



THE AXIOMATIC CHARACTER OF DECISION

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Abstract: *The decision is an act of authority in the military field, and this approach is supported by an axiomatic theory that gives it a logical, rational character.*

Keywords: *axiomatic theory; decision theory.*

Accumulating knowledge, information, data, ideas and experience in relation to nature and society, with himself, the individual has shaped and cultivated throughout history a certain way of being, behaving and manifesting both in family and in collectivity, a set of values and norms, criteria and judgments that helped him to examine and solve multiple daily problems, significantly improving his quality of life and work.

In this evolution, the solving of socio-economic problems at the level of the individual and the society in which he was integrated, of the communities and of the country as a whole, with a strong impact on the consciousness and the existence of man, became acute and became a priority in the concern of the theorists (researchers) and practitioners (politicians) alike. As it has been expected, slowly but surely, scientific research has become more systematic and pragmatic, being institutionalized, and the results (the discovery of some methods and techniques, modern theories and principles) have facilitated the viable, optimal solution of critical issues, the increase of efficiency at micro- or macro-social level and, implicitly, have facilitated lowering the uncertainties and risks that inevitably accompany the implementation of strategies, plans and programs of development, meaning the transition from the present moment to the future time horizon. As decision-making

practice takes two forms: *decision-making* (situations with reduced complexity, with repetitive character, where the variables involved are well known by the manager) and the *decision-making process* (complex situations involving a significant consumption of time, days and even weeks to collect and analyze the information, but also to consult specialists in the field), the formation of a professional, competent point of view of value judgments obliges the decision-maker to go through several stages, in a logical succession, capable of ensuring scientific rigor in the preparation, adoption, implementation and evaluation of the results obtained.

An important role in decision-making is also played by the evaluation of the determinant factors, which are grouped into two distinct categories:

- *Internal factors*, from their own environment (technical, economic, social), expressing the level of technical endowment, the influence of the discoveries in science and technology, the training of the employees, the working climate, the quality of the information system and the logistics. The most important are: the professional (and managerial) training and experience of the decision makers, the motivation of those involved in the act and the decision-making process, the attitude and responsibility towards the content and consequences of decisions, the amount of information available and their actuality, the level of the formal and informal authority of the decision;

- *External factors*, coming from the environment in which the activity takes place, such as: the meaning and rhythm of the branch

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or field development; information and data on the valorization of technological, economic, sociological research; functional and structural, normative, legislative restrictions; the relational framework with other institutions and bodies, from suppliers to customers or direct beneficiaries.

As the managerial act is confused with a relational process between leaders and employees, it means that the decision also appears as a socio-human system with three variables: *the decision-maker, the performers and the environment or the external environment* in which the activity is carried out. The changes in the evolution of the variables and the relations between them influence the whole decisional process, generating a contradictory state of ambiguity. On the one hand, it increases the value of decision-making, its degree of certainty and precision. On the other hand, the complexity of the environment and the homogenization of the professional training of the contractors incite a larger number of variables, complicating the decision making process.

From this perspective, there are some

is the possibility of achieving the ultimate goal, the volume and structure of the data at the disposal of the decision-maker do not, however, allow the evaluation of the chances to achieve them; there are doubts when choosing the appropriate solution); decisions in *ambiguous universe*.

It is obvious that uncertain and risky situations can not be avoided, as a result of the rapid pace of scientific and technological breakthroughs, of political, social and economic circumstances, as well as of the behavior of suppliers and customers. Hence, the current and the most complete information requirement, in order to be able to define clearly and rigorously the problems to be solved and the objectives pursued, as well as to reduce the uncertainties and, consequently, the risks.

The decision is mainly a deliberate act of authority that is binding on organizational structures and subordinates, with the stated aim of achieving common goals (fig.1).

