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CONFLICT MANAGEMENT BY USING THE POSSIBILITIES OF COORDINATED OPTIMIZATION TO ACHIEVE SUSTAINABLE DEVELOPMENT OF ORGANIZATIONAL SYSTEMS

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Abstract: *An analysis of the interests of the subjects in carrying out appropriate activities in which there is an exchange of goods and benefits is made in this research. The most common types of subjects and their target functions are identified in terms of opportunities for coherent optimization of their interests. Some opportunities for application of the principle of the agreed optimum for conflict management and sustainable development of the organizational and production systems are considered. Opportunities for building coalitions of entities working on the principle of the agreed optimum are also presented, which can be applied in modeling, measuring and managing business processes in the organizations and in building a strategic vision for the development of flexible manufacturing enterprises. Findings and conclusions are made about the applicability of the research.*

Key words: *coherent optimum, conflict management, sustainable development*

I. INTRODUCTION

The interests of all communities, collectives, groups of people united in an organization and individuals in a market economy and globalization become an essential driving force. It can be assumed that the maximization of the own prosperity is a property inherent in every living organism, and especially in man and the systems in which he participates and / or manages. Every living subject strives to ensure the best conditions of existence - this is its right, which should not be taken away from it. The presence of their own interests in different people is an objective factor for coordinating their actions, as a result of which, people in pursuit of their own prosperity can harm each other. This sometimes leads to conflict situations in the team, to a violation of the normal psychological climate, when individuals put their personal interests above the interests of other people in the team and / or outside it. It is increasingly important to create such a model of communication and exchange between people, ie. between individuals

and legal entities to create conditions for maximizing the own prosperity of some entities without violating the same of other entities.

II. ANALYSIS OF THE OBJECTIVES OF THE SUBJECTS IN CONCERNED OPTIMIZATION OF THEIR INTERESTS

The degree of satisfaction of each subject must be measured by the subject himself, who gives a subjective assessment of each unit of the received or given good.

The subject is distinguished by the presence of its own interests. These interests are expressed by a target function

$$J = f(\mathbf{x}), \quad (1)$$

to the maximum meaning to which every rational being aspires. The argument of this function is the situation **x**, which characterizes a set of parameters $x_1,...,xn$:

$$\mathbf{x} = (\mathbf{x_1}, \mathbf{. . . , xn}). \quad (2)$$

It can be assumed that these parameters characterize the essential features of a cybernetic system that goes through different states, hereinafter referred to as situations.

As parameters of the situation can be different characteristics of the actions of the subject. We will talk about that subject **S** has the freedom to choose the parameters (2), if there is an area **X**, such that any meaning of **x** from this area **X** can be realized by the subject. Moreover, we will distinguish mental choice when the subject transferred to mind various meanings **x** and evaluates their corresponding values of the function **J,** from the actual choice, when the subject makes his choice x in reality. Cases in which the subject is deprived of real freedom of choice are not considered.

Definitely, not everyone is accountable to himself for what he wants, why he wants it, is it possible for what he wants to come true, what is the probability that it will come true, what is the risk if it does not come true etc. Theoretically, this circumstance can also be taken into account, introducing objective functions for consideration f(**x**) of a stochastic nature, which have the form:

$$f(\mathbf{x}) = \int f(\mathbf{x}, \eta)\, \omega(\eta) d\eta, \quad (3)$$

where η - set of random variables, and $\omega(\eta)$ – its unknown distribution.

It seems that if the target functions of individuals are unknown or difficult to define, then what about the target functions of "big systems", such as countries consisting of millions of individuals? Here is the effect of analyzing the objective functions of large systems, reflected in the so-called limit theorems of probability theory, arguing that when summing a larger number of random

summands the deviation from the total effect of the general rule with the growth of the summands numbers are smoothed. That's why for the big one system we can judge much more definitely than its components.

Cases when the criterion of **i**-th subject is his own well-being, is the most natural and widespread, although this is called by the offensive word "selfishness".

But the described scheme extends to a significantly wider range of tasks. As a target function of the i-th subject can be any combination of target functions of other subjects - the so-called "care for others". It also includes cases of complete altruism - caring for the "common good", if, of course, the subject is aware of the real functions of other people's goals, rather than the distorted image of them. The objective function of the impartial altruist can be expressed as follows:

$$J = \sum_{i=1}^{n} fi(x).$$

(4)

Some subjects also pursue completely transcendent goals, in no way related to their own prosperity, and this can also be put in our scheme.

