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MODELS OF DECISION MAKING - ADVANTAGES AND DRAWBACKS IN CRISIS MANAGEMENT

Marko Jajčinović, Marko Toth

University of Applied Sciences Velika Gorica, Velika Gorica, Croatia

Abstract

It has been shown that professional stress is underexamined when it comes to personnel management in crisis situations. High degree of responsibility associated with this profession implies high stress potential that largely depends on quality of leadership and decisions taken. Decision element is of crucial importance for successful crisis managing. In order to understand and improve decision-making in crisis situations, a necessity for rationalization of decision theory emerges. Researches focusing on the matter of decision-making have been conducted by scientists of many profiles, having establishment of basic approaches of modern decision theory for this result: Normative approach is based on probability functions whereas the prescriptive approach provides guidelines for decision-making in practice. Finally, there is a descriptive approach that harnesses heuristics to describe ways in which people actually decide. In real-life situations decision-making is laid by contextual and psychological boundaries inherent to all people. In that respect, observed patterns of different behaviours in people when it comes to decision-making under ambiguity, different from those in deciding under stress, play a major role. There are significant differences in practical values of particular models of decision making. Therefore, this paper investigates various models of decision making and their applicability in crisis situations for the purpose of prevention and reduction of stress levels in responsible persons. To conclude, the approach of bounded rationality based on heuristic strategies imposes itself as the most appropriate, although fallible, but often the only possible choice. By adopting skills of situational awareness and critical thinking, supported by adequate stress trainings, simulations and preventive measures such as risk analysis, operation strategies and calculations of probability based on postulates of normative domain of decision making-theory, it is possible to mitigate negative influence of stress and enhance decision making in crisis management.

Keywords: theory of decision-making, crisis management, prevention, stress, models of decision-making

Address for correspondence: Marko Toth, University of Applied Sciences Velika Gorica, Velika Gorica, Croatia, e-mail: marko.toth@vvg.hr

1. INTRODUCTION

The act of decision making is a crucial factor when it comes to managing crisis. Through the insights of the interdisciplinary area of theory of decision-making it is possible to acquire a better understanding about the process of decision-making itself, the ways in which people should decide, and the ways in which people usually decide. Maintaining acceptable stress levels of crisis managers is of key importance, especially in unpredictable and ever-changing conditions of a crisis, when environment requirements are the greatest. Decision theory enables us to understand basic principles of human behavior in making choices and judgments. Although a stand-alone academic subject, it is of great interest for economists, statisticians, psychologists, politicians, sociologists and philosophers. In the subsequent text, in addition to a brief description of each theory, these theories are going to be observed through the interest perspective of crisis management, with an emphasis primarily on theoretical rather than technical overview. A major part of rich content created by yearlong research of issues concerning decision-making is concentrated on deciding under risk and ambiguity. Inspection of people's mistakes in such choices can be particularly important in the context of

crisis decision-making as characterized by severe lack of time and information. This paper examines practical values of particular decision models, possibilities of an organization's structural adaptation in order to improve efficiency of crisis decision-making, and the ways in which lessons learned can be integrated for improving quality of performance and reduction of negative stress effects in crisis management.

2. SCIENTIFIC APPROACHES TO DECISION-MAKING

Throughout the history, researchers have created various perspectives on decision-making, methods of examining decision-making and theoretic models in attempts to explain it (Edwards, Miles, & Winterfeldt, 2007). Therefore, we can differentiate between three basic perspectives in the theory of decision-making (Hansson, 1994):

1. *Normative*, with an emphasis on rational choice, has generated models built on assumption that should provide logical guidelines for decision-making.
2. *Descriptive*, which describes the ways in which real people deal with making choices.
3. *Prescriptive*, intended to help people in decision-making by using normative models, with respect to limits of human judgment and practical issues concerning implementation of rational models in a real world, accompanied by simplifying a complex decision environment to a reasonable level susceptible to analysis (Surowik, 2002).