In the terms of the theory of decision, this approach circumscribes all the imperative and

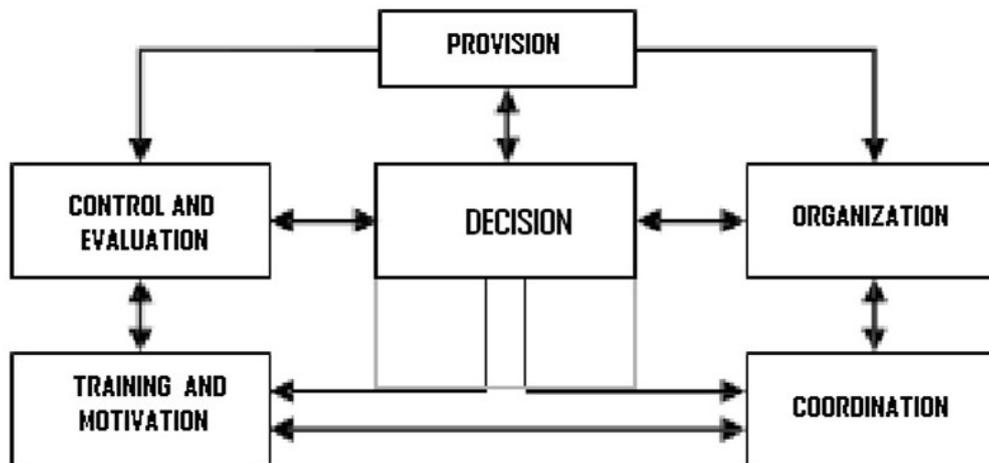


Fig. 1. The decision in the managerial process¹

emblematic decision situations, namely: decisions in *a certain universe* (in which the events that make up the personal network, especially the final one – the object of the decision – have a maximum probability of realization); decisions in *a risky universe* (where part or all of the events that make up the personal network to the final one have a lower probability of realization, some of them even escape control, hence the difficulty of being anticipated); decisions in *the uncertain universe* (although there

conscious actions dedicated to solving the management problems, organized on three levels: *organizational* (data preparation and analysis, identification and elaboration of the alternatives, foundation, adoption and choice of the optimal variant), *informational* (collecting, storing, processing and evaluating valuable data and ideas) and *methodological* (homogeneous activities,

¹ O. Lange, *Decizii optime. Bazele programării*, Scientific Publishing House, Bucharest, 1970.



logical procedures, algorithmic, heuristic and logistic operations).

The evoked operations or activities are finalized (materialized) in: *random decisions*, specific to the leadership factors that rely only on their own experience and intuition; *routine decisions* based on the experience gained in previous solving of similar problems; *learning-oriented decisions*, preferred by managers concerned to constantly explore new and innovative techniques that they can use to solve problems, under increasingly demanding conditions; *paradigmatic decisions*, based on realities and unquestionable truths, on *axiomatic* logic and rationality, on analogy and qualitative requirements, with the chances of becoming reference models for others; *ideological, theoretical decisions* based solely on systemic and prospective, rigorous and scientific analysis.

Since some events, phenomena and processes in nature and society trigger decision-making processes and others do not, there is a requirement to classify them into distinct typologies according to predictable criteria, such as:

- *Safe events* (maximum possibility of occurrence and, in the majority of cases, without new decisions);

- *Probable events* that occur with a certain probability that can be estimated;

- *Possible events* – that occur with a certain probability impossible to measure and estimate.

After the possible alternatives have been identified and defined and the optimal one is chosen with the help of the normative theory, we continue to decipher the general and particular laws that underlie the human behavior, in which case the descriptive theory is used.

Even though such an analysis does not allow the design of a viable modeling and decision-making model that encompasses the stages of the decision-making process, however, the methods and techniques used and also the knowledge present an important methodological value.

The decision is defined as the conscious the act of setting out the objectives to be achieved, the directions of action and the modalities of their implementation, as well as the allocated resources, capable of ensuring the economic and financial self-regulation of the organization as a whole and, of course, the level of profitability. The managerial decision is regarded as a socio-human relationship

with two parameters or action poles. One is the forum or the court empowered to make decisions, and the other, the staff of employees hired to put into action the expected measures.

