Main Principles of Decision Making in Conflict Theory

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***Abstract*— Since the formation of a human society making certain decisions has been constituting the basis of the cognitive and aimed activities of a human group or a team (involving in management processes, or ruling the state and government) to achieve any aims in most cases. In this article, the main principles of decision-making in conflict theory are studied.**

Keywords— conflict; decision; decision making; conflict situations

I. INTRODUCTION

Dialectical development shows that if a human being exists and acts, then he must certainly take place in management or supervision processes in any form. During this process person has to meet with the notion of "decision making". In "decision making" process, he ought to use certain information base (collection). So, the main problem consists of finding the dialectical unity of definite regularities among the notions of activity, management, information and decision making.

Two main problems have been standing before humans since the human society formed and the human being perceived himself: generating financial blessing and sharing them. In mutual interaction with nature a human being tries to get more financial blessing from it in order to make his/her life attractive. Then such a problem emerges: how to share necessary expenditures for obtaining financial blessing? How to share generated financial boons among individuals of the human society? The development level of the society depends on how and with what success these two main problems are solved. Such a question can emerge here: what role does science play in the realization of these problems? It should be noted that, natural and technical sciences play the most important role in generating financial blessing, and social sciences in its distribution. Depending on the nature of the members of the society – humans, a number of conflict situations emerge during the distribution of expenditures and financial boons, and this is mainly associated with that, every individual wants to invest less resource and get more. Therefore, the system of distributing expenditures and blessing must solve the major conflict situation in any form. And the conflict of interests leads to humans' collision. There are three major methods of describing human collisions (clash, fight): 1) from physical aspect; 2) from biological aspect; 3) from purely humanist aspect.

II. PRINCIPLE OF ALTERNATIVE CHOOSING

We will only talk about the third form. The third method of the mutual activities of humans is absolutely humanist: agreement, contract, compromise. Actually, gas and molecules cannot agree, also rabbits and snakes cannot reach a compromise. The description of mutual activity through this method is also a mathematical description. Besides, humanist qualities require that, the distribution of expenditures and boons should also be based on the imaginations of justness. Such a fact is inevitable that, if the majority of the members of a society do not admit the justness of the existing system of distribution, then either the system should be destroyed or more means should be spent for repressing and punishing this system. A new question can appear from it: what is justness; the justice principle?

Humanity since its initiation has thought about various justness principles and formed them. In the modern world every society has its unique justness principle and each of them tries to convince others of the authenticity of its own principles. The science of mathematics turns this ethical postulate into a mathematical axiom and enables hypothesizing the completeness and noncontradictory quality of the system of justness principles.

As a logical conclusion of the abovementioned considerations, we find that, from the viewpoint of the system approaching method, decision making theory deals with a wide diapason of problems ranging from individual decision making under definiteness, indefiniteness and risk claiming conditions to the decision making process of humans and groups, who have full and partial exchange of information on their strategies and compete in a group form.

Under definiteness conditions, i.e. when considering decision making without using probabilities, it is only necessary to consider order utility function. More exactly, we must be interested in the following question: which alternatives have more and which ones have equal utility (usefulness)?

In cases when probability does not exist we should be interested in comparing values. If x is preferable to y and y is preferable to z, then we can equalize the value between x & y and y & z, writing values 3 to x, 2 to y and 1 to z. Also, by writing 100 to x, 2 to y and 1 to z, we can indicate that the difference in utility between x and y is more than that between y and z. If we are only interested in regulating of values, then we say that, we consider order (regulation) utility. If we consider the comparison of difference in values, then we say that it is a numerical value.

In cases where probability exists, it is important to consider both two states of utility.

The notion of utility can be defined with different methods. The heuristic criterion of utility, which is characteristic for the "rational behavior" of a personality, can be described as follows:

1. Comparison axiom. We can say about any alternatives x and y that, one is preferable to the other, or they are equal. So, either $x > y$ or $y > x$, or $x \sim y$. Here $x > y$ indicates that x is preferable to y, and $x \sim y$ indicates that they are equivalent. If y is not preferable to x then we can write $x \geq y$.