Love can also be placed in this scheme, when the goal of the subjects that make up the couple in love is to maximize the prosperity of the partner:

$$J1 = f2(\mathbf{x}); \quad J2 = f1(\mathbf{x}),$$

(5)

and hatred, exacerbated to such an extent that subjects forget about their own prosperity, seek to do maximum harm to each other:

$$J1 = -f2(\mathbf{x}); \quad J2 = -f1(\mathbf{x}).$$

(6)

If we are talking about a state, then this version of relations corresponds to the state of war.

The present study also covers cases where the aim of some or all of the subjects is to minimize rather than maximize the target functions, for example, the goal of i-th subject appears:

$$J\,i = fi(\mathbf{x}) \rightarrow \min.$$

(7)

This task comes down to the standard statement that if we replace the objective function of this subject with the opposite, then the goal is its maximization:

$$Ji = -fi(\mathbf{x}) \rightarrow \max.$$

(8)

In this special case, when the subjects pursue the goal to get the maximum benefit for themselves and to cause maximum harm to the partner,

$$J1 = f1(\mathbf{x}) - f2(\mathbf{x}); \quad J2 = f2(\mathbf{x}) - f1(\mathbf{x}),$$

(9)

the situation becomes antagonistic and falls under the scheme of a situation with two persons with opposing interests (the so-called “zero sum”).

Meaning f(**x**)= f1(**x**) - f2(**x**), this situation can be represented as follows:

$$J1=f(\mathbf{x})\rightarrow \max; \quad J2= -f(\mathbf{x})\rightarrow \max \quad \text{or}$$

$$J1= f(\mathbf{x})\rightarrow \max; \quad J2= f(\mathbf{x})\rightarrow \min$$

(10)

So, we have shown that too many conflict situations boil down to the standard scheme of maximizing several different objective functions. That is why in civil society there is a constant and purposeful work on the education of the new person for the development of the collective interests and for their combination with the personal ones.

Possessing the awareness that together, taking into account the capabilities and needs of all, not just our own, it is possible to achieve more than ourselves, people develop a common goal and common methods to achieve this goal, which requires synchronous action. [2,3]

The simplest interpretation of the task is the desire of each subject to maximize their own well-being in society with interacting subjects, where the behavior of each affects the state of all others. Generally speaking, every rational being has a goal that is different from the goals of other beings. For example, the different goals of the countries, of each branch of the economy, of each enterprise and institution and finally of each individual. This variety of criteria should not be ignored.

III. OPPORTUNITIES FOR APPLICATIONS OF THE CONCILIATED OPTIMUM PRINCIPLE FOR CONFLICT MANAGEMENT AND SUSTAINABLE DEVELOPMENT

The agreed optimum means transforming the conflict situation into one in which none of the parties to the conflict can improve their situation without harming the other partners. Therefore, the state of the agreed optimum is the best for all, ie optimal. Its achievement requires concerted action by the conflicting parties, so this situation can be called a "coordinated optimum”.

If as a solution to this situation we can use a point that is determined by the equations:

$$\frac{dfi}{dxi} = 0 \quad (\, i = 1, \ldots, n),$$

(11)

we can show that this point, to which the decision is reduced (in this case, when all players act on the principle of "each his own", independently of each other) is not optimal, because it realizes only part of the possible maximum profit of each of the players. Therefore, this point can be called the point of the inconsistent optimum.

There is another point at which all players win. This point is determined by the equation:

$$\frac{Df}{Df} = 0,$$

(12)

where **f**=(f1,…, fn) – a vector that is composed of profit functions fi, and D/D**x** – jacobian of vector transformation ***J= f(x)**.

We called this point "the point of the agreed optimum". It is indeed optimal in the sense that any entity deviating from it cannot increase its profit without reducing the profit of the other participants in the situation. Therefore, the violation of the conditions of the agreed optimum by each participant in the situation is punished by all other participants with measures directed against the violator. This gives stability to the point of the agreed optimum.