The logical, rational nature of the decision-making process

The decision-making process consists of several components, the most important being: the decision maker, the multitude of the decisional variants, the many decisional criteria; the environment, the multitude of consequences and, last but not least, the goal pursued. Among the rationality requirements of the decision we could list: scientific substantiation, according to the realities within the organization; the authority of the decision-maker, namely his / her ability and the level of specialized knowledge and assimilated skills; clarity and precision in the formulation of the objectives to be achieved and the decision-making problem to be solved; the opportunity or the best time to substantiate and operationalize the optimal action line; maximizing efficiency or achieving a maximum effect with minimum effort.

The decisional rationality is defined mainly by²:

- a) the correct use of the theoretical concepts of the logical structures - the notion (the elementary logical form representing, in the plan of rational knowledge, different classes of objects, each of them characterized by a multitude of attributes that appear as a totality), the proposition (the logical form that uses notions as constitutive parts in order to express a relation between notions or a property related to a notion) and the reasoning (the more complex logical form within which valuable judgments are used to underlie the movement from one judgment to another);

- b) The observation of certain general principles specific to the logic of decision-making. Among the sentence classes, a particular methodological importance in the decision-making process is given to the categorical judgments, which are logical judgments expressing, under only one of its sides, a single relationship between two absolute notions, without conditioning it in any way. The aim is to correctly construct the „architecture” of the sentence and to formulate the admission criteria or, on the contrary, to reject it, the logical shift from

² O. Lange, *Decizii optime. Bazele programării*, Scientific Publishing House, Bucharest, 1970.



one sentence to another. There are logical links between these structures, and their relationship aims at creating the premises for accepting or rejecting the respective sentences. More synthetically, they are subordinated to the overall purpose of the decision, to solve the multitude of problems faced by the organization, from the current ones, on which its normal functioning depends, to those of perspective, deriving from the laws of competition and profitability. In these conditions, logical reasoning is divided into three classes (*deductive*, *reductive* and *nuanced*), and the reasoning involves the use of logical operations, such as: definition, classification, deduction, induction and demonstration, all being connected with each other by relational links.

The *deductive* reasoning, formulated by Aristotle, seeks, by using formal logic, from true propositions to deduce similar ones. Although it is a powerful tool of knowledge, this method is not sufficient, the difficulty being that there is no certainty that the sentence from which it starts is well or erroneously formulated. From this perspective, the substantiation and decision-making, based solely on rationality, depend on the lucidity and ability of the decision maker in the process of thinking.

The *reductive* reasoning, based on inferences (the transition from one concept to another, where the latter is deduced from the first one) is based, first of all, on the inductive method, i.e. from single, particular cases to general ones.

The *nuanced* reasoning is based on the logic that replaces the discrete character of bivalent logic with one of continuous nature.

In the real economy, simultaneously with the logical decisions, there are also *infralogical decisional* forms, claiming the research of some specific value categories, such as: *value*, *criteria* and *objectives*, *conditioning*, *concentration*, suffering a complementary and mutual influence with a particular significance in the decision-making process. We further analyze the content and the role of each concept:

A. *The value*, like psychological theories, expresses the "functional relationship between a subject and an object, the latter having a psychic predisposition towards value, which is always updated in the relationship", emphasized the

Romanian philosopher Petre Andrei³. In decision theory, value is an essential informational-decision category, being associated with *utility*. As such, the concept of value is closely related to the possible alternatives for action, which the decision-maker compares to determine the optimal action line.

