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LOGICAL-MATHEMATICAL MODELING OF SOCIAL CONFLICTS

The article discusses some aspects of the use of mathematical modeling method in the study of social conflicts. Mathematical modeling methods are widely used in many fields of science where each of them has its own mechanisms of application and specific use. The feature of mathematical modelling application in conflict resolution and analysis is it can elicit conflict causes and mechanisms and, more important, predict further development and which consequences it may lead to.

Based on the use of methods and theoretical principles of mathematics, conflict studies, sociology, and political science, game theory is proposed as the most popular method of representing conflict studying the labor conflict between miners of "Kazakhmys" company and fabric management in August 2023. The matrix which shows conflicting parties strategy is proposed.

The article also proposes the use of dynamic modeling methods to study social processes. Mathematical formula that expresses the degree of balance between the government and the people in the state, with the help of which one can model the degree of decrease or increase in social conflict in society is proposed. Hereby, mathematical modeling methods can be effectively used in the study and resolution of social conflicts.

Key words: mathematical modelling, game theory, social conflict, conflict management.

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Әлеуметтік қақтығыстарды логикалық-математикалық модельдеу

Мақалада әлеуметтік қақтығыстарды зерттеуде математикалық модельдеу әдісін қолданудың кейбір аспектілер қарастырылған. Математикалық модельдеу әдістері ғылымның көптеген салаларында кеңінен қолданылады және олардың әрқайсысының өзіндік қолдану тетіктері мен қолдану ерекшеліктері бар. Зерттеуде әлеуметтік қақтығыстарды талдау мен шешуде математикалық модельдеуді қолданудың ерекшелігі-бұл жанжалдың себептерін, механизмін анықтауға мүмкіндік беретіндігі айқындалған, ең бастысы жанжалдың одан әрі дамуын болжауға және жанжалдың дамуы қандай салдарға әкелуі мүмкін екенін көруге мүмкіндік береді.

Математиканың, конфликтологияның, әлеуметтанудың, саясаттанудың әдістері мен теориялық ережелерін қолдану негізінде ойындар теориясы әдісі «Қазақмыс» компаниясының кеншілері мен осы зауыттың 2023 ж. тамыздағы басшылығы арасындағы еңбек жанжалын зерделеу кезінде жанжалды бейнелеудің ең танымал әдісі ретінде ұсынылды. Мақалада, қарама-қайшы тараптардың стратегияларын анықтауға мүмкіндік беретін матрица ұсынылған.

Мақалада әлеуметтік процестерді зерттеу үшін динамикалық модельдеу әдістерін қолдану ұсынылады. Мемлекеттегі билік пен халық арасындағы тепе-теңдік дәрежесін білдіретін математикалық формула ұсынылған, оның көмегімен қоғамдағы әлеуметтік қақтығыстың төмендеу немесе жоғарылау дәрежесін модельдеуге болады. Осылайша, математикалық модельдеу әдістерін әлеуметтік қақтығыстарды зерттеу мен шешуде тиімді қолдануға болады.

Түйін сөздер: математикалық модельдеу, ойын теориясы, әлеуметтік қақтығыс, қақтығыстарды басқару.

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Логико-математическое моделирование социальных конфликтов

В статье рассмотрены некоторые аспекты использование метода математического моделирования в исследовании социальных конфликтов. Методы математического моделирования широко используются во многих сферах науки, и в каждой из них имеются свои механизмы применения и специфика использования. В исследовании отмечено, что особенностью применения математического моделирования в анализе и разрешении социальных конфликтов является то, что оно позволяет выявить причины, механизм конфликта, а самое главное – спрогнозировать дальнейшее развитие конфликта и умение предвидеть, к каким последствиям может привести развитие конфликта.

На основе использования методов и теоретических положений математики, конфликтологии, социологии, политологии предложена теория игр как наиболее популярный метод репрезентации конфликта при изучении трудового конфликта между шахтерами компании «Казахмыс» и руководством данного завода в августе 2023 года. Предложена матрица, которая позволяет выявить стратегии конфликтующих сторон.