The principle of the agreed optimum is a mathematical expression and a means to achieve a fair resolution of conflicts in human relations. Mathematically, he takes into account the real inequality between people / physical, moral and intellectual/. Therefore, it is deeper than the principles of formal equality, which has never been (and never will be) achieved. The conscientious subjects to whom it relates Homo sapiens, sooner or later they must realize that by coordinating their actions on the principle of the coordinated optimum with the help of cybernetic systems, they can achieve true justice in industrial and other relations without compromising anyone's interests. In a reasonably constructed society, the principle of the agreed optimum can become a fruitful tool for achieving harmony in human relations.[4,5,6,7,8]

Until now, economic cybernetics, based on the principles of mathematical planning theory (or "programming"), has solved only private problems of optimization of production and distribution of products, because it did not have theoretical methods for solving global planning problems. in societies consisting of entities pursuing different goals. The principle of the agreed optimum is the first formal-mathematical tool for solving such problems. The proposed theory makes it possible to solve global management problems.[1,2,5,8]

Global optimization on the principle of the agreed optimum means achieving the greatest benefit for all members of a non-antagonistic society. It includes, in part, the optimization of technology, the economy, social relations in the context of a specific environmental and natural environment, which must be spared as resources and protected from pollution for the benefit of present and future generations. [2,4,5,8].

The agreed optimum is also possible in a society in which the full abundance of material goods has not been reached. The abundance of goods satisfies the needs of the people, and many of the problems that concern us now will disappear. It is about reaching the agreed optimum in a society whose needs exceed its capabilities.

With the help of the principle of the agreed optimum, a number of models of global tasks for optimal management of the economy can be compiled:

- task for the optimal management of the sustainable development of the branches, regions, industrial, urban and suburban areas and territories;
- task for the optimal management of production and organizational systems and / or their volumes by drawing up an optimal general valid plan for production and exchange of all types of products;
- task to establish the optimal proportion between the development of industry and agriculture by determining the optimal levels of industrial and agricultural production;
- task for pricing in society, as a result of the solution of which optimal prices of all products produced in society can be found;
- task for optimization of foreign trade, allowing to replace the existing practice in the relations between the countries of the exact analytical accounts.

In addition, the simplest model of the agreed optimum in the relations between the separate groups in the society can be made.

The solution of the global problems for optimization of the systems on the basis of the offered approach, deriving from the principle of the coordinated optimum, is possible with the modern computer equipment.[1,2] Undoubtedly, the losses caused by planning errors are much smaller than the losses incurred by society from the chaotic competition mechanism, which is the regulator of production.

In the hierarchical management system, built on the principle of the agreed optimum, the "balance" of the subjects who occupy j-th "floor" in the hierarchical ladder are determined by the "balance" of those subjects who are on the lower (j-1)-th „floor”. The hierarchical system built on the principle of the agreed optimum will be optimal in the sense that everyone who represents it will have the opportunity to maximize its efficiency. This approach allows to best solve the problem of "combining public and personal interests" of members of society. Knowing the criteria of all members of society, one can find the criteria of the system as a whole.

The main difficulty in using the proposed approach is the practical compilation of the criteria and target functions of the subjects. Theoretically and practically this problem is solvable, and it will undoubtedly be solved with the joint efforts of engineers, economists and mathematicians.

Establishing the agreed optimum requires absolute intelligence, ie infinite depth of reflection from subjects involved in the conflict. The intellect of a person who is not armed with knowledge of mathematics and is not equipped with measuring and computing equipment is limited due to the law of the impossibility of exceeding twice the average. [1].

We will not touch here on the question of how to measure intelligence. We will confine ourselves to the statement that intelligence, like any other "physical quantity," is in principle measurable.

Collective action is generally undoubtedly more effective than individual action. The strength of the team is that everyone's information becomes available to everyone.

The strength of the team can be more or less than the sum of the efforts of its members, depending on whether all members of the team have a common goal. People with similar interests unite in a team. The mutual support and mutual assistance of the people in the team stems from the existence of common interests. The laws of struggle for existence encourage people to unite in collectives.

