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PSYCHO-PHYSICAL FACTORS OF THE DECISION MAKING PROCESS

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Abstract. Choice situations in everyday life usually are characterized by some degree of uncertainty or risk, which means, that it is not possible to properly assess not only the set of feasible strategies, but also, and perhaps above all, to determine the possible outcomes to achieve. Classical decision models, emphasizing high rationality, are being frequently criticized due to the fact that a single subject has no capabilities to assess the enormous amount of substantial data provided to him by senses and elaborated though reasoning (Goodwin, Wright, Tyszka 2011). A decision made in such circumstances involve at least a potential loss, and thus it may trigger in a decision maker an aversion to the risk (or the uncertainty). George A. Akerlof and Robert J. Schiller in their book (Akerlof, Schiller 2009) would like to see the above mentioned phenomenon, and consequences of such behaviour, as an effect of animal spirits, mistakenly understood as some mysterious forces manifested mainly in fallacious and premature decisions made each day on the global market. Of course, a detailed analysis might be, in some circumstances, beneficial at the micro-scale, however in many other macroscopic analyses some simplifications and generalizations are indispensable. On the other hand mechanisms responsible for the reduction in information material have a biological character and constitute the natural endowment of human beings, thus excluding them from the analysis that distorts the shape of decision models and, therefore, their adequacy in the context of real decisive problems.

JEL classification: D7, D70, D71.
Keywords: management, management functions, decision-making process, problem solving, rationality.
Raktažodžiai: vadyba, vadybos funkcijos, sprendimų priėmimo procesas, problemų sprendimas, racionalumas.

1. Introduction

In literature we may find many approaches to the definition of the notion of management. One of the attempts to organize these definitions and approaches is to perceive management in three aspects: functional, institutional and instrumental. From the standpoint of the issue entrained in this article, we will be interested in the functional aspect within which the functions (actions) performed by managers during the

management process are mentioned. The basis of management functions presented in the literature is H. Fayol's proposition, which distinguished the following actions (activities): forecasting, organizing, commanding, coordinating and monitoring.

Nowadays, an approach in which four functions are mentioned—planning, organizing, leading, monitoring—is commonly accepted. The function of the decision making process, which we find interesting, is not distinguished as a step in the management process, but is regarded (likewise coordinating) as some kind of meta-function, which is being implemented within each of the above-mentioned four functions (Drucker 2005). The analysis of the decision making process must therefore assume the issue of rationality, but at the same time recent studies in biology, as well as in experimental economics, should be taken into consideration (Goodwin, Wright, Tyszka 2011; Camerer 2005, 2006). The decision is in fact a result of psycho-physical characteristics of a subject and a wide context of a space in which a decision is made. Thus, to fully understand this mechanism as well as choice criteria, it is necessary to consider not only descriptive, but also neurophysiological factors. This approach enables the understanding of reasoning and decision-making processes at the micro scale, but also, thanks to proper models, provides the instrument for a smooth move towards macroscopic analysis.

Therefore, our primal aim in this article is to demonstrate how neurobiological components of the human brain structure affect the decision-making process under uncertainty, especially in situations when information is not available or when there is too much information to carry out efficient analysis. This work has been based on analysis of the extensive literature both in the management and psychology as well as in biology, but also on findings of experimental research in psychology, neurology and, basically, economics. These studies allowed us to test the assumption that specific neurobiological features influence accepted decision models and thus deny the irrationality of behaviour that tends to make a decision using the essential biological tools.

Thus, after examining some classical studies in management related to decision-making models, empirical researches allowing the making of a certain profound assumption, will be discussed. Namely the assumption that it is likely that questioned behaviour is not irrational, but rather that the rationality in desk researches was always presented in an inadequate way, what today might be demonstrated through meticulous studies on the evolutionary development of human brain structures and also usage of its different elements in making different kinds of decisions.

2. Substance of the decision making process

Organization management could be treated as a continuous decision making process. The effectiveness of managers' actions is being assessed on the basis of results brought by decisions they had made. Likewise the management, the decision making, is being defined in many different manners and the issue is a subject of many disciplines, among them being philosophy, mathematics, psychology, sociology and economics.