3. NORMATIVE MODELS OF DECISION-MAKING

A decision presupposes the choice between different alternatives or options. They are usually courses of action available to a decision-maker in the time of decision-making, or at least what the decision-maker believes to be so. A set of alternatives can be well- or ill-defined. In some problems of decision-making it is open, while in other it is closed (e.g. deciding about how to spend an evening versus deciding which party to vote for). In decisions where the set is open, the goal is to close the set by choosing one of the alternatives. In actual life, open alternative sets are especially common. In decision theory they are not, and it is regularly assumed for sets of alternatives to be closed. The reason for this is that closure makes decision problems much more accessible to theoretical treatment. If the alternative set is open, a definitive solution to a decision problem is not available.

In the theory of decision making two features of a process play an important role; outcomes and the states of nature. The possible *outcomes* of a decision are defined as the combined effect of a chosen alternative and the state of nature that it obtains. Out of different states they have been given following denominations (Hansson, 1994):

1. *Certainty* if each action is known to lead invariably to a specific outcome.
2. *Risk* if each action leads to one of a set of possible specific outcomes, each outcome occurring with a known probability, with probabilities assumed to be known to the decision maker.
3. *Uncertainty* if either action has as its consequence a set of possible specific outcomes, but the probabilities of these outcomes are completely unknown.

Each of the mentioned states calls for a different type of knowledge; deterministic knowledge for certainty, complete probabilistic knowledge for risk and partial probabilistic knowledge for uncertainty (Hansson, 1994).

3.1. Expected utility and subjective expected utility

The dominant approach to deciding under risk (known probabilities) is expected utility theory (EUT). It is, undoubtedly, the main paradigm in normative and descriptive interpretations of theory of decision-making.

Utility is the numerically represented value of an outcome of a decision. The basic rule is simple: the

alternative with the highest ascribed value should be chosen. In cases where there are more than two alternatives with maximum value the supplemented rule is to pick either of the alternatives with the highest value. This is the rule of *maximization*. Most of the economic theory is based on the idea of utilitarianism – that one should maximize their assets, expressed in monetary values. Critiques of utilitarianism argue that it is too much of a requirement for actual decision makers (Hansson, 1994). The very idea of utility is dubious in psychological sense, therefore, economists favor the term "preference". One may not have the ability to assign numerical values to utilities, but can express preference of some specific courses of action (Surowik, 2007).

In some of its early versions, EUT did not refer to utilities in a contemporary sense but to monetary outcomes. It was recommended to play a game if it increases expected assets, otherwise it is not. Probabilities related to this were objective frequencies, as the ones observed in rolling a dice. However, attributed utility of assets is not described by a linear trend as gambling continues, instead, it grows by a falling rate. Therefore, first $1000 won is perceived as less valuable than $1000 won when a person is already a millionaire. This leads to the theory of subjected expected utility (SEUT).

From the mathematical point of view, the sum of probabilities of an event A and its opposite should be 1. Still, that is not the case in the concept of SEUT. An important argument against SEUT as the descriptive model of choice concerns differences between known and unknown probabilities. This distinction comes under various labels: risk in opposition to uncertainty; clearly defined versus ambiguous probabilities; precise versus indeterminate probabilities etc. Empirical evidence shows that the amount of knowledge about probability of actualization of an outcome can indeed affect the choice of a course of action (Camerer & Weber, 1991).

In the application of the decision theory to economic problems, subjective utilities are commonly used. In risk analysis, on the other hand, objective utility is the dominating approach. The common way to measure risk is to multiply the probability of a risk with its severity, to call that the expectation value and to use this expectation value to compare risks (Hansson, 1994).

3.2. The Paradox of Uncertainty

In making choices between options of the same probabilities people show a tendency toward aversion of uncertainty. People prefer acts with a known probability of winning. That is, they take confidence in estimates of subjective probability into account when making choices. Ellsberg concludes that the degree of uncertainty, or, in contrast, reliability of estimation of probability, has to be considered in decision analysis. This notion is accepted not just from theoreticians but from analysts of decision making as well (Camerer & Weber, 1991).