In strictly decision-making sense, there are several concepts related to value, namely: a_1) *preference*, a_2) *utility* and a_3) *efficiency*.

a_1) *Preference* expresses the ability of empowered or empowered people to choose from a variety of possibilities (variants) the optimal one. For example, from the set of decisional alternatives $D = \{d_1, d_2, \dots, d_n\}$ the manager considers that, from his point of view, the alternative d_2 is better than d_3 , which allows to express mathematically in the following form: $d_2 > d_3$, then „ d_2 is strictly preferred to d_3 ”. For each pair of d_2 and d_3 variants compared in the same way, four situations are possible: the decident asserts that d_2 is better than d_3 , but not vice versa; d_3 is better than d_2 but not vice versa; neither of the alternatives d_2 and d_3 is good and consequently, no one is preferred; d_2 is better than d_3 , d_3 is better than d_2 , depending on certain criteria. In order to remove possible inconveniences, we assume that the preferences of the decision-maker are given by the relation “ $>$ ”, showing two other relations between the pairs of the alternatives that compose the set D , and: $d_2 \geq d_3$, i.e. “ d_2 is poorly preferred to d_3 ” if it is not the case as $d_2 > d_3$ or $d_3 > d_2$. Therefore, the weak preference highlights its absence for a certain alternative, and the indifference indicates the absence of strict preference in both directions. As a rule, the decision-making process involuntarily operates with both categories of value, preference and indifference;

a_2) *Utility* expresses the option in favor of one or another of the decisional alternatives, based on quantitative or qualitative criteria, reality requiring numerical representation of the decision-maker's preferences. Being given the preference relation “ $>$ ” of the set D , this means that its numerical

³ Apud, O. Nicolaescu, *Sistemul decizional al organizației*, Economic Publishing House, Bucharest, 1998, p. 28.



representation is an algebraic function of the form $u: D \rightarrow R$, and $d_2 \succ d_3$ is valid only if $u(d_2) \succ u(d_3)$. The representation is called *function of utility*, with the help of it being measured the alternatives of the set D on a certain numerical scale; the higher value always indicates the decision of the decision-maker in favor of it. In the event that the utility function is increasing, it means that the numeric representations for the preference relation „ \succ ” are unique. Of course, the level of utility is not observable, but it plays an essential role in constructing the theoretical model of the optimal variant.

The concept of utility, as a strictly analytical convention, has three main meanings, in the sense of Bernoulli's⁴ conception of mathematical hope:

1. *the probable utility*, according to which the decisional alternative will be preferred to ensure a maximum average gain. Demonstrating the difference between the value (V) and utility (u), it approximates the logarithmic relation between the two categories or concepts: $u(V) = \log V$.

2. *the marginal utility*, which gives indications that, once chosen, the optimal alternative changes the satisfaction of the decision-maker expressed through a utility function.

3. *the uniqueness and multi-criteria utility* has a more general character, resulting from the multiplication of the criteria according to which the optimal line of action is chosen, as well as the consequences that it propagates not so immediately, but especially on the medium and long term.

The multi-criteria utility, analyzed by Neumann and Morgenstern, starts from the hypothesis that preference can be quantified or measured, evaluated by means of *axioms*, reflecting the rational behavior of the decision-maker throughout the process.

From a purely mathematical point of view, besides the possible alternative set $D = \{d_a, d_b, \dots, d_i\}$, the decision maker can also analyze probabilistic mixes of other alternatives such as df and dg of the following type:

$d' = [\alpha d_f, (1-\alpha)d_g]$, where $\alpha \in [0,1]$ in which the probability is represented. In this situation, they become credible, that is, they are perfectly valid, the following axioms⁵.

⁴ A. Maslow, *Motivation and Personality*, Harper and Row Press, New York, 1987.

⁵ A. Maslow, *Motivation and Personality*, Harper and Row Press, New York, 1987.

Axiom 1.1: If $d_f \succ d_g$, then $d_f \succ d' = [\alpha d_f, (1-\alpha)d_g]$ which $\alpha \in [0,1]$. In the event that $dg \succ d_f$ that and $d' \succ d_f$ for $\alpha \in [0,1]$.

Axiom 1.2: If $d_f \succ d_h \succ d_g$, then $(\exists)d' = [\beta d_f, (1-\beta)d_g]$ such $d' \succ d_f$ for $\alpha \in [0,1]$.

Axiom 1.3: If $d_h \succ d_f \succ d_g$ then $(\exists)d'' = [\alpha d_f, (1-\beta)d_h]$ such $d' \succ d''$.