В статье также предложено использование методов динамического моделирования для исследования социальных процессов. Предложена математическая формула, выражающая степень равновесия между властью и народом в государстве, с помощью которой можно смоделировать степень снижения или увеличения социального конфликта в обществе. Таким образом, методы математического моделирования могут эффективно использоваться при исследовании и решении социальных конфликтов.

Ключевые слова: математическое моделирование, теория игр, социальный конфликт, управление конфликтами.

Introduction

Modern societies are characterized by constant changes and modernization processes. As a rule, they are ambivalent, leading to some improvements, worsening of the human condition or, in most cases, both of them, to different degrees, at the same time. Therefore, there is a need for analysis and modeling of various social processes and conflicts. Modeling techniques can be proposed to explain and explore these processe from a different perspective. They can be used to provide a systematic and holistic approach to research and propose novel interpretations, and possibly solutions, to existing challenges.

Academic literature is not concorde on the very meaning of "model" in the scientific literature with definitions spanning from "a result of reality in the form of a set of certain symbols, signs, judgments", "a visual image of an object, reflecting its features and characteristics," "a theory that describes the structure and internal interaction in a system." What definitions might have in common is that modeling can support and be used to complement any method of scientific research.

Social conflict can be defined as a process of opposition by social actors aimed at resolving contradictions in their interests and goals. As a source material for analysis of social conflicts can be the idea that conflict is a constantly operating type of social relationships in society. English sociologist Giddens gave the definition that social conflict is a real struggle between acting men or groups, regardless of what the sources of this struggle are, its methods and means mobilized by each side. There are three necessary components of any social conflict. The first one of them is the presence two or more sides. The second one is conduction of counteraction by the parties. And the third one is the possibility of assessing the opposition of the parties by an external observer.

In this article, modeling is understood as a multidisciplinary method for studying any social processes. In particular, makes it possible to study complex systems, parts of may be described by various mathematical methods. The use of modeling to study social processes allows us to identify external parameters of a particular process, patterns that are not immediatly observable by force of connecting simulated phenomena with those parameters that are automatically set by the program. We will use this definition to propose empirical modeling of two case studies. One of the goals of conflict mathematical modeling is the deep

understanding of the essence and dynamics of conflict. Modeling allows us to identify the main factors influencing the conflict and their interaction. It helps researchers and analysts better understand the causes and consequences of conflict, as well as predict its development.

In today's complex geopolitical conditions the need for the study and analysis of conflict situations is increasing and the need for constructive resolution of conflicts is especially increasing. Modeling as one of the cognition methods might allow predictions on conflict escalation, development but also prevention. In our case, we intend to use it to explore what a conflict models should be, what properties it should have, what are the capabilities and limits of application of various models, and what could be their effectiveness in conflict management.

Research methodology

During the research, the following methods of scientific analysis were used: a comparative, interdisciplinary systemic approach, which allows for the incorporation of theoretical principles from mathematics, conflict studies, sociology, political science, and other disciplines. Systemic analysis enables the consideration of the specificity of socio-political processes, regional, cultural, and other features of conflict. Additionally, conflict analysis was conducted on existing empirical data to construct a mathematical model of conflict processes.

Main part

Supporters of conflict studies explain all social life as inherently conflict. Conflict is viewed as a normal and even necessary social phenomenon. This position is most vividly reflected in the works of prominent scientists such as G. Simmel, R. Dahrendorf, L. Coser, and others. Theories describing society from the perspective of conflict interaction emerged in the mid-20th century. K. Boulding reproduces conflict interaction in an idealized form and constructs two models of social conflict: static and dynamic. R. Mack and R. Snyder define a model as a set of properties of the concept of "conflict." A special type of conflict model – mathematical model – appears in the works of V. Volterra (model of the struggle for existence of two biological species in a closed environment), L.

Richardson (arms race model), and T. Saaty (dynamic model of nuclear war).

A new impetus to the development of conflict modeling was given by game theory, which became popular due to the works of J. von Neumann and O. Morgenstern "Game Theory and Economic Behavior". This work sparked great interest in studying social processes using the tools provided by mathematics, stimulating further development of the mathematical representation of social science in the language of formulas, programs, and predicates. Model descriptions were created with the aim of choosing the optimal variant of a possible solution to a specific conflict situation.

