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DECISION-MAKING OF FIREFIGHTING MANAGERS IN EMERGENCIES

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PhD dissertation

by

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INTRODUCTION

Timeliness of the topic

The increase of requirements against decision-makers is a natural inherent feature of our economic development. Recent research achievements explain the decision mechanism in emergencies unlike previously, so it is useful to examine this topic in the context of firefighting managers as well.

Decision theory as a branch of organization and management sciences has merely a few decades of research history. The coercion of the risk reduction expectations of business spheres significantly facilitated its becoming a separate science. Therefore, decision theory primarily examined fields, where a decision-maker had by far much more time to make his long-range decisions than a firefighting manager coming under decision compulsion in minutes. Naturally, the case maps or the circumstances are neither similar, so the decision-making mechanism cannot be identical either.

Considering the above, it is quite obvious that decision theory mainly investigates the decisions of economic mechanisms being an integral part of our everyday lives. My observations show that also the training of decision-makers for emergencies exclusively involves the examination, teaching or instruction of conventional decisions. Having scrutinized the different levels of training of the military, the Police, disaster managers and firefighters, I noticed that organization, management and decision theory issues constitute a part of the teaching topic in all cases, however, each issue only intends to transfer the classic organization, management and decision theory knowledge, following the conventional trend, and only contains information, haphazardly or tangentially, which highlight the decision theory background of the operational and tactical tasks of those in emergencies.

The background of decisions made during operational and tactical missions is mainly made up of rules of procedure, which, obviously, grant a great assistance, however, they do not show the true mechanism of decisions made in such situations.

The formulated problems are typical not only for Hungary. The training structures I have studied abroad, as well as my international experience, based on my relationships, also show that the main objective is the transfer of conventional decision-making mechanisms.

Considering the consequence that the decisions made in exceptional situations, insisting on conventional procedures, may also be even dangerous, I am convinced that the study of emergency responders' decision mechanism is very much justified.

Delimitation of the topic

Depending on the interpretation range of an emergency, a decision-maker may feel a kind of constraint before any decision. This is, of course, completely different if it is only about our daily routines (e.g. going to work after getting up), pleasant consequences (e.g. *yes* pronounced at a marriage) or the improvement of our way of life (moving to a new home). However, the majority of people face, from day to day, constraints of entirely different meaning and nature. These constraints are mainly independent from their own will, meaning the toleration, avoidance or termination of some undesirable issues. The interpretation of the term 'constraint' gains an ordinary meaning here.

Further studying the term 'constraint', we can find a segment, where one or more persons, or things that may be closely attached to them, find themselves in a situation or state, from where, based on their own capabilities, more or less, they are no longer able to break free on their own accord. The intention to terminate the negative state is unambiguously desirable; therefore, it is closely and logically linked to *time*. Resolving other people's tight situations and reaching the desirable – at least neutral – state is an obvious constraint from the part of the person granting assistance as well.

Therefore, I regard all those who perform the improvement of a given state or of the situation of persons, as a profession or occupation, under the pressure of time, as emergency responders.

Based on the above, from the aspect of my dissertation, I consider the persons below emergency responders:

- military decision-makers in war or under exercise circumstances;
- fixed or rotary wing aircraft pilots and air traffic controllers;
- police personnel performing operational or covert actions, hostage negotiators;
- first aid personnel, physicians performing surgical interventions or working at casualty surgeries;
- finally, those in the field of disaster management and firefighting, who intervene on an operational or tactical level, authorized by law, and perform command and control tasks; namely firefighting managers and incident onsite commanders.

Despite the fact that the profession or occupation of the above decision-makers is closely linked to emergency decision-making, the topics and specialties of the individual branches may stand so remote to each other that their joint or detailed discussion – also because of the extent of the dissertation – would not be possible.

Due to the above, I have logically narrowed the target group of emergency decision-makers to one that, on the one hand, well shows the peculiarity of decisions made in such situations, I have my own experience on it, on the other hand, which may make my message authentic and my achievements valid from the side of practice.

During my previous career, I performed my duties as a helicopter pilot in the Hungarian Defense Forces; later, in the organization of the fire service, I fulfilled different positions. **Thus I did not only see the decision-making process of military decision-makers, the air traffic controllers of helicopter pilots and firefighting managers as an outsider, but I myself actively participated in these processes. Therefore, I have primarily drawn on the lessons learnt from the decision-making mechanisms of the above three professions in my dissertation in a way that I have intended to focus predominantly on the decisions of firefighting managers.**

Research objectives

During my researches, I have set the following issues as objectives:

1. Study the processes of classic decision-making, assess their opportunities and define and justify their limitations;
2. Study the emergency decisions through specific examples, draw conclusions from them and explore the relationships;
3. Set up hypotheses and perform a survey with a group of persons that can be involved in firefighting management to examine them to determine the peculiarities of the decisions;
4. Identify the circumstances and peculiarities of emergency decision-making;
5. Examine the procedures making emergency decisions more efficient, draw conclusions from them and explore relationships;
6. Set up models to understand the emergency decisions of firefighting managers;
7. Formulate the results of the lessons learnt and relationships in form of recommendations, and facilitate their utilization in the initial and advanced training of disaster managers and fire safety experts in Hungary.

Research hypotheses

In order to fulfill my achievements and to define the trend of my research I have set up and scrutinized four hypotheses. The first one of them concerns the relationship between the field of decision theory researched at present and emergency decision-making.

Based on my hypothesis, a method of dividing decision-making mechanisms can be established, in which the rules of conventional analogous thinking are not infringed, but the decision-making mechanisms on the periphery of the research fields of decision theory, preferred at present, receive a standard role and parity, so, explicitly the emergency decision-making of firefighting managers as well.

My second hypothesis is linked to the decision theory knowledge of firefighting managers, based on the scrutiny of firefighter students studying at higher education establishments. ***Based on my hypothesis, the students will give account of the diverse store of learning, but I exclude the possibility that they would provide complex answers or solutions to the interrelation of special decision-making, characteristic of their work, considering the framework of institutionalized training.***

My third hypothesis relates to the practical observation of firefighters, i.e. how often-repeated activities influence their decisions. ***Based on my hypothesis, the cornerstones of practical observations will be outlined as a result of the study, and all the factors will be conceived, which would influence or limit their decisions the worst.*** I regard it as a clear achievement if *emergency* or the category in relation, i.e. *limited time* in an everyday sense, emerged predominantly.

My fourth hypothesis bears relation to the orientation of task performance of emergency decision-makers, which I intend to study, utilizing a control group, with a word association method. ***Based on my hypothesis, the division of answers of firefighters demonstrably shifts compared to the answers of the control group, i.e. it is overrepresented towards intervention. Based on my assumption, the division of answers of the control group is identical amongst the identified categories, or will show a very similar division, perhaps slightly underrepresented towards intervention.***

Research methods

In order to achieve my research objectives, I have used the main research methods below:

- I have compiled an individual study and research plan, so that they support me the best to achieve my scientific objectives;
- I have studied the relevant chapters of Hungarian and international literature in connection of my theme, publications, studies, manuscripts and the results of the latest researches;

- I have participated in Hungarian and international professional fora, study tours and conferences, where I also delivered lectures besides gaining experience, and exchanged opinions with other researches and practical experts;
- I have collected information on other nations' observations, theoretical and practical achievements;
- I have led consultations with top researchers and experts representing this specialized field;
- I have carried out purposeful searches in libraries and databases in IT networks;
- I have systematized my knowledge attained during my career, my observations made as a firefighter and pilot;
- I have performed analyses from essays freely compiled by a group students;
- I have compiled a self-designed questionnaire, with the help of which I have carried out a word association survey;
- I have elaborated the results of my survey and drawn conclusions from them, which I have transferred into practice (recommendations), depending on opportunities, and I am using them (teaching).

The dissertation shows my personal observations in numerous places and also the background of their evolvement and consequences. I think this cannot be a disadvantage of my dissertation even if others question its objectivity.

I am convinced that the emphasized role of my personal observations enriches the dissertation and thus makes it even more authentic. The application of my observations to underpin and perhaps debate the message in the literature used and the achievements of my own surveys, is not only of identical value, but may even mean more than the lessons learnt from interviews made with colleagues having similar experience and thus regarded as unbiased, referable according to general customs.

Structure of the dissertation

I have built up my dissertation broken down into five main chapters. In chapter one, I give a short overview of the evolutionary relationship of decisions and our actions, of the development of the science of decision theory; I demonstrate that in history, emergency decision-making can be illustrated through many examples, and in chronological order, I give an overview of some stations of the classic decision theory approaches. Finally, *I demonstrate a division of typical decisions, where the time that can be spent on a decision, as the main compulsion of decision-makers in the focus of my dissertation, has an outstanding role*.

In chapter two, I demonstrate the effect of the results of decisions on the effectiveness of interventions. First, I examine the so-called *damage value - time* function generally used for the process of fire. I highlight the background that the economic-based procedures are missing for the examination of the effective operation of state authorities, including fire brigades belonging to disaster management. *I give an overview of the process of firefighting based on the items stipulated by law for firefighting managers, and then I examine in what way decision-makers receive preparation for special tasks.*

In chapter three, I demonstrate my own researches to justify my hypotheses. I identify the methods I use and justify their applicability. First, I demonstrate the method and later the results of the study of essays made by firefighters, from which I draw conclusions. In another study, a control group is involved besides firefighters. I draw conclusions from the results of my association studies made with two groups, by justifying my hypotheses detailed in the chapter.

In chapter four, I illustrate with examples, the limitations of the possibilities of analytical decision-making, explain the difficulties of the circumstances of interventions, then *I review the general operational mechanism of recognition-primed decision-making*. I elaborate the special model of the mechanism relating to

firefighting managers, and I show the process of the development of decision-making. I systematize and present the factors internally promoting the processes.

In chapter five, I examine the mechanisms, which facilitate a more efficient decision-making of firefighting managers. I demonstrate the linking possibilities of the application of analogical thinking and the operational mechanisms of critical thinking. I explore the circumstances of leadership based on the principle of expectations and of the application of satisfactory procedure. I examine in what way heuristics and creativity can help the decisions of firefighting managers. *At the end of the chapter, I set the emergency decision-making of firefighting managers in a complex model.*

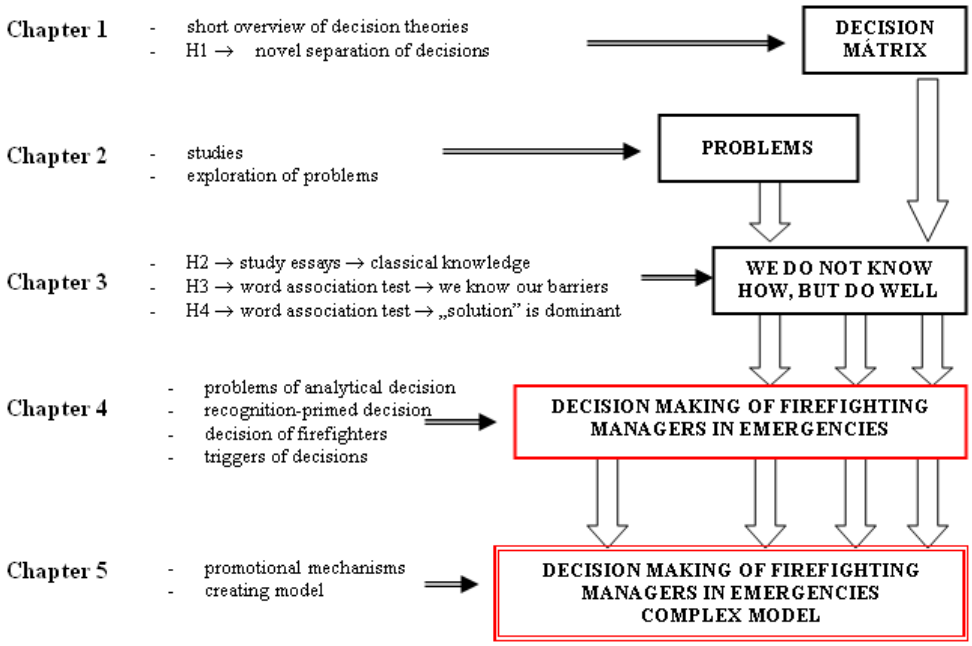

Figure 1 Structure of the dissertation. Source: Author

After the main chapters, I summarize my achievements and ascertain my theses. Based on this, I make recommendations to make the decision-making mechanism of firefighting managers more efficient and to publish my achievements in the framework of education and training.