Axiom 1.4: If the decision maker, having three alternatives d_h, d_f, d_g , supports the relation $d_f \succ d_g$, it also accepts $[\alpha d_f, (1-\alpha)d_h] \succ [\alpha d_g, (1-\alpha)d_h]$. It follows that if the alternative d_f is preferred to d_g , then the combinations of d_f with d_h will be preferred to the combination of d_g with d_h .

Axiom 1.5: If there is $d' = [\alpha d_f, (1-\alpha)d_g]$ then the identity of $[\beta d', (1-\beta)d_g] \equiv [\alpha d_f, (1-\alpha)d_g]$ is obtained, and it can be stated that compound alternatives can be decomposed in simple alternatives, by resorting to probability operations without affecting preferences.

Axiom 1.6: If $d_f \approx d_g$ then exists the equivalence $[\alpha d_f, (1-\alpha)d_h] \equiv [\alpha d_g, (1-\alpha)d_h]$. In synthesis, the axioms specific to preference relations and indifference reflect the rational behavior of the decision maker, but also the truth that utility is a function of real values defined by the D set which has the properties:

(1) Utility is a rising monotone function in relation to preference, according to the relation:

$$d_f \succ d_g \Leftrightarrow u(d_f) \succ u(d_g)$$

(2) When d_h is a probabilistic mixture of alternatives between d_f and d_g , then it comes to the relation: $u(d_h) = \alpha u(d_f) + (1-\alpha)u(d_g)$; the utility of one alternative is equal to the average value of the utilities of the possible results of the alternatives.

When the function u holds properties (1) and (2), when there are two functions of utility u and u' , defined by the set D , then $u'(d_f) = pu(d_f) + q$, where $p > 0$, $(\forall)d_f \in D$, p and q are constant, which means that the utility function is unique to a positive linear transformation.

The function $u(d_f)$ is determined by considering the utilities of two alternatives $u(d_1)$ and $u(d_0)$ where $d_1 \succ d_0$. In case that $u(d_1) = 1$ and $u(d_0) = 0$, we are in one of the situations in which we know the quantitative decision-making consequences and using the linear interpolation method in the interval $[0,1]$, we come to this relation:



The optimal criterion is maximum if:

$$u_{f_g} = \frac{c_{f_g} - c_g^{\min}}{c_g^{\max} - c_g^{\min}}$$

,where u^g is utility and d^f in relation to criterion c_g , and c_g the consequence of the choice d_f by criterion c_g .

In utility estimation, it will be taken into account that the maximum utility is 1, corresponding to the maximum value of the criterion, and the minimum utility is 0, corresponding to the minimum value of the consequence.

The optimal criterion is minimum if:

In this case, the maximum utility with

$$u_{f_g} = \frac{c_g^{\max} - c_{f_g}}{c_g^{\max} - c_g^{\min}}$$

the value 1 corresponds to the minimum value consequence and the minimum utility with the value 0 the maximum value consequence the chosen criterion. Therefore, the reduction of subjectivism calls for the use of specialists to assess the utility of different alternatives to social restrictions influencing the decision-maker's behavior;

a₃) *Efficient decision-making* equivalent in this case is defined as the maximizing of the usefulness of an explicit decision depending on the concrete conditions.

Considering the three elements presented a₁) preference a₂) utility and a₃) efficiency, it can be stated that the *value*, in the decisional sense, is an infralogical form resulting from the estimation by the decision-makers of the preference for an alternative to the other, out of the family or the crowd that are possible. From this statement it follows that the operation with the notion of *value* constitutes, in the decisional practice, a step towards rationalization, the logic of the respective process.

B. *Criteria* (points of view of the decision maker, which isolate aspects of reality for analysis) and *the objectives* (level to be achieved according to strict criteria) considered within the organization, which can be quantitative or qualitative. Each criterion corresponds to several possible values,

called levels, representing as many goals. In relation to the levels, the criteria and the objectives are discrete and continuous, which gives them the property to be divided into sub-criteria and sub-objectives respectively, or, on the contrary, aggregates. For example, the division is done to determine each entity in the organization, and the aggregation or synthesis is done to make a global overview.