2. Transitivity axiom. If $x > y$ and $y > z$, then $x > z$. If $x \sim y$, $y \sim z$, then $x \sim z$.

3. Imperfectness of choice. If $x > y$ and α - is the probability of the alternative x happening, and $(1-\alpha)$ is the probability of the alternative y happening, then $x > \alpha x + (1-\alpha)y$. We should note that, the sign > indicates preference rather than greatness.

4. The continuity of preference. If $x > z > y$, then there is a probability α of the happening of x and a probability $(1-\alpha)$ of the happening of y and $\alpha x + (1-\alpha)y \sim z$.

5. Probability one indicates definiteness:

$$1 \cdot \alpha + 0 \cdot \beta \sim \alpha.$$

6. Commutativity:

$$\alpha x + (1-\alpha)y \sim (1-\alpha)y + \alpha x.$$

7. Combination rule:

$$\alpha[\beta x + 1(1-\beta)y] + (1-\alpha)y \sim \alpha\beta x + (1-\alpha\beta)y.$$

Besides these axioms the utility function may have other additional properties, e.g. monotony.

Monotony property indicates that, as gain increases its utility increases too. And utility decreases as loss increases. Once the utility function is defined and the conditions of limitation on the application of preferences become known, we should try to choose the best alternative from the set of possible alternatives by means of corresponding optimization methodology. The best alternative is that, which provides either maximum, or minimum, or minimax compromise solution depending on the formulation of a problem. And decision making theory under the conditions of uncertainty consists of the collection of notions and systematic methods which enables comprehensive analysis of decision making problems in the circumstances of uncertainty. Improving the decision making process is the main purpose of the theory being considered. The hypothesis of "choosing an alternative must be defined by two factors" lies on the basis of DMT (Decision Making Theory):

1) during choosing this or the other variant giving information to the decision making person about probabilities of different results

2) which ones are preferred among different possible results.

Both two factors are formally included to DMT and taking them into account demands:

a) views about possible results

b) describing numerically views about preference.

The main stages of decision making process are following:

1) Defining alternative action methods. There must be given the collection of useful purposes and must be shown corresponding effective criteria. In its turn this allows to make possible defining the degree of different moves for realizing given purposes. Besides, it's necessary to describe development dynamics by time of studied process and the method of collecting information.

2) Describing probabilities of possible results. For this it is demanded to define indefiniteness connected with alternative solutions numerically by means of probability distributions. Under such operation for every accepted solution the probability of every possible move becomes evident.

3) Sequencing preferences of possible results according to their utility. For this at first effectiveness criterion is chosen. Then with its help numerically is described the attitude of decision making person to results and the probabilities of possible results.

4) Rationally synthesizing of obtained information at first three stages. Here it is needed to analyze all obtained information for choosing preference among possible alternatives and to use effectively. This stage is also connected with analysis of sensitivity. It must be noted that, shown above stages form the base of approaching to decision making from the point of view of common sense way.

III. Axioms of Decision Making Theory

Let us include some designations and definitions before explaining axioms. When saying "simple lottery" we will understand such a probability event $L(x_1, p, x_2)$ which has two possible outcomes x_1 and x_2, and the probabilities of them happening are correspondingly equal to p and $(1 - p)$. Let us designate by symbols $>$, $\sim$, $\geq$ the notions of "preference", "equivalent", "equivalency or preference". For instance, if $x_1 \sim L(x_2, p, x_3)$, then the outcome x_1 is equivalent to the lottery which has the outcome x_2 happening with the probability p, or the outcome x_3 having the probability $(1 - p)$. Now let us explain some axioms.

Axiom 1. Existence of relative preferences. For any two outcomes x_1 and x_2 either $x_1 \sim x_2$, $x_1 > x_2$, or $x_2 > x_1$.