1 TASKS OF EMERGENCY DECISION-MAKERS AND THE CLASSIC DECISIONS

In chapter one, I provide a short overview of the evolutionary relationship between decisions and our actions, of the economic development generating the establishment of the science of decision theory; I demonstrate that in history, emergency decision-making, being the subject of my dissertation, can be illustrated through many examples, and in chronological order, I give an overview of some characteristic stations of the classic decision theory approaches. Finally, rejecting the analyzing and evaluating mentality of the classic approach, I demonstrate a division of typical decisions, where besides the utility of the outcome of decisions, the time that can be spent on a decision, as the main compulsion of decision-makers in the focus of my dissertation, has an outstanding role.

1.1 The origin of decisions of our daily actions

Today, the vast majority of people think that a decision is a term that means the mature end, the deliberate closure of a mechanism, the solution of a problem, which has been implemented in detail, protracted in time (Paprika-Zoltay, 2002). However, it is not an exact formulation by far. We solve our daily activities through a multitude of decisions, only a part of which belongs to the classically interpreted decision-making mechanism. Another type of decision-making, the mechanism of those in an emergency under time pressure is in the focus of my thesis. Therefore, it is not useless to consider the background of the development of decision-making ability, the short explanation and comparison of the different types of decisions as well.

1.1.1 The origin of the relationship of our decisions and actions

In the beginning of the progress of human evolution, actions as processes ensuring existence and survival were not separated, in today's interpretation, from the decisions necessary for to implement them. What our ancestors needed, they did it instantly, that is, made a decision about it. Decision and action, in essence, co-existed at the same time; they were directed and guided by the needs to be satisfied, by

survival instinct (Kordos, 1998). Past actions and future events were given a minor role in the life of our ancestors, who spent their lives overcoming the challenges of the present in the time corridor.

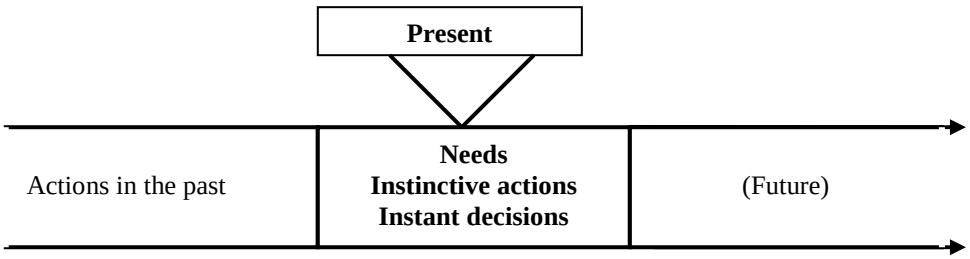

Figure 2 Initial decision-making corridor. Source: Author

In the everyday life of the Neanderthal prehistoric man the struggle for life required the ability to reason, which the early Homo sapiens already possessed[1]. Decision and action could become separated when the intellectual capacity already allowed prehistoric man to be proactive: actions ensuring his survival such as storage, warehousing, manufacture of hand tools and hunting weapons all intended to improve his future situation. These actions, in addition to previous animalism, were obviously deliberate and conscious[2].

In the time interval between the intention of action and its actual implementation the thinking processes in the mind sought the way, which had left traces based on previous memories. Therefore, the thinking ability could develop, which we might call far-sighted thinking ensuring a safer livelihood besides instinctive actions (Angermann & Vogel, 1992).

Decision-making is an inseparable part of this thinking process, through which we implement the occurring intentions by acting or abandon them. In the course of evolution, obviously the individuals were been able to survive, whose far-sighted thinking skills were more developed in the given environment, so they could better adapt to specific conditions.

[1] Az emberiség krónikája (The Chronicles of Humanity); Officina Nova 1988. ISBN 963735601
[2] We may observe the instinct of warehousing on our own pets, e.g., when a dog digs its food it has received in a ditch.

The above decisions were made by our predecessors quickly and without formalities based on their previous experience and the lessons learned from the community. Each of their decisions was obviously a repetition of their previous decisions, that is, recalling their memory, they realized their previous actions, which were most appropriate and purposeful for the specific environment and situation. Their goal was to improve the continuous maintenance of their living conditions as well as possible, concerning which, based on phylogeny, they already made good enough decisions.

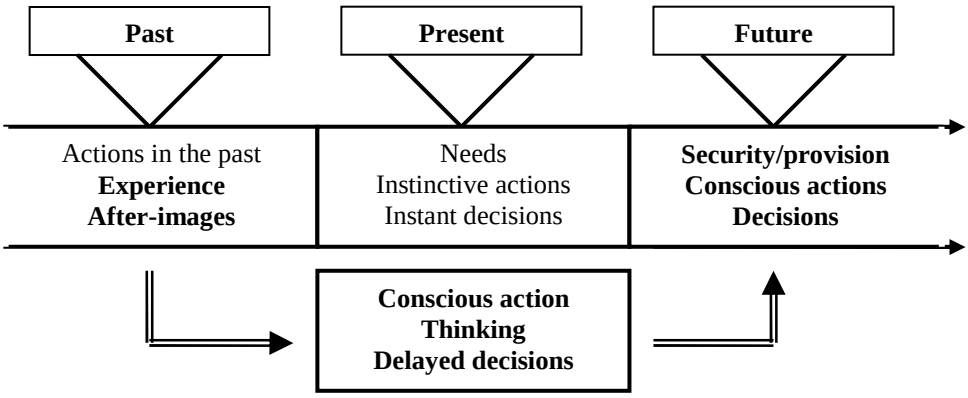

Figure 3 Decision-making corridor in case of conscious thinking. Source: Author.

1.1.2 The birth of the science of decision theory

People have been dealing with governance and management ever since society has existed, characterized by division of labor and separation of intellectual and physical activities (Madarász, 2003). In the beginning of recorded history, the mother of all sciences, philosophy dealt with the topic of decisions, even more with its impacts and consequences. Philosophers tried to classify the *"goodness"* or *"fairness"* of people's actions in their meditation (Paprika-Zoltay, 2002). The improvement of living conditions involuntarily required the clarification of the background of growth, the exploration of the possibilities for further improvement due to the effect of the industrial revolution. Thinkers of the era already recognized numerous organizational and management regularities for the sake of more efficient labor, they created the foundations of modern management theory. The importance of trade came to the fore, by studying the regularities of which modern economics also evolved. They tried to increase efficiency through organizational and management changes, during

which the decision maker's personality came also to the fore. Various theories were created, by which they intended to give an explanation to the growth opportunities of the efficiency of production organizations. The science of organization and management theory of the modern era evolved, which is just over 100 years old, and also one of its branches, decision theory, which only holds a few decades of history.

The above-mentioned show the fact that decision theory became a separate discipline was generated by the economy becoming more complex. On this basis, it is by no chance that up to date the background of the decisions of market participants was and apparently stays in the attention of investigations. The dominant economic actors establish and implement, in time and space, more and more complex plans and strategies, with prolonged effects. Our technical evolution has accelerated dramatically. Compared to earlier times, a multitude of decision support systems is available to us to implement *"better"* or *"more efficient"* decisions, while the change of the decision-making mechanism of consumers is much slower; it is still mostly based on the several thousand-year-old mechanisms, having been *"learned"* in ancient times and applied ever since (Hutchins, 1996).

1.1.3 The epoch-changing decision-makers of history

The above-mentioned show the development trends of decision-making playing a role in the economic life. In the first really influential theory, *the classical economic model*, we behave rationally, accurately calculating all factors affecting decisions (Taylor, 1965). Thus, decision-making is really just a mechanical process, in some ways it is quite static, the personality of the decision-maker is less important.

Notwithstanding the above, it was just the socio-economic development of history that opened the door and gave room for a number of armed conflicts, where, on the battlefield, after the start of the battle, classic decision-making was just not applicable as neither is now, (Killion, 2000). In accordance with the spirit of the era, planning and logistical support received a huge role, but on the battlefield, fighting demanded a different way of thinking, the background of these decisions was given different explanations by either their makers, or the observers of their activities (Clausewitz, 1984; Duggan, 2002.

The suitability of the personality of decision-makers could be guaranteed in the beginning by even their nobility, family and kinship relations predominated (Sár, 2003). Monarchies follow this principle, the *birth privilege model*, even to this day, although at present, their actual weight is only a fraction of the one in the past in the socially advanced countries. Later, the followers of property theory emphasized that the decision ability is determined by *suitability*. In the era of the Greek and Romans, the exceptional abilities of certain warlords were attributed to divine endowment (e.g., Alexander the Great, Germanicus Caesar, Hannibal, Attila).

The background of decisions, affecting the outcome of war, was attributed by Napoleon to the *"piercing eyes"* that can see through momentarily the course of the battle and the consequences, and are able to make the necessary tactical decisions to ensure the desired outcome (Duggan, 2002). Clausewitz used the term *"fog of war"* to a war situation, to the environment surrounding decisions, pointing out its often confusing, inextricable situation (Clausewitz, 1984). The success of a decision-maker depends on how he is able to see through this fog, and how he can make decisions.

History is nothing more than the history of wars (Balica, 2009). The special decision-making ability of generals, preparing and commanding battles, could sweep away earlier empires, and could give peace of mind for many years or a dominant role to nations deemed insignificant up to date. The generals had no way back if you they had crossed the Rubicon[3], only victory and glory, or devastation and contempt awaited them at home.

The notions expressed above only wanted to provide a sketchy and superficial overview of the development, of course, highlighting two peculiarities of the decision-making process, still existing and in use since ancient times. The majority of our decisions belonging to our daily actions are based, on the one hand, on several thousand-year-old mechanisms; on the other hand, despite their circumstances are quite vague and unclear, they can also have an epoch-changing impact.

[3] Julius Caesar saying, based on it BC 49 he launched his armies across the Rubicon River against the Roman Senate and twisted corners of the world.

1.2 Decision theory models based on their chronological development

During the examination of decision-making, researchers used two distinct methods. They define for the decision-maker, in one of the events, the principles and rules, based on which the final result is to be reached (Paprika-Zoltay, 2002). Options may be at hand to the decision-maker, he may perform different levels of analyses and calculations, in fact, he should, but the result is always the same, according to the specific conditions and rules, regardless of the decision-maker. Decision-making methods, based on respecting rules, in fact, ignore the decision-maker's personality, they constrain his activity between boundaries and standards, that is, they determine him how *to decide*. These decision-making methods belong to the so-called *normative models*. *Classic economic models* as the bases of rational decision-making, the *optimizing decision models*, *statistical decision theory* and *game theory models* also are included here.