In the context of risk analysis, it is the task of the risk assessor to use any available information to obtain a number between 0 and 1 for a risk-estimate, with as much precision as possible, together with an estimation of imprecision (Hansson, 1994).

3.3. Bayesianism

In expected utility, probabilities are taken for frequencies or potential frequencies of events in big, potentially endless numbers of repetitions in a physical world (Surowik, 2007). Alternatively, probabilities can be taken as a mere mental phenomenon. Subjective probability is defined as a degree of belief which is different for different persons. The theory of subjective expected utility with properties of subjectively defining probabilities and utilities is called *bayesian theory of decision-making* or *bayesianism* (Hansson, 1994). The range of its use is broad, from clinical trials to the implications in the development of artificial intelligence.

Bayes' theorem is a method used to calculate the validity of beliefs (hypothesis, claims and proposals) based on the best available evidence (observations, data and information). The theorem states as

follows: The probability that some belief is correct according to new evidence = the probability that the belief is correct regardless of evidences × the probability that evidence is correct along with an assumption that the belief is correct ÷ the probability that the evidence is correct no matter the accuracy of belief. Or, to simplify: initial belief + new evidence = new and enhanced belief (Horgan, 2017).

Importance of Bayesianism is reflected in the fact that it is a very general philosophy of theoretical and practical problems of statistical reasoning. When the practical function of Bayesian methods of decision making is experimentally examined, the results are contradictory. Savage, the founder of Bayesian theory, points out that it is not so because something is wrong with Bayesian theory, rather it is the proof that for the majority of people, an improvement in decision-making competency is required (Albert, 2003).

4. DECISION-MAKING UNDER RISK: PROSPECT THEORY

Prospect theory is relevant for the issue of decision-making in general. Developed by the renowned psychologists, Daniel Kahneman and Amos Tversky, it explains the results of tests consisting of choices presented as monetary outcomes and objective probabilities. What differentiates it from other theories is the fact that it is primarily descriptive as it portrays the means in which people act when confronted with choices identified as gain/risk of loss.

Utility is approached by comparing two states of wealth. For instance, utility of getting an extra $500 when one's wealth is already $1 million is the difference between the utility of $1,000,500 and the utility of $1 million (Kahneman, 2011). This important subjective distinction between the effect that gains and losses might have on the individual was long neglected in research, and it was believed that there was no point in examining it.

Furthermore, the prospect theory explains an important phenomenon that influences the choice: the manner in which the problem is framed converts the risk aversion in risk seeking behavior and vice versa.

The prospect theory is more appropriate than some of the other theories (e.g. EUT) because it provides a reference point. It is the earlier state relative to which gains and losses are evaluated. There are three cognitive features at the center of interests of prospect theory that play an essential role in the evaluation of monetary outcomes and are immanent to many automatic processes of *perception, judgment,* and *emotion* (Kahneman, 2011).:

1. Evaluation, relative to a neutral reference point: For monetary outcomes, the usual reference point is the *status quo*; Outcomes that are better than the reference points are gains and those below the reference point are losses.
2. The principle of diminishing sensitivity: applies to both sensory dimensions and the evaluation of changes of wealth. Turning on a weak light has a strong effect in a dark room, but not so in a brightly illuminated room.
3. Loss aversion: When directly compared, losses loom larger than gains. This asymmetry between the power of positive and negative expectations or experiences has an evolutionary history. Organisms that treat threats as more urgent than opportunities have a better chance to survive and reproduce.

Decision-making under uncertainty is an important factor in a crisis decision making. Most of the empirical research examines decision making under risk, not under uncertainty. The critique of such research is that gambling games from the handbook does not reflect the alternatives in the problems of everyday, real world decision-making (Tversky & Wakker, 1995).