Axiom 2. Transitivity. For any lotteries L_1, L_2 and L_3 the following are true:

1. If $L_1 \sim L_2$ and $L_2 \sim L_3$, then $L_1 \sim L_3$;
2. If $L_1 > L_2$ and $L_2 \sim L_3$, then $L_1 > L_3$ and so on.

Axiom 3. Comparison of the simple lottery. If $x_1 > x_2$ for the decision making person, then

1. $L_1(x_1, p_1, x_2) > L_2(x_1, p_2, x_2)$, when $p_1 > p_2$;
2. $L_1(x_1, p_1, x_2) \sim L_2(x_1, p_2, x_2)$, when $p_1 = p_2$.

Axiom 4. Numerical evaluation of preference. The decision making person can put such number $\pi(x)$ $(0 \leq \pi(x) \leq 1)$ against every outcome x that, in this case the condition $x \sim L(x^*, \pi(x), x^0)$ is satisfied.

We designate by x^0 the outcome which is not preferable to any other outcomes. And x^* designates the outcome preferable than any other outcomes.

Axiom 5. Numerical evaluation of the uncertainty of judgments. It is possible to put against every event E, which can influence the outcomes of solution (decision), such number $P(E)$ $(0 \le \mathrm{P(E)} \le 1)$ that, the lottery $L(x^*, P(E), x^0)$ and the situation where the decision making person gets x^* when the event E happens and x^0 when the event E does not happen, are equivalent. The value $P(E)$ is defined by the decision making person.

Axiom 6. Possibility of substitution. If a decision making problem according to a lottery is substituted with the decision making problem according to another lottery and these problems are equal-valued (equivalent) for the decision making person, then both two problems will be equal-valued for the decision making person.

Axiom 7. Equivalence of conditional and unconditional preferences. Let us assume that, L_1 and L_2 are two possible lotteries when the event E happens. If the event E happening or not happening is known, then the decision making person still has the same preference among L_1 and L_2 when this information does not exist.

It should be noted that, Axioms 3 and 4 define the relative measure of the preferences of different outcomes for the decision making person. The quantity $\pi(x)$ called the probability of equal-value indicates that measure. So, the quantity $\pi(x)$ describes the relative preferences for x. It is clear that, in different situations different functions $\pi(x)$ must be taken, as the boundary values x^0 and x^* are free enough for measuring $\pi(x)$. However, for the satisfaction of the above-mentioned seven axioms by all possible π-functions, they must be expressed by means of each other through positive linear transformations.

Any arbitrary positive linear transformation π defined as

$$U(x) = a + b\pi(x), \quad b > 0 \tag{1}$$

is called the utility scale for the outcome x.

If the decision making person rests on the given axioms, then he must choose such alternatives that, he could maximize the expected utility. According to the explained axioms, decision making has no other procedure. As the maximization of U in function (1) is equivalent to the maximization of π, the choice of x^* and x^0 in an arbitrary order does not influence the actual decision (solution).

During making some decisions (solutions) the function

$$U(x) = \sum_{n=1}^{N} k_n U_n(x_n) \tag{2}$$

could be chosen, where U_n is a utility function according to the sign x_n, and k_n is a scalar constant.

In a more general form, it is expedient to choose the utility function

$$U(x) = f[U_1(x_1), U_2(x_2), \ldots, U_N(x_N)]. \tag{3}$$

IV. Areas Covered by Decision Making Theory and Its Methodological Base

1) Multipurpose character. In lots of complex problems achieving different purposes is made aim. Purposes nearly always contradict with one another. At this time progress for achieving some aim causes to the recession for achieving rest of aims. So, decision making person faces the fact of choosing among contradicting purposes.

2) Influence of time factor. When solving some problems important results cannot be obtained at once. Because of this it is not possible to define concrete time for observing this or the other result. For example, to produce some new kind product or to improve and renew the management of the country it is needed to spend enough funds during years for the training of young personnel.

3) Unformed notions. Political moves, authority, excitement, joke, suffering and conscience are the examples of the most important unformed notions. These fundamentally complicate the solution of the problem.