The word "decision" comes from Latin *decisio,* which means provision, settlement, and resolution. The decision is an act of selection from one of possible future behaviours

(Bartkowiak: 1999). It is a conscious act of a decision-maker's will, making a non-random choice from a set of possible solutions to a decision problem, where:

- an act of will is permission to start operation,
- a non-random choice is a conscious and rational choice—finding and selecting a given possibility from a broad range of feasible objectives and methods of operation, taking into consideration certain criteria,
- a decision alternative (possessing alternative choices)—a choice between at least two different possibilities.

Decision making might be also treated as a process of subsequent actions, where the conscious act of will is merely one of many steps. In the literature we identify a large discrepancy in the number of steps within this process, since in the substantive content they are very similar. One of the pioneers in the stream of decision making within management theory, H. Simon, distinguished three stages in the decision making process: recognition, design and choice (Martyniak 1996). Polish authors A. Czermiński and J. Trzcieniecki, both of whom deal with this issue, believe that the decision making process consists of: definition of the problem, gathering information, recognition of possibilities of gaining certain outcome, specifying decision criteria, and finally a choice (Zimniewicz 2008). As basis for further analysis we select the proposition of Adair who proposes the following five stages (Adair 2010):

- recognition, definition and structuring of a decision problem;
- gathering information;
- searching for alternatives and construction of a system of decision alternatives assessment;
- making a decision;
- implementation and monitoring of the effects of the decision made.

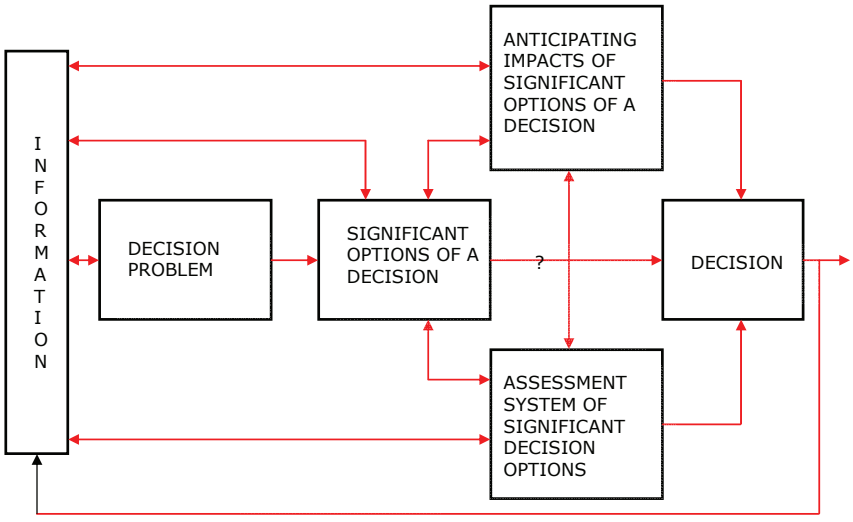

Fig. 1. The classic approach to decision making

Source: prepared by the authors on the basis of Zimniewicz, K., 2008, Współczesne koncepcje i metody zarządzania, PWE, Warszawa

Proposed steps of the decision making should constitute a logic sequence of actions and thus lead to the choice of an optimal solution in certain conditions. Mutual relations between particular stages are shown in Figure 1.

"That does not mean you should follow it blindly in all situations. It is a fairly natural sequence of thought, however, and so even without the formal framework you would tend to follow this mental path. It is useful to think of the five steps as five notes of music. Logically they should be played in strict sequence. But the mind darts about. The notes can be combined in different sequences and mental chords. Thinking is not a tidy process, but it should be done with a sense of order" (Adair 2010).

One of manifestations of the development in decision theory is the appearance of decision-making models that might be classified on the basis of different criteria. One such criteria is the nature of a situation in which a decision is being made. The following models might be distinguished here (Zimniewicz 2008):

Decision making under condition of certainty:
a) full information,
b) reliable situation,
c) deterministic model,
d) results of particular decision alternatives are known.

Decision making under condition of risk:
a) uncertain information,
b) risk situation,
c) probabilistic model,
d) probability of outcomes is known.

Decision making under condition of uncertainty:
a) incomplete information,
b) uncertain situation,
c) strategic model,
d) probability of outcomes is unknown.