In the mid-1980s, V.A. Svetlov developed the program "Practical Logic," which explores the possibilities of using elements of mathematical logic in conducting scientific research. Mathematical modeling as a method of studying intergroup and interstate conflicts is considered by Y.G. Baranovsky and N.N. Vladislavleva. The authors propose a generalized algorithm for researching and constructing models of international conflicts, which can be used in predicting crisis situations, assessing the main sources and causes of conflict, and selecting the most optimal behavioral strategies in an international conflict. Many authors pay attention to modeling as a method of cognition: A.Y. Antsupov, A.I. Shipilov, N.N. Zvonarev, G.R. Valiullina, I.S. Politay, and others.

American sociologist T. Parsons introduced the concept of a model in his work about the structural-functional model of society and conflict. Another American sociologist, K. Boulding, proposed in his famous work two conflict models. The first one is static, in which conflict characterizes a competitive situation where opposite parties seek to occupy a position incompatible with the position of the other party. The second one is dynamic model, based on the behaviorist principle of "stimulus-response reaction", where a person reacts to external stimuli and opposition comes. K. Boulding introduced the term "conflict model". It made him a pioneer in conflict modeling.

Conflict modeling is one of the tools used for analyze and understand conflict situations. It is an approach to understanding and predicting the dynamics of conflict based on the use of mathematical, statistical, and computational methods. Conflict modeling can be used to describe various aspects of a conflict situation, such as conflict participants, goals, resources, and

behavioral strategies. It can also be applied to identify factors that may influence the dynamics of conflict, such as social, political, economic, and cultural factors.

The following authors paid attention to conflicts and its resolving methods in the national scientific literature. They are G.O. Nassimova, B.N. Kylyshbaeva, G.G. Ismukhanova, M.Zh. Sengirbay, B.A. Nuralina etc.

There are certain theoretical approaches in understanding conflict as a form of social interaction that assess and resolve the essence of the conflict and its resolution in different ways. In our research we rely on the capabilities of the systems approach proposed by T. Parsons, R. Merton, as well as many modern conflict scientists such as A.Y. Antsupov, A.I. Shipilov and others.

Model in science acts as an analogue of reality, something that can replace the object being studied in a certain respect. This is not the phenomenon itself, but its simplified image which is used primarily for studying the results of possible changes. The special role in establishing the ideas of modeling as a recognized way of understanding reality is taken by T. Kuhn. His ideas about the so-called disciplinary matrix and its components: symbolic generalizations, conceptual schemes, scientific values and models for solving scientific problems. The use of models is not a universal analytical tool for applied projects. Modeling can be useful if there is a need to explain a particular phenomenon in a particular context and if there is an adequate set of data characterizing that phenomenon.

In a broad sense, modeling is understood as a multifaceted method for studying any social processes. The specificity of modeling, including social modeling, is that it is not the process itself ("the object is the original") that is studied, but its model ("analogue"). Developing a model and replacing it with the original object allows researchers to obtain the following useful effects.

The knowledge of how objest arranges, its fundamental properties, laws of the development, interaction with the environment is the one of the main purpose of modeling. The specific analysis of social conflicts necessitates examining the conflict participants in terms of their role behavior. In this context, the role is considered as a pattern of behavior in a social conflict primarily determined by the emerging conflict situation, rather than by desires and interests of the conflict participants. It is also important to consider the peculiarities of the role positions of each participant in the conflict confrontation. The informational component also plays a significant role in the confrontation, requiring special attention. The discussed aspects of social conflicts allow deep understanding of the nature of social conflicts and possible development prospects in society, as modeling is closely linked to conflict forecasting.

Creating a model of a particular situation can serve as a basis for predicting various conflicts, assuming a possible future occurrence of conflict and its developmental features. On the other hand, based on the forecast, it is possible to create a model of a potential conflict. Therefore, conflict modeling is constructing or choice, studying conflict models to gain new knowledge about it, as well as managing the existing conflict situation or predicting its possible development.

Results and discussions

Lefebvre, studying mathematical game theory, which is widely used to model conflict situations, identified two approaches for studying the decision-making strategy of conflict parties.

