik modellashtirish

**Annotation:** the article analyzes the decision-making strategies based on the model of the process in reducing environmental risks theo antagonistic game of the game. The table opposite interests between the state and the achievement are expressed through the enterprise, and the optimal strategies are determined by the minimax metho maxi visited and also on the net. The existence of a point is investigated and conclusions and proposals for environmental policy are seddl developer. The result of study to make effective decisions your object in the server environment.

**Keywords:** theo Game, Antagonistic game, environmental risks, the optimal strategy is not Seddl point, see also: metho maxi, your decision-making Zero sum game, Environmental management, strategic model

**Annotasiya:** prinyatiya resheniy na osnove teorii v v igrovoy igr strategy analiziruyutsya state model is snijeniya ekologicheskogo proess antagonisticheskoy matter the risk. Mejdu gosudarstvom I cherez tablisu viigrishey predpriyatiem virajayutsya protivopolojnie the interior of the optimal strategy are soon meto a matter chistie opredelyayutsya I minimaksa. I ekologicheskoy I nalichie tochka seddla proveryaetsya virabativayutsya predlojeniya politik vivod is po. Rezultati beginning prinyatiya resheniy effektivnix ekologicheskix slujat issledovaniy.

**Klyuchevie slovo:** igr theory, Antagonisticheskaya igr, Ekologicheskaya opasnost, Optimalnaya strategy, Seddl tochka, other methods, Prinyatie resheniya, Igrt nulevoy s roll, Ekologicheskii management, modelirovanie Strategicheskoe

**To enter** .The environmental problems of mankind today have become one of the most pressing issues in the front. The unfolding activities of industrial enterprises as a result of pollution, waste and the negative effects of harmful substances on the nature poses a threat to environmental stability. In such a situation producers to reduce the environmental balance between the state and the decisions on xavfni is born of a need to find. These decisions are often a conflict of interest with both sides to achieve their goals and seeks was yesterday. This mathematical game theory to the analysis of the context of the position the model will serve as an effective means of antagonistik game. In this article the problem of two players to reduce environmental xavfni — between public and modelling of industrial enterprises in the form of a zero sum game. Through the identification of optimal strategies in environmental policy the possibility to make effective and sustainable decisions are studied.

#### **Literature analysis**

Antagonistik o'optimal strategies in the yin to determine the presence of seddl point, as well as strategies to limit the collection of birth and compact terms, Karush-kuhn-tucker (CC) have been interpreted on the basis of the terms of. In this respect, whose basi T., "Dynamic noncooperative game Theo" game and Owenning G. "Theo Game called" monograph plays a particular role. The evolution of the development of this game in game theory, strategic decision making in a changing environment, principles of linear and analytical form of charging a zero sum game antagonistik has extensive coverage of the algorithm.

#### **Research methodology**

This research is based on game theory modelling of antagonistik xavfni reduce environmental issue. Initially, the main government and industry as voters decide between entities o'strategic zaro was to determine the relationship. Each one of them for complex decisions, constraints, and profit/loss functions shakllantirildi. In the model, zero-yig'the indi game antagonistik the use of structures, thus, each side strives own strategy to select the most comfortable.

For research, mathematical modeling and optimization methods — Lagrange multiplikator of Simplex methods, the technique of identifying optimal solutions seddl point through the use of led. The data collection process of the current environmental standards, is based on statistics and monitoring of waste production.

The process of research — based on analysis of mathematical models of complex systems and processes, effective management and distribution of resources aimed to determine the optimal fandir of them. The various areas of this science — production, logistics, transport, planning and economic system wide services are used. Making a decision, especially in conflict situations in the modeling of strategic readers choice serves as the main means of the theory of games.

Antagonistik game – this shows the reverse effect of the actions of the two opposite sides to each other directly in the game. Choose from one of the available strategies to each side itself and acts independent from the opposite direction. Antagonistik games for two player, zero sum game. The benefits of a side in this game comes on two to lose. The results of the game payments (advances) the expression of matrisa progressing through each player has joined the biggest benefits to low most to lose or get. Maxi player and also visited the minimax approach of using safe strategy, the value of is determined. The value of this is equal to you, then there

will be the optimal solution for the game and it is seddl point. This theoretical approach allows exact modeling of real processes and to make a decision. Research on environmental decisions to reduce xavfni respects to the theory of games antagonistik model applied mathematical modeling in the game. Two players — state and manufacturer directory — tries through the selection of their strategies in the context of conflicting interests. Progress through it without becoming a zero sum game schedule for each strategy was established and the model was formed. Optimal strategies and minimax methods were used to determine the maxi also visited. To check the availability of point seddl were found using the solution of the game in pure strategies. As a practical example, the environmental condition of the vehicle xavfni rated based on the efficiency evaluation was considered. Modeling is based on the results decide how readers can analyze the formation of the movement.