The other method is basically focused on the decision-maker as a thinker and emotionally charged person and the formation process of decisions made by him (Paprika-Zoltay, 2002). It examines how the decision-maker ended up at the given result. Methods in this group are called the collective name *descriptive models*. E.g. *the principle of limited rationality*, *model of strict confirmation, the model of gradual proceeds,* and the *garbage can model* are included.

Very much simplifying and figuratively tagging the above, cultivators of the normative decision theory models are typically closer to natural sciences, so, they are the "*mathematicians*", the “inventors” of the descriptive methods are closer to social sciences, so, they are the "*psychologists*."

1.2.1 Economic approaches

The first scientific-based decision theory approach is linked to the name of Adam Smith (Paprika Zoltay, 2002). In his works, he defined the economic phenomenon strictly in the categories of market values, he relied on, as a default value, the quantitative values of supply and demand. The original model insists that the result is

certain to occur after the selection and implementation (Taylor, 1965), in the improved model, it is no longer the sole criterion. He assumes that the decision-maker is fully informed, and he is perfectly sensitive to the changes, who always seek to maximize his own benefits.

Results of researches in the future, psychology and sociology, have confirmed that the decision-maker cannot and does not always want to strive for profit maximization (Paprika Zoltay, 2002), due to different circumstances and effects.

1.2.2 The administrative model

Expectations of the economic decision theory perception seemed to be excessive and untenable, and therefore, the administrative model was created to solve them. We can find in this the synthesis of the two previous approaches: first, from the management theory side, real experience linked to actual decisions, on the other hand, the results of psychological observations (Paprika Zoltay, 2002).

Based on the latter, it was determined that the same status, due to different effects and factors, were judged differently, that is, during decision-making, its effect of the status perceived is dominant rather than objective reality (Vroom, 1964). Since the observed situation is strongly dependent, not only on external influential factors, but on the person perceiving it as well, so there is no real starting corner, which could meet the conditions of the classical model. From the side of observations of management theory it was confirmed that the decision-maker does not intend, at all, to achieve his ideal decision-making situation, that is, he does not want to "waste" too much energy on the preparation of decision-making, but he is content even if the result of his decision satisfies his overall expectations (Barnard, 1938; Simon, 1957).

Thus, according to the administrative model, the decision-maker is directed by his expectations to be perceived in the future in an environment, which is too complex to fully acquaint himself with it (Paprika Zoltay, 2002). This situation is typical of the circumstances of decision-making, including decision-making in emergencies, so this idea will receive a role later in my dissertation.

1.2.3 Model of strict confirmation

It is regarded as an error of the administrative model that it does not give sufficient explanation to which factors to what extent influence the intention to satisfy. Skinner's studies suggest that, to come to the explanation of the background of decisions, positive results should be explored, which lead to the confirmation that our earlier decisions were correct (Skinner, 1971).

Due to the impacts of positive results, the decision-maker reiterates his earlier actions, while in case of failure, he avoids it (Haire, 1974). The latter is also mentioned as Thorndike’s effect. Decision-making based on positive confirmation is, also according to my experience, a definitely dominant strategy from the side of subordinates, which obviously also incurs some conformism (Bolles, 1967).

1.2.4 The model of gradual proceeds

The model of gradual proceeds also serves to explain the inadequacy of the administrative model (Lindblom, 1959; Allison, 1969). According to this, so many can be the number of action versions that they are neither possible even if the decision-maker strives to satisfy them, based on the comparison of their usefulness. The comparison can only be based on a per-action comparison of versions with the actual results of previous decisions (Paprika-Zoltay, 2002). Since the changes occur in small increments, the decision-maker may be tempted to decide based on the principle of gradual proceeds dividend, that is, strives, as far as success, to minimize the potential negative consequences.

Based on the above, this model is the criticism of decision-making methods of conventional goal-instrument type, which, in a high-level decision-making situation, is simply unusable (Keen, 1977; Dror, 1984).

1.2.5 The decision-making model of organized anarchy

During the examination of the operation of organizations, March and his colleagues came to the conclusion that they do not operate based on clear objectives and methods, but they are in a continuing chaos (March, 2000). The chaos means the formulation of the collection point, where the problems and their solutions, the decision-makers and the options are present without strict order, like in a garbage can, randomly. Since the constellation of elements is unpredictable, it means a kind of a chaos to an outsider, even if the organization seems to operate well.

The garbage can model, according to its creators, serves for the description of the functioning of organizations, but its features are outstandingly suitable for determining the working conditions of emergency responders. Even more so, because in the model, time as a key factor affecting the decision is to play a central role, time automatically systemizes the elements that are necessary for the decision-making process, thus the constellation of actors, solutions, problems and decision-making possibilities.

1.2.6 Other models

In the above elaboration of decision theory approaches, the chronological development is quite logical, it extends from the strict demand of rational behavior of decision-makers in the beginning until its almost full abdication. The *administrative model*, the *strict confirmation model*, later the *model of gradual proceeds* gradually abdicate rationality, appearing in the classic model, as a strict corner point, as a result of which process we finally come the *model regulated anarchy*, ensuring the equal appearance of different decision-making elements.

Divisions different from the system of approach, focusing on rationality, also exist, furthermore, within the science of management and organization, we may also encounter understandably by far more extensive processing. They are, i.a., *Organizational forms and leadership* (Dobák, 1996) and *Organizational behavior and leadership* (Bakacsi, 2001), regarded as basic works during my earlier studies,

which, also expressed in their titles, are made primarily by analyzing and elaborating the organizational aspects. *Management and organizational psychology* (Klein, 2001) focuses on the psychological aspects of decisions within an organization, and *Decision theory* (Paprika-Zoltay, 2002) provides a broad, comprehensive summary, specifically concentrating on decisions and *Decision-making techniques* (Paprika-Zoltay, 2010), with the emphasis on practical solutions. The main trend of all the works primarily stresses managerial, organizational and decision theory knowledge, typical of business life, where the time available for decisions is usually not limited, it is considered a freely utilizable *resource*.

1.3 Decision types based on their temporal impacts and the time spent on them

The logic of development is quite a “one-way street”, it focuses on the behavior of the decision-maker together with its rational qualification. Although the essence of development is based on the abdication of the initial rigors of rationality, however, its contents are constantly modified with the changes of criteria of the models. However, decision-makers of different models attest rational behaviors in all cases (Laudon - Laudon, 2000) amongst the conditions of the individual models.

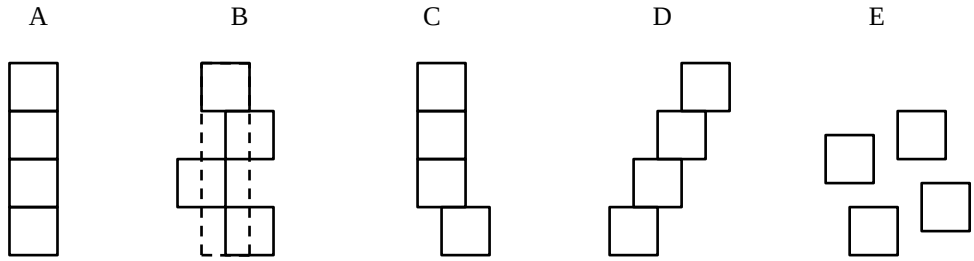

Figure 4 Different decision theory approaches. Source: Author
A: Classic enonomy model, B: Administrative model, C: Model of strict confirmation, D: Model of gradual proceeds, E: Model of regulated anarchy.

To explain and understand the essence of special decision-making mechanisms, being in the focus of my dissertation, I wish to create a unique *matrix*, a different one from the previous division. In this matrix, I regard the *magnitude* of *time spent on decisions* and the *temporal impact of decisions, its "weight"* as determining characteristics.

When establishing the matrix, I set the requirement before myself that it may not infringe the regularities of analogical decisions, nonetheless, it is able to demonstrate the structure of our decisions in a way different from the previous ones, so the unique decision-making mechanism of those in emergencies is included with emphasis.

Based on my hypothesis, a division method of decision-making mechanisms can be constructed, in which the regularities of conventional analogical thinking are not injured, but decision-making mechanisms, located on the periphery of research areas presently preferred, decision theory, specifically the emergency decision-making of firefighting managers receive an authoritative role and equal footing.

The weight of the decisions of managers, paired with the division according to its time horizon can be also found in the work of a Hungarian author (Molnár, 2003). In the center of division, organizations with different structures stand, where "heavy-weight" decisions, i.e. *strategic decisions* are made by *senior managers*, "middle-weight" decisions, i.e. *tactical decisions* by mid-level managers, "light-weight" decisions, i.e. *operational decisions* by low-level managers. The time horizon of decisions means a *long-*, *mid-* and *short-term* division. Molnár, in his summary, does not directly link strategic decisions with the long-term time horizon, furthermore, the tactical one with the mid-term one, and the operational one with the short-term one, however, logically, this content is unambiguously in the background. In the scope of management and decision theory, this concept can be justified through the works of a multitude of different authors (e.g., Kindler, 1991; Bakacsi, 1996), thus I regard it as generally accepted.

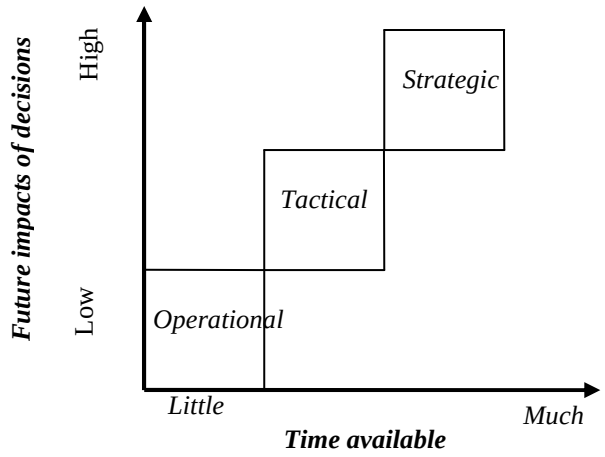

Figure 5 Relationship between strategic, tactical and operational decisions depending on the time available and the future implications. Source: Author

With the illustration of the division, the interrelation between and superstructure of decisions can be well seen (figure 4). Decisions only occupy a part of the fields defined by the coordinate axes, and based on the logic of division, the "empty" parts do not even exist. “Heavy-weight” decisions cannot be made in a short time, and the weight of decisions, made on operational level, may only be low. This type of division is certainly not so strong with authors preferring this method, but its inner core clearly points in this direction.

The above approach, in my opinion, has a view on a decision as an end-product from inside an organization and not as an active link with the partner or the environment. Looking at it from outside, the impact and success of decisions, in my opinion, can be completely different. To obtain a license from the authorities is worth the client a mere *yes*, while from inside an organization, it can obviously be evaluated in a different way, however, the strategic decisions of firms in relation to partners can also be regarded as strategic determination.

We know of the classic models described in the previous chapter that the stakeholders of business life use them to achieve their long-term success, mainly strategic objectives. Strategic objectives obviously greatly influence the long-term activities of actors of business life, so, they can be regarded, based on their future impact, as significant, “heavy-weight” objectives. To do so, decision-makers have enough time, compared to the interpretation domain of the concept of emergency, defined in my dissertation, by magnitudes more time.