5. GAME THEORY

Game theory can be defined as a doctrine about mathematical models of conflict and cooperation between intelligent, rational decision makers. It proposes a formal description of conscious, go-

al-oriented decision-making processes. The real evidence of the impact of game theory is well recognized in economic sciences where theorists tend to understand conflict and cooperation by studying the quantitative models and hypothetical examples (Myerson, 1991). Game-theoretic models have six common features: conflicting parties, choices, information, desired outcomes, results of choices and outcomes dependent on choices of all participants. In the colloquialism of game theory, a game refers to each social situation that includes two or more players.

An important notion of game theory is the notion of the equilibrium. Standard analysis of the equilibrium, or balance respectively, presupposes that all players (Koehler & Harvey, 2004):

1) form their beliefs based on the analysis of others' potential actions (strategic thinking),
2) choose the best action generated by those beliefs (optimization) and
3) adjust their best actions and beliefs until they are in harmony with one another, that is, balance.

In the game theory there is an assumption that for any rational decision-maker there must exist some way of assigning utility numbers to the various possible outcomes that the decision-maker cares about, so they always choose the option that maximizes their expected utility. That is the subject of the *Expected-utility maximization theorem*, which can be paraphrased as follows: if a decision maker would prefer option 1 over option 2 when event A occurs, and he would prefer option 1 over option 2 when event A does not occur, then he should prefer option 1 even before he learns whether event A will occur or not (Myerson, 1991).

Even if one is never involved in a situation in which people's positions are as clearly defined as those studied by game theorists, one can still come to understand real competitive situations better by studying these hypothetical examples.

Most of game theory is not meant to be purely normative as an equilibrium strategy is only ideal if other players believe that players will act in certain ways, that would require the theory to be descriptive. Game theory is also not purely descriptive, it is more analytical: analysis of the formal implications of various levels of mutual rationality in strategic situations. A good part of business strategy decisions involve interdependent outcomes and therefore seem to lend themselves to game theory. Game-theoretic modeling is appropriate, for example, when studying strategic actions between agents with differing goals, a situation typical of many strategic management issues.

It is rather questionable if game theory can be used as a technique that provides precise solutions to strategic management problems because it does not provide a definitive solution. For many real-world problems, a game theoretic analysis may prove intractable. Capturing the reality of the situation may entail a model with hundreds of strategies for each player but computing the equilibrium of such games is not an easy task (Madara, 2010).

6. JUDGEMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES

In models of unbounded rationality there is an assumption that all relevant information is available to the decision maker. In a framing like this, the question arises: If people had valid information for eternity on disposal, how would they behave? Descriptive models of bounded rationality place emphasis on constraints of human mind and tend to answer questions regarding behavior of people under lack of information and time. It is Herbert Simon who is considered to be the founder of the term „bounded rationality", where the „bounded" refers to restraints in environment such as unavailability of information as well as to the constraints of mind (e.g. retrievability of information).

Heuristic is a method of education or a computational program in search for a solution or an answer to a posed question. It is defined as reasoning, not definite and strict, but tentative and barely acceptable, whose purpose is finding a solution to a certain

problem (Simon, 1990). Heuristics as mental operations are employed in judgment under uncertainty (Koehler & Harvey, 2004).

The intuitive assessment of probability resembles the assessment of perceptual quantities such as distance or size. These judgments are all based on data of limited validity, which is processed according to heuristic rules. The reliance on these rules leads to systematic estimation errors. Errors like these usually happen because: 1) People are not generally aware of the rules that govern their impressions and 2) People cannot deliberately control their perceptual impressions (Kahneman & Tversky, 1973).

Gigerenzer tries to remove the stigma of irrationality and absolute fallibility from intuitive cognition and intuitive decision-making which are the center of heuristic approach. Intuitions or "gut feelings" are judgments that are fast occurring in one's consciousness (Pavić, 2009). He claims that intuitions are the result of an evolutionary process that has enabled the human mind to cope with challenges of the outside world. Better understanding of heuristic principles and biases caused by intuitive reasoning can improve judgments and decision-making in situations marked with ambiguity.