During the interaction of system elements, positive feedback can arise, which strengthens the stability of the system's behavior in the chosen direction; if the system achieves a negative effect, then negative feedback arises, which weakens the stability of the system's behavior in the chosen direction. Both types of feedback perform the function of self-regulation of the system; both positive and negative feedback can have different effects on the functioning of the system. If the summed effect of the interaction of system elements exceeds the effect exerted by each of them separately, then we speak of synergetic feedback. Since each object is both an element and a system, we can talk about a synergistic connection between systems A and B: strengthening (weakening) of system A leads to weakening (strengthening) of system B.

Therefore we see that 2 types of positive feedback are possible:

1. System (element) A receives confirmation of its positive attitude or action towards system (element) B by the inverse positive attitude or action of B towards A – synergy.

2. System (element) A receives confirmation of its negative attitude or action towards system

(element) B by the reverse negative attitude or action of B towards A – antagonism.

Game theory is the most popular method of representing conflict; it is a powerful tool for analyzing various situations, including social conflicts. Game theory is based on the idea that decisions are made not by individuals, but by interacting parties, each of which seeks to optimize its benefits. Let's say we have 2 opposing sides, which we will call players. By "strategy" we mean a set of potential actions. Let $a_1, \ldots, a_n$ −be the strategies of the first player, $b_1, \ldots, b_n$ − be the strategies of the second player. Each player receives a certain payoff, which depends on what strategy he chose himself and what strategy his opponent chose.

The game is specified in the form of a matrix, where each row corresponds to the strategy of the first player, and each column corresponds to the strategy of the second player.

	b_1	b_2	...	b_j	...	b_n
a_1						
a_2						
...						
a_i				$x_{ij}y_{ij}$		
...						
a_n						

x_{ij} − we will understand as the winnings of the first player, y_ij- the winnings of the second player, respectively.

In social conflicts one of the most complex are labor conflicts. It is the type of social conflict where the object is labor relations and its conditions of ensuring. Labor conflicts can have both negative and positive implications. For example, I.M. Kozina highlights the following positive functions of labor conflict: firstly, labor conflicts are the way to force the formation of more favorable working conditions, and secondly, important function of the conflict is to protect workers from violations by the employer of labor legislation or labor agreements.

In analyzing various approaches to consider labor conflicts, it becomes obvious that conflict is recognized by scientists as an inevitable, necessary and resolving factor in the development of labor relations. It is considered as the promotion of new level of mutual understanding and cooperation. But at the same time, conflict can become a destruction factor of social and labor relations. The negative consequence of a labor conflict may be the decreasing of product quality, labor productivity, the increasing of employee turnover and the increasing of the number of injuries and illnesses. Therefore, scientists come to the conclusion that it is necessary to learn the competent management, studying of conflict resolving abilities and conduct it in the right direction for the organization.

The forms of labor conflicts can be different and, depending on this, the methods of preventing and resolving them also differ. We propose to consider the well-known case of protest between the miners of the Kazakhmys company and the management of this factory. On August 14, 2023, the organization's employees began a strike, presenting their list of demands of at least 13 points, which included demands for increased wages, changes in the provided health insurance, review working conditions, replace old equipment, increase the number of workers, increase employee experience.

	b_1	b_2	b_3	b_4	b_5
a_1	100,0	100,25	100,50	100,75	100,100
a_2	75,0	75,25	75,50	75,75	75,100
a_3	50,0	50,25	50,50	50,75	50,100
a_4	25,0	25,25	25,50	25,75	25,100
a_5	0,0	0,25	0,50	0,75	0,100

Let us imagine the group of protesters under the set $= a_1, a_2, a_3, a_4, a_5$, a $B = b_1, b_2, b_3, b_4, b_5$− a group of representatives of the management of the Kazakhmys company. Let us expand these expressions: a_1 −management satisfied all the requirements, a_2 − management satisfied most of the requirements, a_3 − management satisfied half of the requirements, a_4 − management satisfied a minority of the requirements, a_5 − management refused to cooperate. While b_1 − will be understood as a loss from satisfying all the demands of the striking miners, which is equal to 0, b_2 −loss from satisfying most of the demands, b_3 −- gain from satisfying half of the demands, b_4 −gain from satisfying a minority of the demands, b_5 − gain in case of refusal to cooperate with employees, that is, non-satisfaction of requirements.