If I take the significance of the serious impacts of decisions, I assume that there must be, on the contrary, a decision with a “weight”, whose impacts are considerably lower. We all practice them daily, regarding them as *routine-like*; based on this, I name them routine decisions. Another well-known feature of routine decisions is that not only their future impacts are scarce, but also we only spend a little time to make them; due their automatism, we practically do not even notice them. Despite of this fact, this decision type should not be neglected, since our everyday actions are mainly based on them (Ribárszki, 1999).

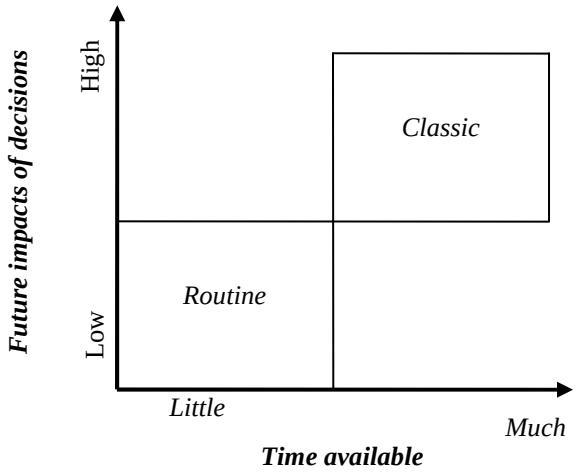

Figure 6. Relationship between classic and routine decisions depending on the time available and the future implications. Source: Author.

Regarding the interrelation between classic and routine decisions I ascertain that they are converse as far as their future impacts and the time spent on them; the former has significant impact and long time, the latter has scarce impact and short time. The above are illustrated in a coordinate system in *figure 6*.

Following the above train of thought, logically, the question arises whether the unfilled parts in the coordinate system can be filled, i.e. a relatively low-importance decision paired with long decision-making time and its opposite, significant future impact paired with short decision-making time, from the aspect of decision-making procedures.

I divide the sides of the matrix, i.e. the axes in the simplest way: in the case of time, *little-much*, in the case of the impacts of decisions, *low-high* values. Thus, the matrix gives four fields (figure 5), to which I use the following names: *classic, bureaucratic*, *routine* and *recognition-primed decisions*. The values of classic and routine decisions, based on the above, have already been defined: in the previous case both values are high, in the latter they are low. The values of the two new fields are contradictory: in the case of bureaucratic decisions, their future impacts are *low*, the time that may be spent on them is *much*. With recognition-primed decision, the situation is opposite: the extent of impact is *high*, the time that may be spent on it is of *little* value. Thus, the fields of the matrix have been filled, however, it is necessary to review what their content actually means.

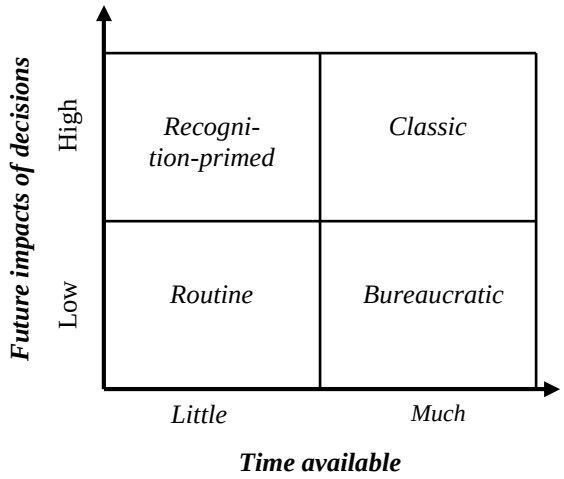

Figure 7 Decision matrix in relation to the time available and future impacts. Source: Author

1.3.1 Classic decisions

Researchers of decision theory study this decision-making mechanism in the widest ranges, thus, the different literatures contain this of field of decision theory the most (Dobák, 1996; Paprika-Zoltay, 2002). The characteristics of the field are that decision-making has on both exes “high” values. The action as a result of the decision has a significant future impact. In order to make this decision, careful considerations are necessary, which can only be done with sufficient time spent on it. It means that from the time of recognizing the problematic situation until specific decisions days, weeks or perhaps months may be available. It facilitates the decision-maker to collect information, analyze it, create options based on the results, to modify and compare them by introducing new conditions, or perhaps completely exclude certain options. Options that may bring the best results for the decision-maker, based on the elaboration of information and conditions available in a given time, will be implemented.

The above steps can, of course, be put in another form. Not specifying this decision field any longer, I conclude that we are dealing with a long-term quest, allowing the development of several variations, to which I use the name: classic decision-making.

During the operation of law enforcement agencies, including the area of disaster management and the fire service, it is the dominant form of decision-making. Each manager is to apply it at different levels, obviously for the sake of facilitating and ensuring long-term efficient operation. A chief fire officer, based on previous intervention statistics and depending on the probable future vulnerabilities of the area under his responsibility, makes an effort to replace equipment due to depreciation, to purchase new equipment, to increase the staff or regroup. These efforts, naturally, are often in contradiction to the will of the senior management, primarily not due to professional disagreements, but budget restrictions (Restás, 2011). The latter depends on the country's fiscal situation, the size of the amounts to be spent on fire protection.

The classic decision-making mechanism as a protracted process, can receive a role during operational and tactical interventions of firefighters, especially in fire incidents, eliminated over a longer time (e.g., large forest fires), but even at other interventions (e.g., HAZMAT intervention, flood management).

1.3.2 Bureaucratic decisions

It can be observed as a typical decision-making process at a bureaucratic organization. The field is characterized by the fact that the problem’s weight is *low*, while the time spent on a solution, represents a *high* value. The operating mechanisms of these organizations are analyzed by sociology, more specifically by organizational sociology. The essence of the background is decision is not to reach an individual solution, taking into account the characteristics of the given problem, but to prepare a template, aligned to the operational mechanism of the organization and easily manageable. Its simplest example can be the forms and questionnaires of authorities.

Not underestimating even by chance the work performed by such an organization, however, I conclude that from the aspect of decisions, the activities of bureaucratic organizations can best be compared to compliance, after comparison. Specifically, a comparison of the problem’s contents takes place with the provisions of an existing sample (mostly legislation), which usually requires a *yes-no* elementary decision,

without variations. The organization usually has restricted time, but at least days to make this decision.

Despite the pejorative sense of the name, I note that bureaucracy is one of the development results of the formation of 19th century modern states, whose contemporary examination can be associated with mostly with Weber's name. In his view, bureaucracy represents the highest level of rules, which, as far as stability, discipline and reliability, significantly outperforms all other systems (Tari, 2004). This disciplined environment made it possible the appropriate and smooth functioning of the state administration for many decades.

In the field of law enforcement agencies, there are also many examples of the above decision-making mechanism. Taking the fire service as a basis as an organization acting as a public authority and as a professional authority in different matters, manages requests submitted to it accordingly under the act on the rules of public administration procedure[4]. In its competence, it compares the issues submitted in the requests (such as the establishment and use of buildings) with the relevant legislation in force, and agrees to the decision (authorizes it) or not. The decision-maker does not change the subject of a request in case of non-compliance, it does not recommend or give advice. The simplistic outcome of their decision is the communication to the applicant of a *yes – no* variation. The above are, of course, very simplified descriptions of the process, and the result is similar during the functioning of any other authority (e.g. police, local government).

Due to the above, we may not have any negative prejudices against this decision-making mechanism, as this form of decision-making is essential for the normal functioning of society, just as well as the classic one.

1.3.3 Routine decisions

Small actions of daily life are based on this decision-making mechanism. The field's characteristic is that both values of the factors of the matrix are low. This is exactly

[4] Act CXL of 2004 on the general rules of administrative proceedings and services

what individuals need to take to tackle the constantly repeating moments of everyday life not to constitute a decision problem. Many times, it is a subconscious set of activities, whose deeper examination is covered by psychology. Since it is a rerun of identical activities, the brain will automatically give orders to implement it, without committing substantial capacity.

It belongs to the essence of the fact of the decision that basic problems are solved here, to which previously there was the same or similar response. So, by recalling, a process that has already occurred will be repeated. As a result of constant repetitions, one of the characteristic features of decision is the effectiveness of automatism, that is, the time spent on decision manifests itself in its minimum requirement.

1.3.4 Recognition-primed decisions

The field is characterized by the fact that decisions drawing behind serious consequences shall be made in a relatively short time. Classic decision-making mechanism, already discussed, due to the shortage of time, is practically useless, in some cases it may be even dangerous (Klein, 1989).

The comforting weightlessness of routine decisions, by the very nature of the problem, clearly cannot receive a role. The fact that this is a typical decision-making model, is crystallized as a result of a number of observations. It was observed during a military exercise that chief fire officers made the vast majority of their decisions in less than 1 minute. The number of decisions made in more than five minutes was rather scarce (Ribárszki, 1999).

During another survey, involving chief fire officers with over 20 years of practice, having studied 450 decisions of a total of 150 experienced decision-makers, they ascertained that 85% of decisions were made within one minute. They drew the consequence that, different from the analyzing and evaluating thinking, it is a typical decision-making procedure, to which they gave the name of recognition-primed decision (Klein, 1989). This procedure is the typical decision-making model of professional managers in emergencies, like firefighting (rescue operations) managers, in the focus of my dissertation.

1.4 Summary of the results of the chapter

In chapter one, I have given a short overview of the evolutionary relationship of decisions and our actions, denoting that during humanization, in the beginning, our actions and decisions were not or only slightly separated in time. They were instinctive and served to satisfy immediate needs. It radically changed during evolution, decisions became conscious, in time, they were separated from actions, they were determined by far-sighted care.

In the following, I pointed out that, during history, generals proved with several examples the military application of emergency decision-making. The decisions of generals, after the start of the battle, evolved depending on the situation, they could only be planned in a limited way or not at all, however, their future impacts could even become epoch-changing, historically.

In the chapter, I have reviewed some of the stations of classic decision theory approaches in chronological order, e.g. the models of *economy*, *administration*, *strict confirmation*, *gradual proceeds*, and *organized anarchy*. The trend of the overview was designed by the extent of rationalism of decisions, gradually quitting which one can reach the model of regulated anarchy from the exclusivity experienced in classic models.

Based on my assumption, the mechanism of decisions can be divided in a way that ensures the equivalence of emergency decision-making. To justify my hypothesis, I created a decision matrix, in which I took as a basis the future impact of decisions and the time spent on it; thus, I received 4 fields. Each field contains a characteristic decision type, i.e. *classic*, *bureaucratic*, *routine* and *recognition-primed decisions*. The significance of the division lies in the fact that, by doing so, the decision mechanism of emergency decision-makers receives an equivalent decision position from the periphery of mechanisms studied so far.

2 DECISION-MAKING AND THE ACTIVITY OF EMERGENCY RESPONDERS

In this chapter, I demonstrate the effect of the results of decisions on the effectiveness of interventions. First, I apply the so-called *damage value - time* function, generally used for the process of fire, on which I graphically illustrate the damage value reducing effect of decisions professionally correct. I highlight the background that the economic-based procedures are missing for the examination of the effective operation of state authorities, including fire brigades, and as a result, the shortcomings of decision-making do not come to the fore.

In the chapter, I give an overview of the process of firefighting, based on the items stipulated by law for firefighting managers, then I examine in what way decision-makers receive preparation for implementing special tasks. For this, I use the content of education materials accessible to me, my experience gained so far in my previous (flying), recent (firefighting) and present (education) career. In light of the present situation, I demonstrate, through some examples that the possibilities of analytical thinking are many times limited, so, it is expedient to explore the possibilities, which may expand the present barriers.