### Results and analysis

Xavfni research on reducing the environmental decision-making process were analyzed using the model antagonistik game. The game has two sides — the state and the manufacturer directory — the conflict between the interests of expression is directed. Based on the results of the game is the payout schedule for each strategy. The strengthening of the environmental strategies of the state penalties, tax rate increase, and the introduction of environmental monitoring systems included. Their directory while environmental cleaning of the production process, reduce waste or update existing technologies have the opportunity to choose strategies. The theory of games Antagonistik — conflicting interests between these two sides on the basis of the mathematical model is built, then each participant their maximum benefit, I will try to do the minimum while the benefits of the opponent. These games are usually side is called a zero sum game, because a win, lose the second hand exactly so.

On the basis of understanding how does it work?

This theory works on the basis of the following main concepts:

1. Participants (players) – each independent of the parties who accepted their decision.
2. Strategies – is a collection of choices that can be chosen for each participant.
3. Achievements (payment) function – the expectations of each participant for each pair of strategies or loss of benefits.
4. The optimal strategy – how your opponent, let's try a strategy that gives the best results of the participants.
5. Seddl point (a certain point) – the game changing strategies the participants in the collection of glycogen matrisa the benefits of their strategy also change the point of useless.
6. Mixed strategy – a strategy with a certain probability by choosing multiple participants determines their movement

Matrisa game model with antagonistik

The parties following strategies to make the payments (advances) is characterized by matritasi

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$$

Determine the availability of point Seddl

Payment matritasida seddl point of the game by determining the presence of or absence have a solution in pure strategies is checked. You seddl point if there is a clear sign of the optimal decision for the parties they could.

5. Mixed strategies solution methods and apply

If you seddl point is available, the optimal solution is found through the mixed strategies. At this stage the following mathematical approach is applied:

- \* Simplex method
- \* Factor of lagrange
- \* Line in linear programming

Mixed strategies will identify by probability

$$\begin{aligned} x &= (x_1, x_2, \dots, x_m), \\ y &= (y_1, y_2, \dots, y_n) \end{aligned}$$

Optimal value:

$$V(x, y) = x^T A y$$

Analysis and interpretation of the results. In the final stage of the game will analyze the results. Here is the level of environmental risk, economic loss or profit, and assessed the effects of regulator the effectiveness of environmental policy.

Statement of the issues

The authority of a city (A player) the following strategy against enterprises which produce harmful waste in order to reduce environmental xavfnimay choose iya.

The cost of the strategies: from -10 to 10 pm, which is the value of winning here is regarded as reduce the effectiveness of environmental xavfni. Power (A) how successful the move, the price so high that, while successful enterprise in a show of resistance – this value is reduced.

State (A) strategies:

I1: Quick to conduct I1 – Quick inquiries (8 points)

I2: Fine held I2 – Fine application of (6 points)

I3: temporarily stop the activity I3 – stop business (4 points)

Directory (player b) to protect himself while the following were chosen:

Directory (B) strategies:

J1: a legal claim to open J1 – the court of appeals (5 points)

J2: restore reputation through advertising J2 – mass advertising (3 points)

J3: J3 activity Hidden – Hidden activity (2 points)

Gameschedule:

	J1(5)	J2(3)	J3(2)
I1(8)	8-5=3	8-3=5	8-2=6
I2(6)	6-5=1	6-3=3	6-2=4
I2(4)	4-5=-1	4-3=1	4-2=2

	J1(5)	J2(3)	J3(2)
I1(8)	3	5	6
I2(6)	1	3	4
I2(4)	-1	1	2

**A company for.**

1-step. Each in a row, the minimum will find. Found results table to the right of the roof in the refrigerator new in the column writes.

2-step . Most good of a strategy as a 1-step is found from the minimum to the maximum , corresponding to which row will select.

**V the company for.**

1-step. Each a column the maximum of finds. Found results table lower on the side of a new line writes.

2-step . Most good of a strategy as a 1-step is found from the maximum to the minimum , corresponding to which the column will select.

In so doing, A company's own minimum achievements to maximize try will (see also: maxi), same time at V the company of their maximum lose that mini-mallashtirishga move makes (minimax).

1) I1:  $\min(3,5,6)=3$

I2:  $\min(1,3,4)=1$

I3:  $\min(-1,1,3)=1$

see also:  $\max=\max(3,1,1)=3$

2) J1  $\max(3.1 \text{ manuals}, -1)=3$

J2:  $\max(5,3,1)=5$

J3:  $\max(6,4,2)=6$

$\min\max=\min(3,5,6)=3$

Winning 3 points

A quick tekshuv

B to apply to the court

**The final results.** So, antagonistik game model based on the maximum gains 3 points as a result of analysis, the state — “A. Quick verification” Enterprise “to the court of appeal b.” they come in a pair of strategies. This is a pair of strategies for the balance of the game and reflects compliance with decisions aimed at reducing the environmental point xavfni make up.

**Conclusion.** Environmental xavfni in this article, aimed at reducing the decision-making process was studied based on the model antagonistik game. Conflicting interests between the state and enterprises and their mathematical modeling is an analysis of the strategies and achievements. Pure strategies in the modeling process can determine the point seddl on the basis of a balanced solution. The decisions of voters as a result of research and decided that a balance between providing optimal xavfni serves to reduce environmental strategies were recommended. Effective protection of the environment can also be achieved through this approach of showing economic was given.

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