4) Uncertainty. As mentioned above, at decision making (more clearly, choice of alternative action) moment the probability of every alternative result being known is little.

5) Possibility of getting information. Often it is possible to get some information for making decision about choosing among alternatives. For example, organizing medical checkup for easing diagnostics and later treatment of illness, analyzing of the market construction for defining demands to new kind of product, analyzing information about candidates and their rating during election and so on, are examples of this. It must be noted that, much money and time is needed for getting these information and they cannot always be accurate.

6) Dynamic aspects of decision making process. After making some decision there could appear such situation that, investigated problem is not finished yet and next decision for the complete solving of problem could be made some years later. That is, decision made today can "close the door" of some actions, "open the door more widely" of others. It is one of the very important problems to feel such dynamic aspects of problems beforehand and to see what perspectives made decision will create for future decisions.

7) Dissemination of decision to groups. During making lots of governmental decisions choice of some alternative can influence many political and social groups. It is clear that in such situations passing any knowledge and information to the person responsible for decision making, which even a little influences to the decision making, is very useful.

8) Collective decision making. Often not separate individuals, but a whole group is responsible for decision making (choice of alternatives). In fact, there are such problems in which it is not possible to define exactly functions

and responsibilities in this or the other problems of decision making persons.

Decision making person has a chance to choose any of the decisions. At this time preferring this or the other decision depends on the collection of external conditions. For getting information about external factors decision making person has a chance to carry out various experiments. Each experiment requires some expenses. Regardless, such a question appears: what methodology must be considered acceptable during decision making and can this methodology help to find answers to the following questions:

1) Which decision could be the best one in the cases when experiments are not carried out?

2) Does the decision making person need to carry out experiment? If needs, which one among these experiments is better?

3) In what degree must the maximal payment be for a particular experiment?

4) How must the maximal payment be for volume of some experimental information?

It must be noted, in lots of complex problems for describing external conditions there could be required a great number of different features, or characteristic instructions. Then such description is called multidimensional description.

After this listing the problem of numerical description of uncertainty of the views appears.

Due to this belief the decision maker can get thorough conclusions and this person can show his subjective probabilities on the basis of numerous views for various possible events. Here is included information about physical events, empirical data, and the results of modeling of the mutual relation of various factors and expert views of different people, primarily, of the specialists of investigated field. One of the experts is a decision maker. After this stage it is needed to evaluate the utility of each possible result. The procedure of function evaluation consists of five stages:

1) Primary analysis for factual evaluation

2) Defining of corresponding quality parameters

3) Formalization of quantity constraints

4) Choice of utility function

5) Checking the correspondence

V. The Importance, Application and Future of Decision Making Theory

It must be noted that, decision making theory dictates activity norm to the decision making person and under this he must do so that not to encounter contradiction among his views and preferences. Also this theory does not give the description method for behavior of different persons. It arms decision making person with a methodology for making complex decisions which has subjectivity elements. Things we told about are connected with that, by the becoming of problems complex the ability of the decision maker to analyze all information associated to his views and preferences significantly reduces. In such situations DMT prevails in comparison with other analytical approaches, because it can formally involve a lot of subjective aspects of a problem.

Finally, it must be underlined that, decision making is one of the very important processes. Phrases of "decision making process" or "policy development process", being part of the administrative actions of power institutes and policy development chain, also characterize indestructible sequence of important and less useful decisions. During decision making the work of advisers and experts is of great importance. And dynamic character of political processes complicates an adviser's work very much. After explaining his standpoint, or the conclusions of research, the adviser must be sure that his advice and recommendations do not divert from decision making person's attention. So, the problem which solution is finished at the moment could be reviewed after some weeks or days. This time the adviser has to meet with a very difficult problem. For this, first of all, he must try his standpoint be listened attentively, also decision making person (persons) always keep the developed presentations in the focus of attention and perform securing the necessary actions for their realization.

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