2.1 The efficiency of decisions based on the damage – time function

“Don’t forget, time is money”, wrote Benjamin Franklin in 1748, whose slogan did not only express the mentality of his era, but his viewpoint is still timely and predominant. If we accept it and logically adapt the idea to firefighting tasks, the failure of the possibility of the professionally fastest extinguishing of a fire, in terms of losses, also costs money. Based on the determination of the society of firefighters, it shows in *damage value*, and as its reflection, in the amount of *saved (rescued) value*. Therefore, the decisions of firefighting managers may significantly influence the extent of causing damages and/or the amount of saved value; therefore, depending on decisions, I wish to briefly analyze the function describing the process of fire.

I examine the process of fire through the adapted version of the so-called *damage value – time function* (Abdumarigov, 1980; Bleszity, 1989). The format of the

function is different in each individual case, however, considering its character, it has numerous, well-definable common features. Thus, it is suitable for the general investigation or study of fires. The vertical axis shows the amount of *damage value*, the horizontal one illustrates the lapse of *time*. The study of the function relates to confined space in the majority of cases (e.g., dwelling buildings), but we may come across with some special (e.g., forest fire) designs of it as well (Restás, 2010). Assuming free spread of fire, the function first tends to rise steeply, later, with the decrease of the combustible substance, the curve flattens. If the combustible substance is consumed (burnt), the fire extinguishes itself, it goes out spontaneously, the curve is broken (*figure 8*). The endpoint of the curve also defines the amount of damage value (D_{max}).

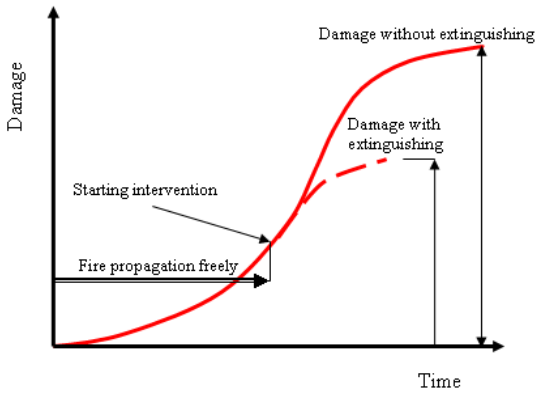

Figure 8. Representation of the process of fire, based on the damage value – time function. Simplified model. Source: Author based on Bleszity.

In case of intervention by firefighters, depending on its duration, the natural flow of the curve will break, later, it will be terminated. This endpoint of the curve shows the damage value assigned to firefighting (D_{ff}). The difference between the natural endpoint of the curve and the endpoint established as a result of the extinguishing process implemented by the firefighters, measured along the vertical axis, gives the amount of saved value (S_{ff}). A previous intervention and the increase of efficiency of at the same intervention, results in the decrease of the damage value ($D_{ff}\downarrow$), and the increase of the saved value ($S_{ff}\uparrow$) (1).

$$D_{max} - D_{ff} = S_{ff} \qquad (1)$$

where:

D_{max} - amount of damage value without firefighting (max. damage value);

D_{ff} - amount of damage value with firefighting;

S_{ff} - value saved with firefighting.

In terms of the above an intervention, firefighting may be regarded as successful if the amount of saved vale is the highest possible ($S_{ff} \rightarrow S_{max}$), with help of personnel and assets available (R_{ff}), and the damage value caused is the lowest possible ($D_{ff} \rightarrow D_{min}$). In terms of the above, we may reduce the duration of the combustion of the fire by firefighting ($t_1 \rightarrow t_2$), on the other hand, in case of wild fire (e.g., forest fire), also its extent ($A_1 \rightarrow A_2$) (2). During firefighting, we should strive that the damage value be the lowest possible, the saved value be the highest possible. The above ascertainments also mean the targeted functions of a firefighting task (3).

$$t_2 < t_1 \quad \text{and} \quad A_2 < A_1 \tag{2}$$

$$S_{\max} = \max_{j=1,\ldots,n} S_j \qquad t_{\min} = \min_{j=1,\ldots,n} t_j \qquad A_{\min} = \min_{j=1,\ldots,n} A_j \tag{3}$$

where:

t_x - duration (time) of combustion of a fire;

A_x - amount of an area burnt down.

A decision professionally more efficient affects the above targeted functions: it reduces the time of intervention, thus decreases the damage value and in parallel, it increases the saved value; so, the efforts to improve the efficiency of decisions, also in terms of being economic, are unambiguously useful.

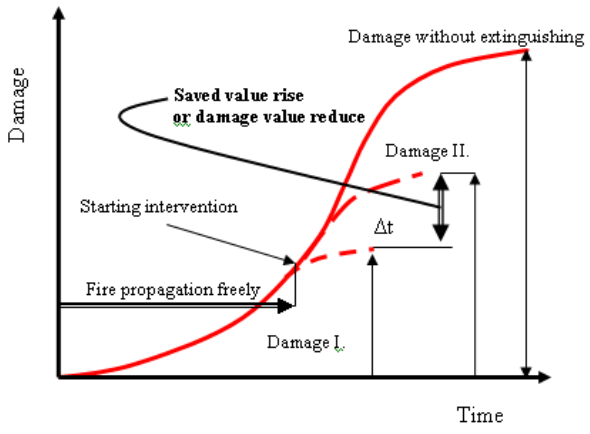

Figure 9. Representation of the process of fire, based on the damage value – time function. A model complemented with a decision theory approach. Source: Author

2.2 The economy study of the efficiency of firefighting

Activities of organizations, funded by the central government, like the *armed forces, police, disaster management,* are rarely examined from an economic point of view of efficiency criteria, although in some cases, we can find information on partial task analysis (Orosz, 2011). The same is typical of the activities of *fire brigades*, economic aspect analyses are only rarely found (Restás, 2004, 2010, 2011b, 2011c).

The aspect of being economical is rarely thought through in the everyday operation of an organization, in a figurative sense, to cover it we use the expression "*efficiency*". On the level of tactical responders, in item 32.4 of the Rules of Firefighting[5], the necessity[6] to consider the economic aspects as a responsibility of firefighting managers reads as follows:

"in the cases where a fire has no significance from a national economy perspective, or its extinguishing does not incur saved value …a firefighting manager shall decide - considering the economic (personnel, equipment, use of extinguishing agent) and environment protection aspects – to put out the fire or control the complete combustion to avoid any collateral damage in connection with the fire".

In contrast to the activities of fire brigades, however, society has a clear expectation that the costs spent on fire protection ($\sum C_{fire\_protection}$) be effectively used, also from an economic perspective; that is, during interventions, the amount of *saved value* ($\sum S_{saved\_value}$) should minimum reach, but rather exceed the expenses. If the saved value and the expenditure on it are in balance, in an economic sense, in fact, it is all the same for the society, whether we allow a full devastation of a fire, without protection, or one must protect himself or herself if its costs paid are equal to the damage caused. By increasing the efficiency of decisions, we can gradually reduce this damage generated and achieve a higher level of fire protection.

[5] Minister of the Interior Decree No. 1/2003. (I. 9.) on the Rules of Firefighting and Technical Rescue Activities of Fire Brigades (hereinafter: MoI Decree No. 1/2003. on the Rules of Firefighting)
[6] The draft of the modification of the MoI Decree No. 1/2003. on the Rules of Firefighting inserts the above text without changes.

$$\sum S_{saved\_valeue} \geq \sum C_{fire\_protection} \quad (7)$$

where:

$\sum S_{saved\_value}$ – value that can be saved by fire safety expenditures;

$\sum C_{fire\_protection}$ – fire safety expenditures of the society.

The list goes on with the criticism of the above findings, such as inability to determine the losses of certain damages, of inhomogeneity of the distribution of fires in time and area, or on the most general, but erroneous perception of the inestimability of the value[7] of human life (Adorján, 2004).

Overall, we get to the point that it is in vain to address the economic issues of fire protection, but if it is not useless, the result is always that we need more money: for more up-to-date technology, new and more fire appliances and special vehicles, more fire brigades, a greater number of staff, better coverage. Therefore, the view is eventually crystallized that more effective fire protection can only be achieved at an extra cost. It is useful to consider if these opinions are really correct, or whether we have, perhaps, hidden reserves, the exploration of which solely and exclusively depends on the professional attitude of policy makers, the paradigms used or on their abdication.

Depending on the interpretation range, not detailed here, there may be different definitions of the concept of efficiency. One of them is the so-called *technical efficiency*, which can be found at operational and tactical tasks of each organization. If we ask a chief fire officer, efficiency means to him to save lives, and the liquidation of fires and damages as soon as possible, the minimization of losses with the personnel and assets available. A very serious limitation is included in the above statement, namely the wording "with the personnel and assets available." The thinking of chief fire officers, of course, is adapted to this, so, in order to increase efficiency this limiting factor is attempted to be reduced, i.e., they require the possession of ever more specialized and automatically more expensive equipment, who would dare to say the opposite, in general. This is, in terms of chief fire officers, is a clearly good effort, and also provide for the increase of professional efficiency!

[7] Not with ethnic considerations, but the value of a statistical human being (ref.: Adorján, 2004).

However, it is not sure at all that, increasing professional efficiency is associated with the increase of efficiency, from an economic perspective. This is only true if the newer and more modern equipment are able to "produce" their own cost, i.e., when the saved value is expected to be higher than as much new equipment cost (Restás, 2011c).

The above logic manages decision-making as a static factor and does not take into account its significant influencing role on the outcome of an intervention. If we are able to professionally use the equipment available in a more efficient way through more advantageous decisions, that is, to reduce damage value and increase saved value, it is logical that we increased the extent of economic efficiency. That is, the decisions of firefighting managers are not static, but dynamic factors significantly influencing the economy-approach efficiency.

2.3 The study of the process of firefighting

I deduce the process of firefighting according to the relevant items of a decree[8] on the rules of firefighting and rescue activities of fire brigades. Based on this, the first information for a fire brigade is the *fire alarm*, which is implemented by the person reporting it or an automatic fire alarm system. Without alarm, there is no fire for a fire brigade! (Restás, 2006)

2.3.1 Fire alarm, its assessment and deployment

Fire alarm is registered by the communications duty officer, is *assessed* by the chief duty shift officer. The goal of assessment is to make a *decision* on assigning equipment to the incident site according to the type of incident, i.e. a decision on the alert. The chief duty shift officer makes decisions on 3 essential issues:

1. Determining the necessary forces. In this case, the decision-maker chooses a pre-designed plan from a grouped system of equipment and actions we call the *determination of alert degree*. The decision-maker makes everyone aware of it by saying a “jargon”, a simple expression. In the case

[8] MoI Decree No. 1/2003. on the Rules of Firefighting, between items 50 and 126.

there is a demand on the change of the general grouping, the decision-maker determines one by one.

2. Protective equipment[9] used by firefighters. This is usually a simple selection, which in the vast majority of cases, means to put on protective clothing, boots, gants (gloves), helmets and many time breathing apparatus. The decision-maker, in case of demand different from the protective equipment generally used, determines it individually and mostly on the incident site.

3. Approach route. The chief fire officer makes the route clear for the driver, in practice, by giving him the address of fire, its separate interpretation rarely occurs. This decision is also mainly automatic, a logical choice, however, with the simultaneous approach of several vehicles, it is expedient to order separate approach routes.