In the first model, a decision is being made in terms of access to full information, whilst in the two other models access to information is restricted. From the standpoint of the problem analysed it the article, a proposition made by French authors who hide themselves under the pseudonym STRATEGOR (Strategor 2001), is interesting. They describe four decision-making models distinguished on the basis of a degree of their rationality.

1. Single actor model:
a) decision is an effect of reasoning of one rationally thinking actor;
b) an actor seeks for maximization of set objectives;
c) there is no conflict of objectives;
d) an action results from the objectives and preferences of a decision-maker;
e) objectives are defined clearly and precisely;
f) preferences are fixed in specified time intervals.

2. Organizational model:
a) each part of an organization is guided by its own rules and procedures;

b) objectives of action for particular of its parts are being defined by the management;
c) particular parts of an organization do not renounce their own objectives;
d) tasks translate into familiar patterns;
e) known procedures lead to choice of a first solution that satisfies expectations of the management.

3. Political model:
a) an organization is seen as a game, where its participants (individuals or groups) occupy certain positions within its structure;
b) participants control various resources (decision making powers, money, time, people, and information);
c) an organization has no clear *a priori* objectives;
d) objectives are constantly being discussed by participants depending on the knowledge they possess.

4. "Trash bin" model:
a) regards a decision as an accidental creature of special circumstances;
b) decision is not regarded as a manner of solving problems (applying solutions fashionable in a situation that do not constitute a problem);
c) organizations are rather generators of action, than devices for solving problems.

In the first model it is assumed that the rationality of actions of a decision-maker (regardless of whether it is a single person or a group of people) is something natural and obvious. It is a situation when we have full access to information while solving quantitative problems. For example, statisticians or economists are unlikely to consider what phenomena occur in the behaviour of a decision-maker, in his personality, cognitive processes, they are not interested in the features of an entity as a decision-maker. In other models it is assumed that a subject who takes a decision has a limited rationality, which exposes various determinants causing that actual behaviour of participants of decision making processes significantly differ from assumptions of the mono-rational model and thus traditional theories that are its consequences.

3. Some misunderstandings

Choice situations in everyday life usually, if not always, are characterized by some degree of uncertainty or risk, which means that it is not possible to properly assess not only the set of feasible strategies, but also, and perhaps above all, to determine the possible outcomes to achieve. A decision taken in such circumstances involves at least a potential loss, and thus it may trigger in a decision maker an aversion to the risk (or the uncertainty). George A. Akerlof and Robert J. Schiller in their book (Akerlof, Schiller 2009) would like to see the above mentioned phenomenon, and consequences of such behavior, as an effect of animal spirits, mistakenly understood as some myste-

rious forces manifested mainly in fallacious and premature decisions made each day on the global market. It means, in their opinion, that both enthusiasm and crisis are caused by alterations in the trust level of subjects acting on markets, which is in turn associated with narrative stories spread in a particular moment of time. But I cannot resist the impression, that a decrease or an increase of the level of trust is a strict consequence of complex processes, which take their place in the world of economy, as well as in the space, where every day, even minor, decisions are being made. Of course, there is indeed a kind of narration that to some extend influences the direction of chosen strategies, but it seems clear to me that all these stories have primarily the function of providing information, which constitute a basis for the decision, but are not factors that directly change the trust level. At the same time, such a broad approach to the cultural and social context usually is not included in most decision models of "standard" subjects.

Among the spirits that are suspected of causing crisis, Akerlof and Schiller have mentioned not only trust and its changes, but also veiling to temptations, envy, resentment and delusions. But at least the latter does not seem to be a defect of the reasoning process, but rather an immanent feature of the world, where decision models are being created. Similarly, problems with estimating the probability of particular options not only demonstrate the weakness of the human brain/mind, but first of all it indicates the complexity of the world, that is the space of decisions. Delusions are nothing more than a belief, that the most favourable variant will be realized, while, having restricted information, the decision maker has no basis for such beliefs. But there still remains a question, whether he/she could acquire this kind of complete knowledge, taking into account time and cognitive limitations? This is dubious. Thus, regardless the economic conditions, decisions usually are being made under the influence of some kinds of delusions. And since the trust and confidence (also self-confidence) are of fundamental significance to the whole theory, discrediting these factors should lead to the collapse of the intricate, but based of meagre grounds, construction.