The most advantageous position for both parties from a logical point of view is the situation $a_3, b_3 = 50,50$, that is, where the demands of the workers are half fulfilled and the company management will have to cede their privileges, which is what

happened. But we understand that the strikers will not be satisfied for long that their demands are only half fulfilled.

The central problem of conflictology is considered to be the problem of conflict management. Conflict management includes: diagnostics, forecasting, prevention, prevention, etc. Conflict modeling in the scientific literature is most often referred to as forecasting or conflict resolution. It is important to understand that in a dynamically developing world, social conflicts are an integral part of society, as a result of which it is of great importance to understand the essence of the conflict and have the ability to resolve it. By conflict resolution we will understand the most necessary result.

Russian scientist A. Samarsky proposed a number of dynamic modeling methods for complexly formalized problems, which we can use for social processes. The authors tried to present a social conflict based on the proposed model of A. Samarsky. Social conflict between the people and the state can arise for various reasons, which may be related to political, economic, cultural or social factors. The proposed model is based on the fact that the social conflict between the population of the country and the government depends on the following factors: the growth of discontent among the people, the ineffectiveness of the government system, the growth of social tension, the degree of people's distrust of the state and the degree of ignorance of the needs of the population by the power structure itself. The increase in ignorance of the needs of the population and dissatisfaction are directly proportional, i.e.

$$\frac{dM_1}{dt} = \alpha_1(t)M_2 - \beta_1(t)M_1 + \gamma_1(t),$$

$$\frac{dM_2}{dt} = \alpha_2(t)M_1 - \beta_2(t)M_2 + \gamma_2(t) \tag{1}$$

In equation (1) $M_1(t) \geq 0, M_2(t) \geq 0 -$ is the volume of dissatisfaction and inefficiency of the government system, coefficients $\alpha_1(t) > 0, \beta_1(t) > 0, \alpha_2(t) > 0, \beta_2(t) > 0$ represent the rate of change of discontent and growth of social tension, functions

$\gamma_1(t) \geq 0, \gamma_2(t) \geq 0$ level of mutual distrust, which is considered independent of dissatisfaction.

Model (1) is the simplest when it does not depend on time:

$$\frac{dM_1}{dt} = \alpha_1 M_2 - \beta_1 M_1 + \gamma_1,$$

$$\frac{dM_2}{dt} = \alpha_2 M_1 - \beta_2 M_2 + \gamma_2 \tag{2}$$

Let us imagine ideal conditions when $\frac{dM_1}{dt} = 0$ $\frac{dM_2}{dt} = 0$ and M_1^0, M_2^0, which represent the equilibrium conditions for the equations, and for reality – when the degree of satisfaction with the life of the citizens of the state and the high efficiency of the government system approximately equal, found as follows

$$\alpha_1 M_2 - \beta_1 M_1 + \gamma_1 = 0, \quad \alpha_2 M_1 - \beta_2 M_2 + \gamma_2 = 0$$

and are equal

$$M_1^0 = \frac{\alpha_1 \gamma_2 + \beta_2 \gamma_1}{\beta_1 \beta_2 - \alpha_1 \alpha_2}$$

$$M_2^0 = \frac{\alpha_2 \gamma_1 + \beta_1 \gamma_2}{\beta_1 \beta_2 - \alpha_1 \alpha_2} \tag{3}$$

From (3) it follows that for the equilibrium value of the functions the following equality must be satisfied:

$$\beta_1 \beta_2 > \alpha_1 \alpha_2 \tag{4}$$

One of the main causes of conflict between the people and the state may be associated with the unfair distribution of resources, both material and intangible. For example, if people do not receive high enough wages or do not have access to quality education and healthcare, this can cause discontent and protests. Another reason for social conflict may be related to state policies that do not take into account the interests and needs of certain groups of the population. For example, if a government passes laws that are contrary to the views of the majority of citizens, this can lead to mass protests and even violence. In addition, social conflict between the people and the state may be associated with undemocratic methods of governance. If the state does not respect freedom of speech, the rights to peaceful demonstrations and protests, this can lead to growing discontent among the people and violence from the state.