Also, the decisional criteria are dependent or independent, having different importance to the relative importance: one of axiological nature (judgment of the decision-maker's value, based on economic, social, political or psychological considerations) and another of an ecart type (the possibility that the levels of a certain criteria vary within close or more distant limits.) As far as it can be easily ascertained, the criteria and objectives are time-dependent, in most cases the time factor modifying their objectives and their relative importance.

C. *The cause-effect relational conditioning*, which is specific to systemic analysis and prospective thinking, whose essence lies in the fact that, in nature and in society, any event, process or phenomenon has a cause, and the same causes produce similar effects. In the conception of J. Stuart Mill⁶, the most important inductive methods, based on the causality principle, are the following:

c₁ – The method of concordance, according to which the phenomenon which always precedes the effect is the presumed cause thereof;

c₂ – The method of differences, according to which, if the disappearance of a previous phenomenon results in the disappearance of the phenomenon then surely the antecedent phenomenon (x) is the cause of the successor one (s);

c₃ – The method of concomitant variations, i.e. whether two phenomena x and y always show the same trend of variation, regardless of the association with other phenomena, it means that there are causal links between them;

c₄ – The method of the remnant, in the sense of the combination of deduction and induction, possibly synthesized as follows: it is assumed the known causal (x → y) and the concrete situation in

⁶ Apud, O. Nicolaescu, *Sistemul decizional al organizației*, Economic Publishing House, Bucharest, 1998.



which the series of phenomena (x_1, y_1) are in the antecedent of the couple (x_2, y_2) ; eliminating the effect y , whose cause is x , it is deduced that y_1 is the cause of the y_2 effect;

c_5 – The combined method, of concordance and difference, based on the reasoning: if any y_1 has together with other phenomena as y_1, x and y_2 , x does not appear together with y_1, y_2 , then it can be said that x is the cause of y . Consequently, the meaning of conditionality in the decision-making process is the following: if two sets of entities X and Y are analyzed, then the conditioning between them determines the correspondence between the components x_1, x_2, \dots, x_m and, respectively, y_1, y_2, \dots, y_n . In order to preserve its general character, no restrictions are imposed on the two sets and on the correspondence between the component elements x_1, x_2, \dots, x_m and respectively, y_1, y_2, \dots, y_n .

D. Concentration, an infra-red decisional form specific only to group decision-making, which is based on two essential characteristics:

d₁) The spirit of collaboration between the decision-making structures, without which concentration becomes impossible.

d₂) The diversity of opinions, in the absence of which the concentration would be devoid of logical support. Concerning the specific approach, the concentration is: formal (collaboration according to group decision-making methods) and informal (spontaneous, unorganized collaboration deriving from the professional training and the information and documentation).

CONCLUSIONS

Given that there are certain difficulties - especially psychological ones – in the way of adopting and enforcing decisions, it is imperative to strictly observe some fundamental principles, such as: *the principle of definition*, which ensures the logical character of the decision; *the principle of justification*, which enshrines the truth that decisions are being sued for well-founded reasons; *the principle of identity*, requiring careful

verification of the facts and circumstances of the moment; *the principle of accountability*, given that some of the employees try to delay the decision to get as much information as possible and others get precipitated and take the decision before the appropriate time, without the data and information necessary for the thorough and pertinent analysis, sufficient preparation of the prerequisites.

The specialized literature highlights some general principles of decisional logic, the fundamental ones being: the identity of the proposition that designates the decisional problem, in the conditions of unchanged state of nature and decisional criteria, of its duration over time; non-contradiction, which gives the decision-maker the opportunity to rule on the choice or rejection of an alternative; the sufficient reason that, in obtaining the truth of a reasoning, it is not enough to leave the indisputable, axiomatic premises.

The importance of the decision lies in the fact that it is found in all the functions or attributes of the managerial process. Thus, in the field of forecasting, this is reflected in variants of strategy, plans or programs.

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