Undoubtedly, the "spirit" that could influence the process of decision making might be not trust, but rather fear. If an element, called in psychology and neurophysiology the *somatic marker,* was included in the model of the decision making process, it would probably be possible to see that on some higher level there is a mechanism of the "fight or flight response", that functioning properly enables people to make the decision on confrontation or withdrawal. In some sense this alarm signal causes some negative associations, and thus the fear of a potential loss that allows, under normal circumstances, to reduce feasible strategies to the set of these that will be the most beneficial. Of course it would be truism to say that profits must not be necessarily expressed in hard cash. A brain of a particular subject may respond better to incentives related to prestige and social recognition, but it does not mean that such a person acts in an irrational manner.

It thus becomes clear, that the theory that trust goes beyond rationality seems to be ungrounded. Of course, decisions are often made in an "instinctive" manner, to some

degree automatic (which has found its confirmation in experimental studies conducted with healthy individuals, as well as with patients having some neurological afflictions). A fact, that we are not able to reproduce the unconscious deliberation, should not lead us to the conclusion that the reasoning, and thus the decision that has been taken, has an irrational characteristic. Though it is obvious that such a "decision automaton" might make some mistakes, especially because the inductive reasoning is generally fallible, still it is necessary to reduce the redundant aspects, because otherwise one would be unable to liberate oneself from the decision paralysis. In some sense, the somatic marker allows us to reduce the reasoning and to treat some aspects of the reality as constants. It would mean that the trust and the confidence are not themselves an attribute of behaviour, but a way of its secondary categorization, an effort of capturing the operation of the somatic maker, and other biological mechanisms, that operate beyond and faster than the standard rational processes. Otherwise a detailed analysis of various and complex issues would be impossible.

This still does not give us an understanding of the mechanism of spreading the stories that is of the fact how independent subjects might find themselves in the trap of collective panic. Of course, a disclosure of numerous and obvious frauds does not support overcoming the crisis, but it is rather connected with subjective risk (uncertainty) assessment and possibly also with temporarily increased risk aversion. It would thus be proper to remember the most common biases of the reasoning process, such as the availability heuristic or the anchoring. Surely, Akerlof and Schiller noticed that stories should not be trusted too much. But, on the other hand, critical to other narrations, they have developed their own coherent story, which they not only strive to sustain, but also give a semblance of probability, despite the methodological and logical errors contained in it. Stories circulated in society are not a factor that is shaping the level of trust, but rather a mechanism that leads, through multiple repetitions, to common errors in reasoning and fixation of a belief that the majority of its choices cannot be wrong, that perhaps individuals go astray, but the trend is basically correct. Since, our own experience does not include data on the strategy in a given situation we have the evolutionary capability of learning from rich and diverse experiences of others, however, usually such a test is based on a specific sample and in no way should be regarded as representative.

I believe that all this has little to do with justice in the sense given to that term in contemporary legislation. The mechanism is rather similar to the more primeval "revenge" approach to the issue of penalties, closer to ancient codes. The problem of prices increasing after blizzards is rather related to the common belief that the same object cannot be worth two prices, which is a simple misunderstanding of the mechanism of supply and demand. Of course, if we directly ask the question whether people consider the increase of prices to be unfair, the answer would be predictable. But such a question from a methodological point of view, as implying an assessment, seems to be doubtful.