7. PRESCRIPTION FOR CRISIS MANAGERS

In more than three decades of decision research, rational theories from economics, statistics, and logic have been used to argue that descriptive behavior falls systematically short of normative ideals. This gap between the normative and the descriptive has provoked many debates: Is there in fact a gap? And, if there is, can it be closed and biases removed? The identification and dissemination of better strategies belongs to a prescriptive domain of decision-making (Koehler & Harvey, 2004).

7.1. Expertize in decision making

Scholars of decision-making in psychology have focused extensively on a lack of rationality, not on the fact that people are able to improve their efficiency in problem solving and in raising their level of incentive with increased practice. There are two ways in which decision-making and expertise can be shown to be related. In the first approach, researchers studied how experts make decisions. In the second approach, researchers investigated whether people can be experts in making decisions, or, in other words, whether decision-making expertise or competence even exists.

Klein and other developed the naturalistic decision-making approach, which consists of studying real-world decision-making behavior (Campitelli & Gobet, 2010). In particular, they studied the decisions made by experts under time pressure. A striking result is that experts can understand problem situations and make decision rapidly in a matter of seconds. With routine problems, these decisions tend to be the correct ones, or at least reasonable ones. It is generally accepted that this rapid decision making is made possible by the perceptual knowledge that experts have acquired over years of practice and training. Klein goes even further, claiming: "in certain domains and situations, experts consider only one course of action that they carry out, thus not even choosing among two or more possible options" (Campitelli & Gobet, 2010:12).

It is worth mentioning that expert's cognitive system does not differ notably from that of novices; parameters such as short-term memory capacity and learning rate are invariant across skill levels. The only difference is the knowledge experts acquire by experience and training through years of effortful dedication to their domain of expertise (Bruine de Bruin, Parker, & Fischhoff, 2007). Effort and experience do not change the architecture of cognitive system, they make it more efficient. Expert knowledge saves them time by avoiding exploring useless alternatives. Experts are more selective in their decision making-process. However, they are not perfectly rational subjects.

7.2. The constitution of decision making in crisis situations

In the literature on crisis management, the centralization of decision-making is often portrayed as a

primary organizational structure of crisis response. It implies concentration of power in the hands of a smaller number of executives (Kešetović, Korajlić & Toth, 2013). The setting of centralization should be examined further, as well as the structures and the systems of crisis response. It is the time pressure and the lack of information which makes crisis manager's decision-making a particularly stressful activity. When the degree of perceived time pressure is high, structures that enable rapid responses are adopted.

This entails an *ad hoc* improvisation. On the other hand, when the degree of perceived time pressure is low, more formal, preplanned contingent response modes emerge (Boin, 2008).

Time pressure is perceived differently at strategic and operational levels which constrains crisis management responses in multiple ways. At the operational level, time pressure is generally unambiguously visible, requiring a basically instant response. At the strategic level, perceptions of time are mitigated by the concern for a long-term ramification of events. From there, different crisis-induced types of response emerge (Boin, 2008): formal and informal decentralization, non-decision-making, situational dominance, paralysis and strategic avoidance of responsibility.

Apart from the question of centralization, the second mediating variable that affects the quality of decision-making and the flow of crisis is the responding system's precrisis organizational structure, divided into mechanistic and pragmatic response structures.

Mechanistic structures tend to involve a routine-oriented bureaucratic hierarchy and formal chains of command and communication. Pragmatic structures are commonly associated with some form of matrix or project organization. Organizations whose pre-crisis structures possess the characteristics of the pragmatic type will experience less difficulty in adapting to crisis events. In particular, improvised and decentralized responses to crisis-induced time pressures will be regarded as less problematic, and will, therefore, come about more quickly and effectively than in centralized organizations.

If there appears to be an overall need for quick action (minutes or hours), interagency differences will temporarily be put aside. If this is not the case, or when the initial sense of urgency abates, bureaucratic politics will increase. Also, the fact that the dominant structural pattern of crisis response may shift as the crisis evolves through time should be taken into account. This is particularly the case in "slow" or protracted crises, where the initial tendency to misperceive or underestimate the threat can lead to postponement of decision act.