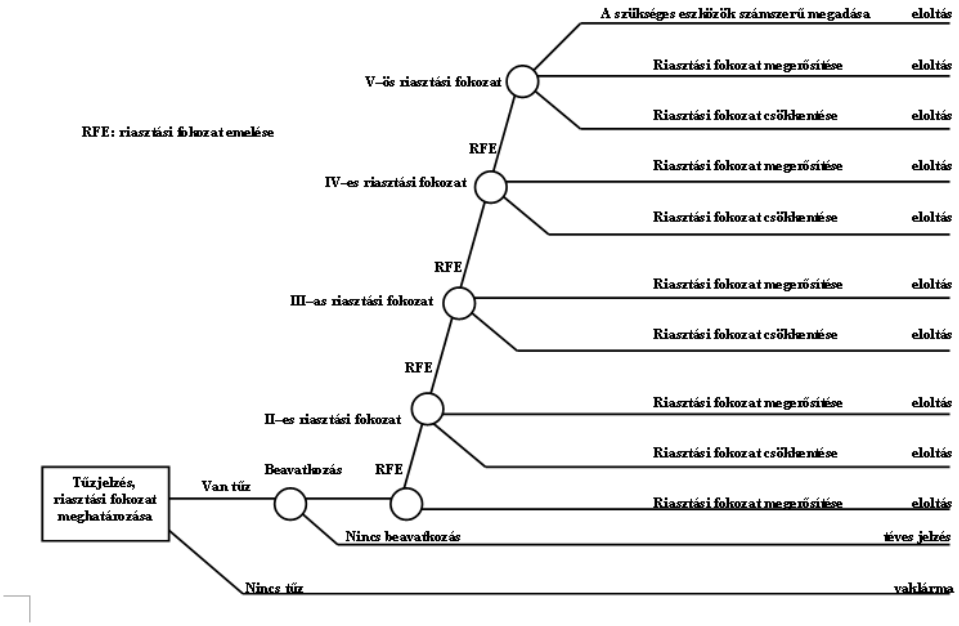

Figure 10 Decision tree of the determination of alert degree. Source: Author.

A chief fire officer is relatively slightly burdened by the above, his decision functions mainly through automatic mechanisms, often using the method of *management based on exceptions* (Restás, 2001).

[9] The draft of the modification of the MoI Decree No. 1/2003. on the Rules of Firefighting stipulates it under the Chapter *Preparation of Firefighting*.

My own experience shows that the decision incompetence of vehicle commanders may already be revealed right after the start of approach. *Stress* caused by an unknown situation may evoke human behavior, which can doubt the capacity of chief fire officers to control later processes. I have met in the system decision-makers, who were over-excited during approach. They did not help the driver in the traffic, but "controlled" him by issuing regular instructions, they cursed at other participants of traffic, swore out loud "even without reason", insulted the subordinates. Several simultaneous existences of the above elements, to my conviction, preclude the possibility that the person is suitable for the task.

2.3.2 Actions after arrival

After arriving on site, a firefighting manager has the following responsibilities, based on the Rules of Firefighting:

"A firefighting manager shall decide, based on the data of the fire alarm, the Alert and Assistance Plan and the Firefighting and Technical Rescue Plan, the personal knowledge of the site and the information acquired during approach

- *on the order to use necessary protective equipment,*
- *on the designation of the site of operation of fire appliance(s),*
- *on the selection of the modality of preparation for firefighting."*[10]

The Rules further detail and explore the above items. These are built up in a logical sequence, linked together, providing explanations, they facilitate the conceptual integration of information belonging to each group. In certain cases, the selection takes place based on exclusions, while in others, parallel options may remain. The tasks hierarchically dividable allow that the thoughts of a firefighting manager are only burdened with a limited number of information.

Some examples of parallel information from the Rules of Firefighting are the provisions for the selection of the site of operation:

"When selecting the site of operation, a firefighting manager shall take into consideration:

- *to maintain the safety of the personnel and equipment participating in firefighting, to safeguard their integrity,*

– *that the site of operation of fire appliance(s)*[11] *should not be changed if possible,*

– *the site of operation of fire appliance(s) and equipment arriving later should be ensured,*

– *the modality of resupply of extinguishing substance, the location and suitability of extinguishing substance."*[12]

An example of selection based on exclusion is the determination of the modality of preparation of firefighting:

"The modalities of preparation of firefighting

– *assembly of fire pressure hose (water, foam, powder) from tank or the use of rapid intervention fire pressure hose,*

– *assembly of base feed hose together with designating the site of the distributor and the method of feeding,*

– *assembly of feeding."*[13]

Within the selection based on exclusion there may be an explanatory guidance, within which it may depend on the given situation whether the option of further selections based on exclusion will prevail or parallel options will remain.

"*The modality of preparing firefighting shall be ordered by the firefighting manager, to assemble the fire hose from a tank if*

– *it is necessary for life-saving or reconnaissance,*

– *the danger of explosion or significant increase in damage value can be prevented through interventions,*

– *the fire can be extinguished with the tank water,*

– *during the operability of the fire hose the extinguishing agent can be continuously supplied,*

the assembly of the base feed hose if, based on our preliminary information, the operation of several fire hoses will be necessary, whose site, with the exception of that of the distributor, cannot be precisely determined,

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[10] MoI Decree No. 1/2003. on the Rules of Firefighting, item 76.
[11] Joint professional name of motor vehicles assigned to interventions, e.g. fire engine.
[12] MoI Decree No. 1/2003. on the Rules of Firefighting, item 77.
[13] MoI Decree No. 1/2003. on the Rules of Firefighting, item 78.

the assembly of feeding if our provisional information does not allow the use of previous modalities and the need for a continuing large amount of extinguishing agent can be foreseen."[14]

By preparing firefighting, we can ensure that the professional extinguishing action may start. It is stipulated by the Rules as well:

"The preparation of firefighting comes to an end when the assembly/assemblies determined in the previous item have taken place and the continuous supply of extinguishing agent is ensured."[15]

2.3.3 Reconnaissance

Reconnaissance is one of the most important elements of the process of firefighting. We gather experience on an unknown situation in different ways, mostly by our own active activity (Restás, 2006). Reconnaissance is an activity so much bound to a given situation that to limit it within strict boundaries can only be implemented by identifying and designating threatening factors and prime tasks (life-saving). After arrival, the first issue is to reconnoiter the site.

„Reconnaissance shall cover the determination of dangers to life, explosion and collapse and the presence of HAZMAT, the circumstances and environment of fire, weather conditions, and other influencing factors.

Reconnaissance shall be suitable to

- *assess the given and expected situation,*
- *select the correct solution and determine the task necessary,*
- *solve special tasks emerging during a phase of firefighting,*
- *take precautionary measures necessary for the sake of safety of responders.*

Without onsite reconnaissance no order may be issued to start intervention" [16].

[14] MoI Decree No. 1/2003. on the Rules of Firefighting, item 79.
[15] MoI Decree No. 1/2003. on the Rules of Firefighting, item 80.
[16] MoI Decree No. 1/2003. on the Rules of Firefighting, items 82-84.

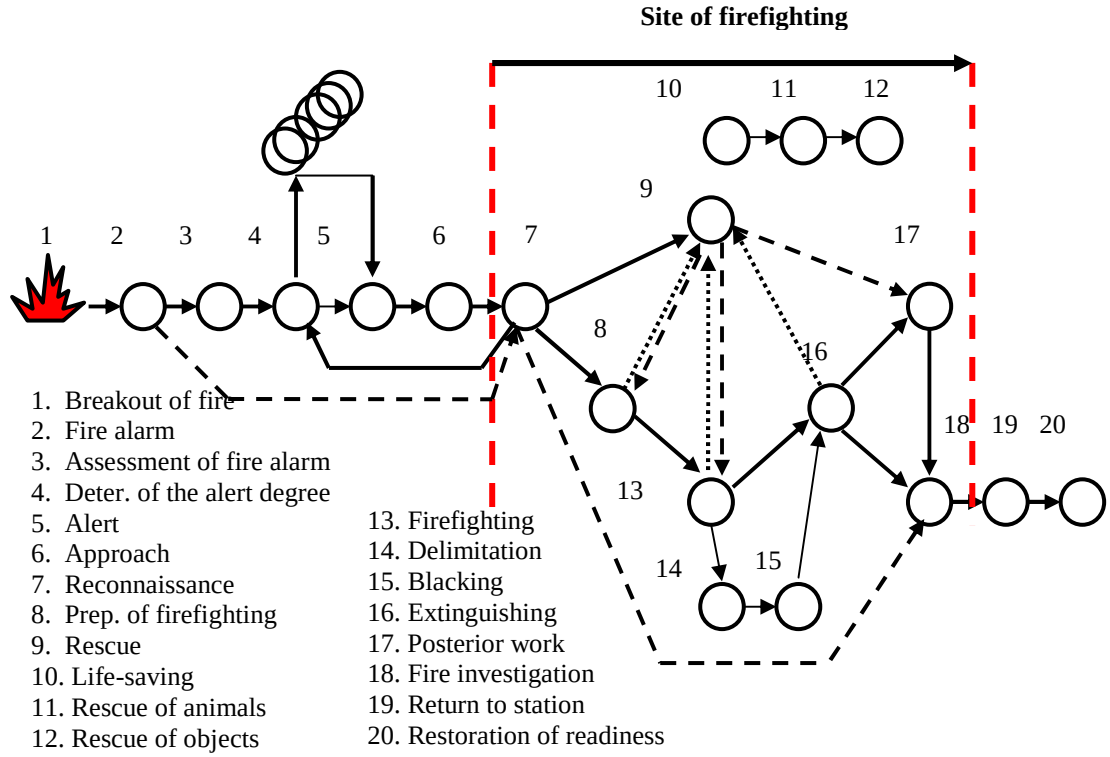


Figure 11 The process of firefighting. Source: Author.

Based on reconnaissance and collection of information, the mission may start after the information, the so-called *first feedback* is sent to the dispatcher,.

"*The first feedback includes data on:*

- *arrival, location and size of the fire,*
- *what is burning,*
- *what the fire endangers (life, possible explosion, etc.),*
- *the necessity of assigning personnel and equipment above the given alert degree,*
- *the method of intervention,"*[17]

During an intervention, reconnaissance should be continuously maintained in order to monitor the spread of fire and to keep up the efficiency of extinguishing, which is especially important in the case of large-scale, long-duration fires. A firefighting manager receives information on the development of fire through the feedback over radio transceiver.

[17] MoI Decree No. 1/2003. on the Rules of Firefighting, item 32.7.1.

This information is occasionally biased, based on the subjective judgement of the situation of the person reporting it. A firefighting manager's decisions are negatively affected by this phenomenon, including the option of wrong decisions (Restás, 2006).

As far as I know, legislators have been involving firefighting managers for a long time in the elaboration of and drafting the Rules. During this active cooperation, their written or oral opinion is asked for, also the amendment recommendations based on their daily routine. Based on all this, it can be ensured that the Rules fix the useful practical experience crystallized in long years as professional cornerstones, so, in its context, though it may seem a logical and an unmanageable set of prescriptions for an outsider; it significantly simplifies the management of the mass of information during an intervention. Since the possibilities to process the information simultaneously are quite limited (Miller, 1956), the structure of the Rules, logically built on each other, not only simplifies decision-making, but provides a guideline to implement the necessary actions.

As a summary, the provisions of the Rules do not hinder, on the contrary, facilitate and promote the decisions of firefighting managers, allowing them to continuously maintain their decision capacity.