Let us imagine a condition when there is an increase in dissatisfaction with the authorities, as

well as social tension, but the power structure does not react properly, then inequality (4) will be violated, and in the absence of distrust on both sides, then to fulfill the condition of equilibrium of functions, the amount of discontent on both sides must also be absent, i.e. equal zero.

Suppose that mutual dissatisfaction increases by a small amount $d\alpha$ ($d\alpha = d\alpha_1 = d\alpha_2$) while both parties want their own interests not to be infringed, then we get:

$$dM_1^0 = \frac{\alpha_1\alpha_2\gamma_2 + \alpha_2\beta_2\gamma_1 + \alpha_1^2\gamma_2 + \alpha_1\beta_2\gamma_1}{(\beta_1\beta_2 - \alpha_1\alpha_2)^2} d\alpha$$

$$dM_2^0 = \frac{\alpha_1\alpha_2\gamma_1 + \alpha_1\beta_1\gamma_2 + \alpha_1^2\gamma_2 + \alpha_1\beta_2\gamma_1}{(\beta_1\beta_2 - \alpha_1\alpha_2)^2} d\alpha$$

To facilitate solvability, we assume that the level of distrust in each other is equal to $\gamma_1 = \gamma_2$ and for the equality $dM_1^0 = dM_2^0$ we obtain the condition of equality, with a slight change in the equilibrium conditions:

$$\alpha_1(\alpha_1 + \beta_2 - \beta_1) = \alpha_2(\alpha_2 + \beta_1 - \beta_2)$$

which may be included in the agreement between the parties. Under the condition $\alpha_2 = \delta\alpha_1, \delta > 0$, we obtain the following equality

$$\alpha_1(1 - \delta) = \beta_1 - \beta_2$$

When the condition is met, i.e. when there is an effective management system for government bodies, social tension should decrease. The opposite condition shows, on the contrary, a critical increase in social tension.

$$\alpha_1(\alpha_1 + \beta_2 - \beta_1) = \alpha_2(\alpha_2 + \beta_1 - \beta_2)$$

This mathematical formula expresses the degree of balance between the government and the people in the state. The formula expresses how social conflicts can have a peaceful resolution. When social tension increases, the structure of the formula does not work.

Thus, using this formula, it is possible to model the degree of decrease or increase of social conflict in society. The key to resolving such conflicts is communication between the people and the state and the search for constructive solutions which take into account the interests of all parties.

Conclusion

Modeling conflict situations requires taking into account many factors, and when trying to resolve conflicts, it is necessary to use such methods as diagnostics, forecasting, prevention, prevention and other mechanisms. Attempts to mathematically model complex social processes such as conflict, protests and other similar phenomena depend on the type of model, as well as the context and conditions on which the models are based. We see many strategies for interaction between the subjects of the conflict that can affect the course and development of the confrontation. Samarsky's model represents interdependent variables that are not always representative of real conflict cases. Models can identify the influence of external factors such as economic and social differences, but taking into account all aspects of a social conflict more accurately they must also consider the instability and dynamism of human behavior, which definitely limits the accuracy of the calculations. These conclusions do not exhaust the specificity of modeling, since this area of science is relevant and developing to this day.

References

Smagulov A. Cherez mednyj truby: chego dobilis' bastovavshie rabochie «Kazahmysa». [Through copper pipes: what "Kazakhmys" workers on strike achieved]. //Orda. Internet-izdanie, informacionnyj portal. URL: https://orda.kz/cherez-mednye-truby-chego-dobilis-bastovavshie-rabochie-kazahmysa/. (In Russian)

A.S. Ahremenko. Politicheskij analiz i prognozirovanie. [Political analysis and forecasting]. Moskva: Gardariki, 2006 – 333s. (In Russian)

«Sushhnost', soderzhanie i funkcii modelej i modelirovanija». [Essence, content and functions of models and simulation]. URL: https://www.yaneuch.ru/cat_110/sushhnost-soderzhanie-i-funkcii-modelej/186297.2016660.page1.html (In Russian)

Boulding K. Conflict and defense: A General Theory, 1962. – 349 p.