The mechanical association of people with directed functions

$$J1 = f1(\mathbf{x}), \ldots , \quad Jn = fn(\mathbf{x}) \qquad (13)$$

in the collective leads to an arithmetic addition of their directed functions:

$$J = i = \sum_{i=1}^{n} fi(x) \qquad (14)$$

By differentiating these functions by all arguments we get:

$$dJ = \left(\sum_{i=1}^{n} \xi i(x), dx \right), \text{ where } \xi i(x) = \frac{dfi(x)}{dx} \qquad (15)$$

By denoting $\xi(x) = \sum_{i=}^{n} \xi i(x)$, we get:

$$dJ = (\xi(x), dx). \qquad (16)$$

A vector that is orthogonal to the vector $\xi(\mathbf{x})$, determines the direction of the interests of the team, and the vector itself $\xi(\mathbf{x})$ represents in itself a vector sum of vectors $\xi i(\mathbf{x})$, orthogonal to the vectors of interests of team members. Thus, the gathering of the interests of team members can be considered as a simple gathering of vectors. It is clear that when collecting similarly directed vectors a vector can be obtained whose "length" is greater than "the length" of the collected vectors, and when collecting vectors directed in opposite countries a vector "length" can be obtained. ”Of which is less than the“ length ”of each of the collected. The same happens when the forces of the subjects gather in the power of the collective. The strength of the collective can be identified with the "length" of its vector of interests, of course, without understanding "length" in the sense of Euclid - as the sum of the squares of the "length" of the components. „ Metrics ”of interaction of the participants from the team is

unconditionally more complicated than the mechanical gathering of their physical forces.

The art of creating strong teams aimed at solving certain tasks is reduced to the selection of subjects, vectors of interests, which are aimed at solving the given tasks or their components.

Modern society is experiencing an acute shortage of mental energy because the need for mental energy increases in proportion to the square of the physical energy in the hands of humanity. This deficit is being overcome thanks to the use of cyber machines, which first appeared in the middle of the last century and are now widespread. Freeing people from monotonous mental work of true art, cybernetics helps to resolve the "crisis of thought" and the rallying of human society in a collective.

Mathematics, measuring and computing techniques provide humanity with absolute intelligence, the mastery of which is a necessary prerequisite for the harmony of human relations.

IV. OPPORTUNITIES FOR BUILDING COALITIONS WORKING ON THE PRINCIPLE OF THE AGREED OPTIMUM

The purpose of this section is to substantiate the theory of the agreed optimum as a mathematical basis for the formation and functioning of coalitions of entities.

To simplify the presentation, we will look at the situation of interaction and exchange between n persons S_1,.S_n, each of which has the freedom to choose a numerical parameter. In this way we will look at the situation with target functions

$$J_1 = f_1,\ldots, \quad J_n = f_n(\mathbf{x}),$$

(17)

depending on n prime numerical parameters: $\mathbf{x} = x_1,\ldots, x_n)$, where x_i is a parameter controlled by the subject $\mathbf{S}_i$.

4.1. THREE-PERSONAL INTERACTION COALITIES

The simplest situation in which the possible formation of coalitions is the case of the interaction and exchange among three persons S_1, S_2, S_3. There are three possible coalitions in it, which we will denote by $\{S_1, S_2\}$, $\{S_1, S_3\}$ and $\{S_2, S_3\}$. For example we will consider coalition $\{S_1, S_2\}$.

Necessary condition of the agreed optimum in the relations between S1 and S2 is the zero equality of the major minor of the second row of the matrix (18) by n=2.

$$\begin{vmatrix} \xi_{11} \cdots \xi_{n1} \\ \xi_{1n} \cdots \xi_{nn} \end{vmatrix} = 0 \qquad (18)$$

This relationship of variables x_1, x_2, x_3 allows the reaction to be expressed S_1 of actions S_2 and S_3:

$x_1 = \varphi_1(x_2, x_3)$ and to find its full differential:

$$dx_1 = \psi_{12} dx_2 + \psi_{13} dx_3$$

By substituting this formula in (17) by n = 3, we get: (i= 1,2,3)

$$dJi = (\xi_{i1}\psi_{12} + \xi_{i2})dx_2 + (\xi_{i1}\psi_{13} + \xi_{i3})dx_3 = 0$$

The accession of the subject S_3 to the coalition $\{S_1, S_2\}$ based on the principle of the agreed optimum, imposes two necessary conditions:

$$\begin{vmatrix} \xi_{11}\psi_{12} + \xi_{12} & \xi_{21}\psi_{12} + \xi_{22} \\ \xi_{11}\psi_{13} + \xi_{13} & \xi_{21}\psi_{13} + \xi_{23} \end{vmatrix} = 0 \qquad (19)$$

$$\begin{vmatrix} \xi_{11}\psi_{12} + \xi_{12} & \xi_{31}\psi_{12} + \xi_{32} \\ \xi_{11}\psi_{13} + \xi_{13} & \xi_{31}\psi_{13} + \xi_{33} \end{vmatrix} = 0$$

These conditions together with the condition (19) give a definite system of three equations versus three unknowns x_1, x_2 and x_3, which, as a rule, has only one solution. Thus, the interaction of three persons in a fixed coalition of two of them has a single point of the agreed optimum.[1].