2.4 Training firefighting managers for a special mission

2.4.1 The features of the environment of interventions

The conditions and circumstances of interventions by firefighters are quite diverse even for outsiders. To understand it, I show some examples taken from my own experience that can be set in parallel:

At the fire of a residential building generally responders can count with quite a restricted physical dimension (magnitude of 100 m^2), while at a forest fire, natural or artificial obstacles, rivers, gulches, forest roads may mean the confinement of the spread of fire. At the same time, a fire of a residential building represents a much smaller magnitude in time; usually it lasts approximately one hour in terms of

essential processes, while a forest fire can exceed a time interval expressed in days. At individual residential buildings, in general, we can count with the risk of the spread of fire spread in a limited way becoming unmanageable, depending on the environment, as opposed to *mid-high* or *high* buildings, where the possibility of spread could be catastrophic.

At a car accident, generally, we can count with only a few casualties and a usually well accessible site; at the accident of a watercraft, it is by fortune if our equipment (suitable watercraft) allows rapid intervention. An accident of a small aircraft relates to a small area, so the intervention is quite similar to the accident of a car than a disaster of a passenger plane.

The fire of a container storing carbon hydrogen should be obviously extinguished with foam, at forest fires, the use of hand tools are preferred, while with solid combustibles the choice logically falls on water as extinguishing agent. The explosiveness of propane-butane gas bottles very much depends on the amount of filling material: if empty, due to intensive flames it may explode in one minute, while fully filled, it may resist fire even 6 minutes. If it does not explode until cooling begins, we can be sure that it will no longer do so. In contrast, this is by no means valid in the case of acetylene bottles used for welding: after a certain time it is impossible to revert or stop the dissolutive exothermic chain reaction in the bottle after reaching a threshold value: due to the thermal insulation effects of silica in it, the water’s heat reduction capacity is objectively insufficient to absorb the heat released by the dissolutive reaction through the steel body.

In spite that the above are just randomly selected examples from the inexhaustible diversity of circumstances of interventions, the conclusion can be drawn that individual incidents can be relatively well defined by physical and chemical characteristics, which strongly express the possibilities and limits of interventions, also the emerging threats and risks. These features are transferred to the firefighters during training through the subject of firefighting tactics, and are repeated several times on the road to becoming a leader, in a more and more profound level (Bleszity, 2011).

2.4.2 Research and teaching of decision theory

In the course of my researches, I have studied the training structures of several Hungarian and international educational establishments, during which I searched for the answer how extensive and detailed the training is for operational and tactical responders under the pressure of time of their characteristic decision-making mechanism. In Hungary, all higher education institutes teach *management and organizational theory and/or decision theory*. Based on the teaching plans and curricula studied by me, topics important from the point of view of business actors, but up to my knowledge, generally, they do not especially deal with *decision-making* under the pressure of time.

At the Decision Theory Department of the Corvinus University of Budapest, I have found two researches and surveys, which studied the topic of decision-making under the pressure of time. Könczey's researches, although specifically deal with decision-making under the pressure of time, focus on the decisions of business stakeholders (Könczey, 2010). In his work, time factor means a constraint as far as the speed of economic mechanisms, which is different by an order of magnitude from and larger than the constraint in the domain of interpretation of my dissertation.

The other research, in the form of a monograph, entitled "Decision and Risk", is linked to Mezey's name, which was published in the program of the year 2009 "Research excellence scholarship", with the support of the Corvinus University of Budapest (Mezey, 2009). In Mezey's work, the individual decision-maker is mentioned in general, then by analyzing the *class of uncertain and risky decisions*, by illustrating with examples he primarily analyzes the decision situations of strategic and to a lesser extent of operational decision-makers. In his work, he predominantly studied decisions related to uncertainty and risk, exploring and analyzing them from different angles. We find examples of decisions on the conduct of business actors just as on the activities of military commanders or disaster management leaders. His work basically reflects strategic thinking, despite this fact, decisions under the pressure of time are highlighted, linked to *natural decision making*.

I have reviewed the training and teaching materials of decision-makers of organizations performing elimination of incidents and emergencies causing disturbances in everyday life. I rank amongst them the operational and tactical decision-makers of the Hungarian Defense Forces, the Police and disaster management, fire brigades. I have reviewed the education and training structure of the students of the Disaster Management Training Center (DMTC) of NDGDM, the Police Academy[18] and the "Zrínyi Miklós" National Defense University[19,20] (ZMNDU).

As a summary, I have witnessed that organizational and management subjects are taught in all three institutes, however, the teaching of decision theory separately is only done at ZMNDU. This latter's curriculum and teaching plan, just as at the other two, prefer the themes of classic decision theory, no deeper or more detailed transfer of special knowledge to operational decision-makers under the pressure of time. In ZMNDU's library, I found two notes in relation: Bolgár's "*Management and decision psychology*" provides rather general management theory knowledge (Bolgár, 1999); Ribárszki's *"Decision psychology"* is illustrated with several military examples (Ribárszki, 1999). The latter briefly details the decision-making mechanism characteristic of military decision-makers at two places; first, at the reference to the differentiation of four types of Svenson's decision problems (Svenson, 1993), then at the brief presentation of Klein's results (Klein, 1989). Ribárszki schematically shows the results and the method of evolvement of *recognition-primed decision*, however, compared to the special decision situation of the participants of the training, since the size of the notes limit it, these are not adequate.

Also at ZMNDU, I came across another work of Mezey: "*Decision support of complex emergency response and crisis management on the level of the Cabinet"*. It provides a wide range of analysis of the application possibilities of different decision support systems, analysis methods, their benefits and disadvantages, however, they concentrate on the strategic decision-making level in each case (Mezey, 2006).

[18] http://www.rtf.hu/index.php?option=com_content&view=article&id=313:tantargyak-tematikak&catid=66:vezeteselmeleti-tanszek&Itemid=111
[19] http://portal.zmne.hu/portal/page?_pageid=34,58611&_dad=portal&_schema=PORTAL
[20] Legal successor of the university from 1 January 2012: National University of Public Service.

In relation to the above topic, I met the work of Radnóti and Faragó, who published the results of their relevant researches entitled "*The study of risk perception and risk-taking at an armed agency"* (Radnóti and Faragó, 2005).

After studying the Hungarian situation, I have made an international review, based on which I have studied the materials accessible to me, from the neighboring countries: Croatia and Slovakia, and from distant countries: Germany and United States, and used my personal contacts.

In Slovakia, the University of Zsolna (Žilina) teaches crisis management, where an annual crisis management conference is organized (Krízový Manažment). After reviewing the earlier publications accessible under the same name, giving account of the presentations of the conference (2002-2004; 2011-2012; edited in 2012: by Novák) I ascertain that no articles deal with the decision-making of operational decision-makers under the pressure of time[21]; this was also confirmed through my personal contacts.

The facilitation of the planning of military operations in the armed force of the United States is realized within the framework of the Joint Operational Planning and Execution System (JOPES). Killion, in his work, details the necessity and the possibilities of combining conventional decision-making structure and natural decision (Killion, 2000). Within this framework, *recognition-primed decision-making* is illustrated in an adapted way in Klein's work in this regard (Klein, 1989), which devotes special attention to avoiding errors that can be traced back to earlier, apparently leadership mistakes.

The results of the research of *recognition-primed decision-making*, its utilization in practical life, is now used by U.S. on a doctrinal level as well (Killion, 2000). At the end of the 1990s, it was first tested by the Navy, where, within the framework of the program of *tactical decision-making under stress* (*TADMUS*), a specialized decision support program for the training was developed and later further developed (Cohen et al., 1996).

[21] Krízový Manažment, Zilinskej Univerzity v Ziline, Zilina; ISSN 1336-0019

My researches in Croatia[22] and Germany[23] were based on personal contacts: speaking with experts, teachers, experienced in training of firefighters, it became clear that the situation is similar to that of in Slovakia or Hungary: the emphasis is mainly placed on the education of general management skills, tactical interventions must be performed under the requirement of regulations, the previous experience of firefighters dominate in the management of the situation. In Croatia, the training is completely uniform, in Germany, it may be rather called a diverse, based on the advanced voluntary movement, but the specificities of emergency decision-making nowhere forms part of training, based on my experience. For Germany, I have found examples of publications of experience on military applications (Strunz, 2011), but this neither includes firefighter-specific recommendations.

2.4.3 My own experience

The experience of my previous work, the anomalies of preparations therefor, and my natural curiosity led to the interesting field of decision theory. As both a helicopter pilot and a firefighter, I faced everyday a situation, where, in a very short time, I had to make decisions with serious implications on our safety and the effectiveness of task execution. I feel that during my studies, I was not prepared to learn of the characteristics of decisions, the sequence of training itself did not include it, now I know that its drafters were not sufficiently aware of its importance of its or background of mechanisms. The latter is obviously proven by the fact that the determining milestones of researches in relation date back just a little over twenty years (Klein, 1989; Gruner, 1990; Schmitt, 1995; Krulak, 1999 and Killion, 2000).

My natural curiosity, the permanent dissatisfaction with my own work's efficiency, the negative consequences caused by the mistakes I made, the intention to avoid stress, and the contradictions between what I had learnt and what I had experienced in reality have led to look for the reasons of my own deficiencies and "*non-existing capabilities*" and also to correct them.

[22] Personal consultation (7 January 2010, Zagreb) with Mladen Vinkovic, senior official at DUZS (Croatian Fire Service) and instructor at the Croatian Fire Training Center.
[23] Personal consultation (22 May 2010, Athens, FireSafe Europe, InterAigis Conference) with Dr. Dieter Nüssler, President of FEU (Federation of the European Union Fire Officer Associations).

This gave me encouragement and guidance to more profoundly explore and investigate the circumstances of executing tactical tasks of those under constraint.

Like most kids, I wanted to be a pilot, too. My endeavors in this direction were successful, and after my high school years, even though I had the chance to study mechanical engineering as well, having chosen a military career, I was trained to be a helicopter pilot. A very thorough theoretical preparation preceded flying training, and many elements were drilled and acquired by us, such as the so-called necessary movements, a series of actions in "*special cases*"[24], of the type "*I must be able to recall it even if I'm awakened from my deepest sleep.* This type of knowledge, such a deep level of knowledge of professional skills and regulations are necessary for the safety of pilots and the lives of entrusted to them. It can be said of the flight rules that they were enforced by the experience of previous accidents, disasters, and by a multitude of lives lost, in the language of aviators: "*written in blood"* (Barlay, 1990). All of them were very strictly re-checked, unimaginable in everyday life, day after day, even from the beginning of flying training, sanctionable even by banning from flying.

The so-called *training*, *practice* and *operational tasks* of military flights are different from each other, so the preparation is done separately. The readiness of pilots is checked before each flight on various levels. If there are doubts about the quality of preparedness, the correctness of decisions, a pilot may not start his job. The checks are very strict and they include the knowledge of actions, in some cases, different from planned. This may include, for example, when due to the change and worsening of the weather, you need to cancel the task and choose another airport, or perform a forced landing because of an equipment failure during flight. In this case, the tasks different from normal procedures, *must be known "by heart"* and a pilot must be able to properly decide, considering safety requirements.

The effect of conditions on our decision-making capability, changing in the course of flight, can be justified with instrumental tests. The so-called *Balaton* device is used for the quantified measurement of mental performance through aero-medical

[24] Umbrella term of problems occurring during flight, mainly of technical origin, because of which the implementation of a flight plan must be altered in a certain form for the sake of safety.

examination. This instrument was used during the space flight[25] of the first Hungarian astronaut, Bertalan Farkas (Horváth, 2008). As a general view among flight instructors, we all agreed what we know on the ground to 100%, we are able to recall it in the air to 50% maximum. Therefore, it was important to learn correctly and know all scenarios on the ground.