Clear advantages and disadvantages appear from a functionalist perspective, for instance, strategic centralization is aimed at increasing top-level control over crisis operations but has a high risk of presenting policy makers with an input overload. This may impel toward dysfunctional coping behaviors such as *hypervigilance* (Boin, 2008).

Thinking in terms of alternative models of structuring a crisis response may enhance a more equitable assessment of the functions and dysfunctions of rigidly centralized decision-making. For each structural pattern, differentiation may be identified for successful and unsuccessful cases of crisis management. Consequently, hypotheses identifying the structural and processual determinants of success and failure in each of these cases may be developed and tested. The results of such an analysis may then provide an important contribution to a much-needed prescriptive theory of crisis management.

8. INFLUENCE ON PROCESSES OF DECISION-MAKING AND STRESS REDUCTION IN CRISIS MANAGEMENT

Stress induced by time pressure and lack of information deteriorates the capacity of quality judgment and valid decision-making significantly. In the context of an organization, as contraction of authority increases, the stress upon existing executives is heightened too. Hence, the increase in the stress on authority units can lead to the transfer of

some of the stress to the other parts of the organization. By definition, crises are events unexpected from the organization. In an unfamiliar situation some degree of trial and error is present in seeking a suitable response. When, for lack of feedback, an authority unit fails to discover that an error has been made, the organization's viability comes in question (Boin, 2008).

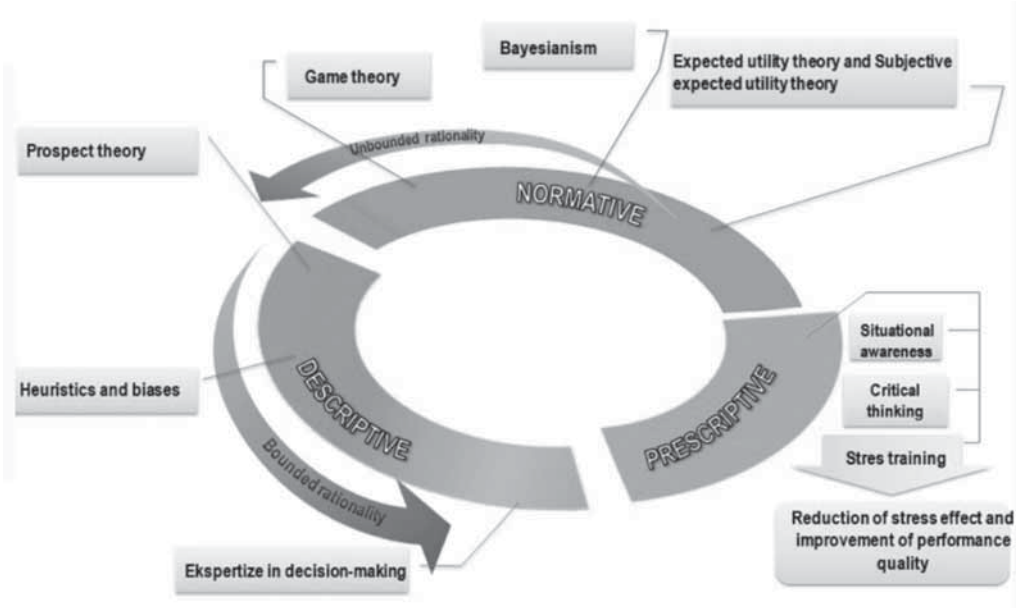
In order to improve decision-making processes in dynamic environments such as crises, it is necessary to determine required skills and measures so that stress levels can be reduced. When it comes to required skills that stand out, it is the skills of situational awareness and critical thinking – skills that are not innate, but rather the ones that should be acquired over time through practice.