Snyder R., Bruck H.W., Sapin B., Decision Making as an Approach to the Study of International Politics. Princeton University, Foreign Policy Analysis – Series No. 3, 1954.

Vol'terra V. Matematicheskaja teorija bor'by za sushhestvovanie. [Mathematical theory of struggle of survival]. – M.: Nauka, 1976. – 285 c. (In Russian)

Saaty, T.L., Alexander J.M. Thinking with models: mathematical models in the physical, biological and social sciences. – N.Y.: Pergamon Press, 1981.

Ovchinnikova T.M. Dialekticheskaja i formal'no-logicheskaja specifika modelirovanija konflikta. [Dialectical and formal-logical specificity of conflict modeling]. Omsk, 2015. – 171 s. (In Russian)

Ancupov A.Y., Shipilov A.I. Konfliktologija. Uchebnik dlja vuzov. [Conflict studies. textbook for universities.]. — 2-e izd., pererab. i dop. – M.: JUNITI-DANA, 2004. – 591 s. Elektronnaja versija. (In Russian)

Parsons T. The structure of social action. — Collier-Macmillan Canada, Ltd (Toronto: Canada), 1966. — 887 p.

Nasimova G.O. Osnovnye faktory i prichiny social'nyh konfliktov v Kazahstane. [Main factors and causes of social conflicts in Kazakhstan]. //Chelovek. Soobshhestvo. Upravlenie. № 1, 2009 – s. 59-66. (In Russian)

Ismuhanova G.G. Sovremennye promyshlennye konflikty i ih otrazhenie v teorii R. Darendorfa (na materialah Respubliki Kazahstan). [Modern industrial conflicts and their reflection in the theory of R. Dahrendorf (based on materials from the Republic of Kazakhstan)] // dissertacija na soiskanie stepeni kandidata social'nyh nauk. – Almaty, 1996. – 179 s. (In Russian)

Kylyshbaeva, B. N. Konfliktologija. [Conflict studies]. /uchebnoe posobie/ Almaty: Қазақ universiteti, 2009. – 250 s. (In Russian)

Sengirbaj M.Zh. Jetnosaralyқ konflikt zhane onyn aldyp alu men retteu tehnologijalary. [Inter-ethnic conflict and technologies of its capture and regulation]. Almaty: Қазақ universiteti, 2015. (In Kazakh)

Nuralina B.A. Sajasi zhanzhaldardy sheshudegi kelissөzder procesiniң strategijasy men taktikasy. [Strategy and tactics of the negotiation process in resolving political conflicts] – filosofija d-ry (PhD). dis. : 6D050200 – Sajasattanu mamandyғy bojynsha. – Almaty : 2023. – 144 p. (In Kazakh)

Merton R. K. Social Theory and Social Structure. The Free Press (New York: USA), 1968 – p. 698.

Lefebvr V.A., Smoljan G.A. Algebra konflikta. [Conflict algebra]. Lenand, 2022. – 72 s. (In Russian)

Kun T. Struktura nauchnyh revoljucij. [Structure of scientific revolution]. – M., 1975. (In Russian)

Jones A.A. Game theory: Mathematical models of conflict. – Horwood Publishing Limited, 2000. – p. 286.

O priostanovlenii rabot na rudnikah Gruppy kompanij «Kazahmys». [On the suspension of work at the mines of the "Kazakhmys" Group Company.] // Internet-izdanie korporacii «Kazahmys». URL: http://www.kazakhmys.kz/ru/news/item-o-priostanovlenii-rabot-na-rudnikah. (In Russian)

Samarskij A.A., Mihajlov A.P. Matematicheskoe modelirovanie: Idei. Metody. Primery. [Mathematical modeling. Ideas. Methods. Examples]. – M.: Fizmatlit, 2001. – 320 s. (In Russian)

Kozina I.M. Industrialnye konflikty v sovremennoy Rossii. [Industrial conflicts iin modern Russia]. – Ekonomicheskaya sociologiya. T.10, №3, 2009, s. 16-32. (In Russian)

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