4.2 COALITIES IN THE INTERACTION OF FOUR AND MORE PERSONS

The situation with four people differs from that with three people with the variety of possibilities for forming coalitions. There are 6 possible coalitions of the type „2 – 2" and 4 coalitions of the type „3 – 1". We will limit ourselves to considering only the case when the subjects join existing coalitions one by one. [6]. The condition of the agreed optimum (18) in coalitions $\{S_1, S_2\}$, by n=2, gives the opportunity to express the reaction of the first subject to the actions of the others:

$x_1 = \varphi_1(x_2, x_3, x_4)$ and to find its full differential: $dx_1 = \psi_{12} dx_2 + \psi_{13} dx_3 + \psi_{14} dx_4.$

We substitute this formula in (17) by n = 4 and we get:

$$dj_i = (\xi_{i2} + \xi_{i1}\varphi_{12})dx_2 + (\xi_{i3} + \xi_{i1}\varphi_{13})dx_3 + (\xi_{i4} + \xi_{i1}\varphi_{14})dx_4 = 0 \quad \text{(i= 1, 2, 3, 4)}$$

(20)

The accession of the subject S_3 to the coalitions $\{S_1, S_3\}$ imposes two connections:

$$\begin{vmatrix} \xi_{12} + \xi_{11}\psi_{12} & \xi_{13} + \xi_{11}\psi_{13} \\ \xi_{22} + \xi_{21}\psi_{12} & \xi_{23} + \xi_{21}\psi_{13} \end{vmatrix} = 0$$

(21)

$$\begin{vmatrix} \xi_{12} + \xi_{11}\psi_{12} & \xi_{13} + \xi_{11}\psi_{13} \\ \xi_{32} + \xi_{31}\psi_{12} & \xi_{33} + \xi_{31}\psi_{13} \end{vmatrix} = 0$$

These two conditions together with the condition (18) by n=3 allow to express the reactions of the first three subjects to the actions of the fourth: $x_1 = \varphi_1(x_4), \quad x_2 = \varphi_2(x_4), \quad x_3 = \varphi_3(x_4),$ and find their differentials $dx_1 = \psi_1 dx_4,$ $dx_2 = \psi_2 dx_4, \quad dx_3 = \psi_3 dx_4.$

After substituting these formulas in (20) we get:

$$dJ_i = (\xi_{i1}\varphi_1 + \xi_{i2}\varphi_2 + \xi_{i3}\varphi_3 + \xi_{i4}) = 0 \quad (i = 1, 2, 3, 4).$$

(22)

The accession of the subject S_4 to the coalition $\{S_1, S_2\}, S_3\}$ requires four more conditions of the type to be imposed:

$$\xi_{i1}\psi_1 + \xi_{i2}\psi_2 + \xi_{i3}\psi_3 + \xi_{i4} = 0 \quad (i = 1, 2, 3, 4),$$ of these same variables x_1, x_2, x_3 и x_4.

But these four conditions contradict the previously established three conditions. Thus, the accession of the fourth subject to the coalition of the three makes us reconsider the whole system of past relations between them. This rule is also maintained for games with more than four participants: the accession of each new entity to an existing coalition makes us reconsider the entire existing system of relations between them. As far as in practice such a review of relations is not frequent, those subjects who join a coalition earlier than others find themselves in a winning position.

V. FINDINGS AND CONCLUSIONS

1. The presented research is an attempt of the author to look for common ground between the needs of conflict management and sustainable development of organizational and production systems and the possibilities of coherent optimization and can serve to discuss the effectiveness, benefits and opportunities of this approach.

2. The presented approach can be used to develop optimization models of specific systems and entities, in the implementation of their targeted activities and exchange of beneficial effects.

3. Based on these models, algorithms and software can be developed to perform specific computerized procedures and optimization.

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