With respect to preventive measures, there is a necessity to establish the type and efficacy of suitable training, which, due to the dynamic character of crisis, is not an easy task. General training is not sufficient as a preparation for a highly stressful conditions. Therefore, a need for conducting a specific type of training called *stress training*, designed purely for the purpose of preparation of cognitive and behavioral response in highly stressful environment is pointed out. Those who learn how to approach demands in a positive and self-confident manner are less likely to find themselves distracted by outside variables of stressful environment (Hancock, Vincenzi, Wise, & Mouloua, 2008).

9. CONCLUSION

As technology changes, the scope of potential man-made crisis is increasing, as well as the potential scope of decisions about crisis preparedne-

Figure 1: Graphic display of the models of decision-making



Source: authors

ss, mitigation, and response. It is important that crisis analysts recognize these issues and make analytical and empirical contributions that facilitate at least a reasoned debate about their consequences.

In crisis management, the maxims of the normative domain of decision theory based on the idea of expected utility are significant in risk assessment and judgments of possibilities. Game theory can be useful in some situations for planning the strategy of action. The value of the prospect theory and the models of bounded rationality lay in their

ability to educate us about the ways in which people actually decide under risk or uncertainty. To prevent individual decision makers to be doomed solely on intuitive decision making, although it is inevitable, it should be underpinned by implementation and practice of situational awareness and critical thinking skills. Insights acquired by rationalization of decision theory and knowledge about constraints of human mind to make valid judgments, particularly in a time of crisis, may prompt critical thinking and alteration of cognitive strategies, and consequently, decrease the impact of stress.

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MODELI ODLUČIVANJA – PREDNOSTI I NEDOSTACI U KRIZNOM UPRAVLJANJU

Sažetak:

Profesionalni stres kod osoba na upravljačkim pozicijama u kriznim situacijama premalo je proučavan. Visok stupanj odgovornosti kod kriznih menadžera vezuje uz sebe visoki stresni potencijal koji uvelike ovisi o samoj kvaliteti vodstva i donesenih odluka. Element odluke od presudnog je značaja za uspješno ovladavanje krizom. U svrhu boljeg razumijevanja i poboljšanja procesa odlučivanja u kriznim situacijama ukazuje se potreba za racionalizacijom teorije odlučivanja. Istraživanja usmjerena na problematiku odlučivanja provode znanstvenici različitih profila, a za rezultat imaju formiranje osnovnih pristupa suvremene teorije odlučivanja. Normativni pristup je zasnovan na vjerojatnosnim funkcijama dok preskriptivni pruža smjernice za odlučivanje u praksi. Naposljetku, deskriptivni pristup bavi se heuristikama koje opisuju kako ljudi zapravo odlučuju. U stvarnim situacijama odlučivanje je određeno kontekstualnim i psihološkim ograničenjima svojstvenih svim ljudima. Pritom važnu ulogu imaju uočeni obrasci ponašanja kod ljudi pri odlučivanju u uvjetima neizvjesnosti, različiti od onih kod odlučivanja pod rizikom. Postoje značajne razlike u uporabnoj vrijednosti pojedinih modela odlučivanja stoga ovaj rad razmatra različite modele odlučivanja i njihovu primjenjivost u kriznim situacijama u svrhu prevencije i smanjivanja stupnja stresa kod odgovornih osoba. U zaključku ovog rada pristup ograničene racionalnosti zasnovan na heurističkim strategijama nameće se kao najpogodniji, pogrešiv, ali često jedini mogući izbor. Uz usvajanje vještina situacijske svjesnosti i kritičkog razmišljanja potkrijepljenih adekvatnim stres-treninzima i simulacijama te preventivnim mjerama poput izrade analiza rizika, strategija djelovanja i izračuna vjerojatnosti na temelju postulata normativne domene teorije odlučivanja moguće je umanjiti negativan utjecaj stresa i time pospješiti odlučivanje u kriznom upravljanju.

Ključne riječi: teorija odlučivanja, krizno upravljanje, prevencija, stres, modeli odlučivanja