4. The neurological approach

First of all, we should follow the theses of Antonio Damasio (Damasio 2003, 2011): our rationality is not impaired by interaction with emotions. According to the hypothesis posed by Damasio, feelings are not an insignificant phenomenon in the decision making process, but enable a direct perception of the incentives that are perceived by the body and thus help one to connect them with proper areas in the memory. The effective decision process requires, for the rapid identification of the characteristics of a situation in which the entity is located, the knowledge of specific rules and social conventions. Some of these mechanisms work, so to say, on the surface, others are hidden and act beyond the possibility of capturing them in the process of inference (see also: Nęcka, Orzechowski, Szymura 2008). Damage of certain brain areas results in impairment of brain functions, which are responsible for efficient and effective choices from among an infinite multitude of possibilities, some of which are not even available, while others may be harmful from a biological or social perspective. Thus, decisions should primarily be based on the reduction of opportunities that will not bring the expected benefits to such an entity. Examples discussed by Damasio (Phineas P. Gage, Elliot) clearly show that errors in reasoning are caused not only by the lack of knowledge or incorrect assessment of the situation, but also by standard knowledge, where a multitude of possibilities cannot be eradicated in any way, which must necessarily lead to a paralysis. Thus, when a subject is unable to understand his/her own time and cognitive limitations, the excess in rationality is a fatal factor. And since it is obvious that there are some areas in the brain responsible for so-called rational reasoning, the same areas have a lot to do with emotions and feelings that support the decision making process. Therefore, obviously, the course of the reasoning process, as well as the ultimate decision, is influenced not only by biological or, more precisely, neurochemical, but also by social factors. Only such an approach represents a comprehensive picture of the subject and of the environmental context conditioning him/her. This is the mechanism of rationality which we are endowed with and without these biological factors the achieved model would be useless.

Of course it is possible, as Akerlof and Schiller note, that people generally try to avoid such inelegant factors, which derive from their origins in psychology, philosophy, sociology or anthropology, but the appeal of the classic studies of Camerer (2003, 2006) or Damasio (2003, 2011) on the mechanisms of making choices cannot be considered as inelegant. The development of the experimental economy, using the most advanced neurological and psychological techniques, has become a fact which a gentleman cannot dispute. It may therefore seem that the typical examples of panic in the markets are an example of the well-recognized mechanism of escape or defence. In a situation where defence in the face of some dangerous factor seems impossible, the body takes a natural decision to withdraw, while saving as much as there still can be saved. The crisis should be therefore considered as any other type of environmental threat to an individual's survival and welfare. Mechanisms that evolved then take a concrete shape in individual development and are being filled with content within the specific environ-

mental context in which the individual lives. Somatic markers, together with the availability of certain types of information, such as turbulences on the stock market induce individuals to "escape," and a repetition of this procedure a number of times gives a picture of typical market panic. Emotions are not completely useless and do not always lead to wrong decisions. On the contrary, their action usually produces the desired effects in the form of recognition of a certain scheme, which can then be processed in a memory and used in the future. Although, obviously, in some situations it would be far wiser to master emotions and a full application of the reasoning process in which the entity would be able to understand that he/she had made a wrong categorization and had applied incorrect analogies, or that he/she had not fully recognized the context in which they needed to make a decision (Surma 2010). Proper identification and, above all, awareness of these mechanisms, allows for the adequate response and for ceasing these automated choices, which in itself may not only be beneficial but also could provide valuable data for the system generating somatic markers, allowing it to be "tuned" to the decision space.

Learning and exploiting the experiences, due to a possible reduction of unfeasible strategies or features that do not match the wider environmental context, can shorten and simplify the decision-making process. Thus this enables finding the perfect balance between the enormity of information collected during numerous experiences and the processing of incoming stimuli from the environment, and reducing the space of choices due to select the most probable or the most favourable scenario and, at the same time, taking into consideration the factors posing a threat. Learning enables pondering, as far as it is necessary in the particular decision-making problem, but the use of additional data at the same time allows to rely on previously considered patterns of mechanical and often even non-verbal activities, though certainly it remains possible to verbalize them in any conceptual categories, such as *trust* and *justice*. Of course, if we only make an effort of a retrospective analysis of our behaviour. Usually, however, the brain can in a flash make a decision on even a complex issue, while the rational "surface" consideration of it would take far too much time. Often drawing on a simplified mechanism gives even better results than trying to consider too much information in a too short a time. This may lead to a condition called, in the case of laboratory tests, an experimental neurosis, but in this case it happens during the real decision-making process that determines the fate of an individual.

Errors in reasoning, ignorance of the theory of probability and statistics are of course still important causes of failures in the formal processes of inference, but a number of behaviours cannot be explained solely on the basis of these factors. Therefore, the somatic marker hypothesis helps the researchers in these complex issues, but it still remains necessary to take into consideration that its performance may be affected by personal and thus unreliable experiences that are largely being shaped by a system of individual and on some subsequent stage social preferences. The formation of biological structures, responsible for the theory of self and for the theory of the others, is a continuous and internally-linked process that simultaneously leads to the production of a system of expectations on the behaviour of other decision-making subjects who are

active in our space of choices. But, according to Damasio, emotions and feelings ought not to remain in the model without an attempt of a thorough understanding of mechanisms through which they affect the process of reasoning and ultimately made choices. The use of labels cannot be a good solution anywhere, where the scientific explanation and prediction of future behaviour are an issue, and thus where it is necessary to take into account the complex non-biological context in which the ontogenetic phenotype of an individual is being shaped.

5. Conclusions

Preferences of an individual are strongly influenced by the tendency for maximization of the utility and, on the other hand for minimizing the risk which is related to each particular choice. Some situations, recognized as irrational and panic, might therefore be considered as an attempt to reduce the uncertainty and risk associated with leaving a problem unresolved. According to the findings of researches (Ostaszewski, Błaszek, Oniszk, 2008; Nęcka, Orzechowski, Szymura 2008) combining psychology and economics, treating preferences as phenomena isolated from the broad ontogenetic and social context associated with a choice situation, as well as with a mental construct of a particular subject, is fallacious. In situations, where there are more than one good choice, the subject must retain a balance between all of his/her decisions. Analogically, risk and uncertainty are multiplied, which compels the subject to consider feasible options carefully or to reduce the reasoning as in standard situations when the somatic marker acts. If we were to analyse panic on the stock market, we would see that aside from a normal optimization rule, there is also present a discounting mechanism, which, from the psychological perspective, consists of a value reduction of an expected good in relation to potential time distance separating one from a reward. A subjective value of expected benefits may therefore, in accordance with this concept, vary due to many factors, especially the need to share it with others, risk, etc. Moreover, researches indicate that this process is not occasional, but remains a constant feature of the decision-making processes, which could be observed under experimental conditions and then well-described in statistical terms and presented as a discount curve that shows how fast a reward loses its value depending on the waiting time and risks associated with its actual occurrence.

Therefore, in light of all that was said above, there must be a hypothesis that the biological mechanisms that are the natural endowment of any decision-making human, and possibly also some other species, such as somatic markers or the discounting process, constitute natural warning signals and defensive reactions facilitating an increase of a total utility, and thus, survival. This fact cannot be denied, even if these mechanisms operate sometimes in an unreliable way and can lead to hasty, less favourable decisions. Usually, however, their role for the proper functioning of the individual in the biological and social environment, including the specific economic environment, is immense.

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PSICHOFIZINIAI VEIKSNIAI PRIIMANT SPRENDIMUS

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Santrauka. Pasirinkimo situacijos kasdieniniame gyvenime pasižymi tam tikru nepaibrėžtumu arba rizika, kas reiškia, kad neįmanoma tinkamai įvertinti ne tik galimas stratgeijas, bet ir galimas jų įgyvendinimo pasekmes. Klasikiniai sprendimų priėmimo modeliai, pabrėžiantys racionalumą, dažnai yra kritikuojami dėl to, kad eilinis rinkos dalyvis neturi gebėjimų įvertinti didelio kiekio informacijos, kurį jam teikia jutimo organai bei smegenys. Priimant sprendimus tokioje situacijoje susiduriama su nepalankaus sprendimo priėmimo rizika. George A. Akerlof ir Robert J. Schiller savo knygoje aprašo šį fenomeną ir jo paskemes. Detali infomracijos analizė mikorlygmeniu galėtų būti naudinga, tačiau makrolygmeniu tam tikri supaprastinimai ir apibendrinimai priimant sprendimus yra būtini. Už informacijos sumažinimą atsakingi mechanizmai turi biologinį charakterį ir sudaro natūralius žmogiškųjų būtybių išteklius ir taip juos apsaugo nuo per didelio informacijos kiekio analizės bei iškraipo sprendimo priėmimo modelį bei neleidžia priimti visiškai racionalių sprendimų. Straipsnyje ananlizuojami psichofiziniai sprendimų priėmimo veiksniai.

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