There was a particularly interesting experience of the above, because in the school-based training, no reference to the specificity of our decisions was made, during the exercise of our future profession, during teaching of classic management and organization theory, we could hear only of it through the reports, memories and stories of mostly older pilots having experienced the trials.

In the course of my flying career, I had so-called *special cases* at several occasions, failures of the radio and navigation system and various instruments and generators, which never caused a major problem using the procedures provided for (or avoiding their violation). By the grace of fate, I could survive an air accident, in which, during a close-to-surface flight at low altitude (15-30 m), water reached the engine of the helicopter, flow by me, from a high-performance irrigation device. I had to shut the engines down and perform a forced landing. The experience of these individual cases are typically kept in mind, some of their moments (and generated effects) apparently accompany us until the end of our lives. I remember as the performance indicators of the engines of a helicopter, after a big bang, with a characteristic sound, immediately and dramatically began to fall, then the warning panels of connected systems, dropping under the critical values of their proper operation, turning red and with a booming noise, started to flash. The above phenomena lasted maybe two or three seconds, with the spatial position becoming uncertain, while recognizing the situation, I, nevertheless, started thinking, to a flash of thought, how I could make the engines functionable again as soon as possible by “in the air start” (from battery) and to save that can be saved.

[25] Space flight aboard Soyuz-36 between 26 May and 3 June 1980.

I certainly estimated less time than a second for the latter period, quite literally, it could have lasted a fraction of a second, I still do not think that I could not have done it! With the recognition that our situation was doomed, I focused my attention to balance of the helicopter, the reduction of speed and coordination of its landing position. After landing, the chassis of the helicopter broke; it tilted losing its balance, then slipped capsizing over its longitudinal axis, and nearly after 80 meters, stopped, turning on its side. Upon arrival at the ground, I did not have any possibility to influence the events. Recalling the events, my thoughts were occupied with the expectation that due to some involuntary physical effect, I will immediately feel strong pain, see blood spurting, and, obviously, I will not survive this accident. However, I could get out of the wreck intact, thus praising the excellent work of flight engineers.

The background that I had to perform a procedure based on learned, automatic series of movements in a moment, from normal position, it went on problem-free, regardless of the outcome of the incident, mechanism of the decision has never left me relax. Dealing more with the issue, as a bitter historical irony, having received a role in the advanced training of firefighters, I was able to teach the rules of interventions following aircraft accidents and disasters.

I started my firefighting career in Miskolc. I could have had the chance to find employment at other professional organizations as well, however, despite the fact that the circumstances of the fire service were the worst, spectacularly, somehow, at first glance (by intuition); the *adrenaline* was here, which, I thought, I would enjoy.

The work of firefighters is effective if can begin the intervention as soon as possible. To do so, after a fire alarm, one has to depart from the station as soon as possible. As a former soldier, I classified myself among those who are immediately able to reach the readiness status ready to march. Despite this, I wondered, on my first day on duty, during a conversation in the courtyard, having been alerted; the firefighters standing around me disappeared in a moment in order to take their position in the appliance and pit on their protective garments.

These are drilled, automatic series of activities that may ensure the preservation of the lives of others. In the organization of the Disaster Management Training Center, I participated as a senior lecturer in the training and examination of firefighters, at different levels. There were extreme cases at two different examinations, having virtually identical characteristics. The “exam funk” is a general phenomenon, observed also in adulthood, to conquer which the examinees establish themselves different mechanisms in the course of time, but can also get expert help in this regard (Márton, 2010). At the exam closing the training entitling firefighting managers with competence, I met two students at two different times, who were more excited than a normal funk. A very white complexion, tremors, uttering speech could describe them. Previously, during teaching, none of them occurred, at least I did not notice them, or they were not unusually striking in the case of either student.

If persons who is forced to take immediate decisions in crises, based on a theoretical experience and the experience of previous periods, the tasks resulting from success-oriented examination create such a stress situation, the question arises: how would he solve his tasks in a real emergency. Based on the decision of the examination board, the performance of each student has been approved, leaving me in doubt, even today, how they can do their jobs today.

The conclusion can be drawn from my own experience that there is no training of the characteristics of emergency decision-making mechanism, in terms of leadership (management) theory and decision theory in the various fields. They are being experienced in practical life, and are also automatically applied. I have further conclusions that this automatism certainly helps our decisions to be made quickly even when we are not or cannot be really aware of it; on the other hand, this very well (and automatically) operating support results in to not pay more attention to the characteristics of the decision mechanism. Notwithstanding the foregoing, however, the training system itself allows inclusions to remain, which certainly represent a latent source of danger based on the *method of expert assessment*, either for responders or for those waiting to be rescued.

2.5 The operational failures of analytic decision support mechanisms

I presented at earlier historical examples that as explanation of the success of military leaders, historians, the decision-makers themselves or the researchers mention a certainly *special decision procedure,* elusive since a long time, or difficult to describe (Clausewitz, 1984, Duggan, 2002). The vague wording certainly suggests that neither the generals nor the descriptors of their success did know its background, mechanism, clean and clear explanation. Despite this, however, exactly these specifications show that the applied mechanism has existed and worked well since ancient times.
I pointed out that to suspend or stop battle actions is impossible after launching it, however, to direct and continuously monitor it is essential (Cohen et al., 1999). This means for the leaders a continuous *time pressure decision-making*, i.e. *emergency decision-making*, considering the enemy's intentions as well.

With the technological development and a consequence of the effectiveness of economic models, adapted to *analytical thinking* (JOPES[26]), e.g., in the period of the Cold War, in military planning, in addition to strategic tasks, to the level of tactical tasks as well (Killion, 2000; Wolgast, 2005). I can see in its background that with a sudden increase of computing possibilities, the process and assessment of the mass of information available was drastically reduced in time. It was used by both a military and economic actors using the opportunities offered by information technology. Successes achieved in economic life and the Cold War becoming permanent on strategic level and limited to problem solving, logically resulted in that problems with an analytic solution supported by computers, became customary and extensive practice on lower levels of management.

The mass of tasks necessary for strategic problem solving is done by computers in a short time, with the use of different pre-designed algorithms, they, so to speak, shorten so much the time of executing a strategic task that they become applicable by the decision support systems, even at operational and tactical levels.

[26] Joint Planning and Executive System

The statistical ratio of live situations, relatively rare, provided that the number of possible erroneous decisions (and losses, damage value) remain below a tolerable threshold, that is, not to be a constraint for action from the part of senior decision-makers.

I confirm the complete expansion of the mechanisms of classic decision-making by the themes of educational materials studied, by an exclusive strategic approach of higher-level command training, using the multitude of decision support systems on all decision-making levels and by the view to operational planning in military doctrines (e.g., JOPES).

Despite the fact that the military budget facilitated the introduction of, in many countries, the most advanced computer technology, and does it possible today, still wrong solutions were made by applying them in some cases, which drew the attention to the limitations of analytical decision-making and the need to explore mechanisms actually functioning (Krulak, 1999).

It was always an incident that incurred some very serious consequences, drew the attention to the weaknesses of conventional decision-making. One of the failures of *computer technology-assisted decision support* was the nuclear accident at Three Mile Island. During the analysis of the incident near Harrisburg, Pennsylvania, United States, on 28 March 1979, in addition to technical problems and the inadequacy of training, the limits of human capabilities were shown, especially the possible erroneous interactions of computer operations (Killion, 2002).

A serious military error drew the attention to the necessity, no longer delayable, of a more thorough examination of specific decision mechanisms, as a cornerstone. During the armed conflict between Iraq and Iran, on 3 June 1988, the *USS Vincennes* cruiser, stationed in the Persian Gulf, shot down flight IR655 of Iran Air, bound for Dubai from Bandar Abbas, with two guided missiles. All the 290 passengers, traveling on board, were killed. Studies have shown that although the soldiers acted in accordance with normal procedures in place aboard the cruiser, their action did not meet the expectation what decision-makers should be able to do, in the rapidly changing situation, to accurately recognize the circumstances and correctly decide

based on them. During the entire decision-making process, from the detection of the aircraft, through the attempt to identify and contact it, the report to the commander, its re-check, up to the issue of the order to fire a total of 3 minutes and 40 seconds passed (Roberts and Dotterway, 1995). Gruner analyzed the problem from a point of view of decision-making as well, and led its cause back to human limitations concerning computer technology, developing rapidly, and the processability of information offered by it (Gruner, 1990). We are all witnessing today as well the dynamic development of the former, while the latter is said to be almost static, even in the prospect of thousands of years (Hutchins, 1996).

Civilian life also proves with a multitude of examples that our situation assessment, based on our own experience, is sometimes better than to follow the rules blindfolded. Bruce defines his experience in the field of health, when he assisted a passenger on board who became ill during flight. Although it would have been compulsory to follow specific rules, he relied on his intuition and deviated from the rules of protocol assistance due to the personal (eye) contact with the patient. His belief proved to be valid during a posterior examination, supported by instrumentation, according to which the use of standard procedures would certainly have been inappropriate in the given situation. According to Bruce's assessment, a *patient's sight is worth 1,000 times more*[27] than a diagnosis put it into words (Bruce, 2011).

Based on Radnai's work, we can mention examples in Hungary as well on the study of emergency decisions in the field of health care. He analyzes the subject of decision-making processes in emergency care, in terms of quality. In the background of his findings, there are the techniques of *triage*[28], derived from emergency medicine, in which, based on previous experience, *we allocate "scarce resources to high priority patients, and withdraw them from low priority patients, or from those who are hopeless*." (Radnai, 2011).

[27] Bruce, E. (2011) "*A Picture is Worth a Thousand Words – at Least"*
[28] Word of French origin, meaning to select, to sort. The philosophy behind it was first used by the field surgeon of Napoleon, Dominique Jean Larray (1766-1842).

The above examples clearly show that situations can easily be found in the field of health care as well, when emergency decision-making is based on past experience and thus, we may (or in the lack of resources we must) neglect conventional protocol procedures to the standard protocol procedures.

Literatures mention in the following case as a basic story of Klein's work, in which firefighters approached a fire in a residential building, and during the extinguishing process, the firefighting manager suddenly withdrew his team, without reason visible to others. In the story, after the approach, in a couple of minutes, the whole house fell into flames and collapsed helplessly (Klein, 1999). Based on what the chief fire officer, acting as a firefighting manager, foresaw that his men would drift into deadly danger, they could not formulate precisely. Klein, in his works, although focuses on the research of military decision-making as a psychologist, he regards the firefighting experience mentioned above as a typical example of this specific decision-making process, so that there is hardly an expert who would not refer to this case.

The proper interpretation of the above fire in Hungary, professionally also requires the reconsideration of building habits that considerably characterize the circumstances of the given case. The incident occurred, described by Klein as an example, in a light structured wooden building, where the flames reached the basement from the kitchen as well, through the ventilation system. Based on recall of the chief fire officer, the fire spread despite the high extinguishing intensity, so knowing the properties of the timber-structured building, the decision-maker really did not have any other professional choice as to withdrawing his men. In Hungary, the vast majority of houses are built of non-combustible materials, so one does not have to fear similar incidents as above, i.e. the house becoming engulfed by flames, or with a more precise professional wording, we should anticipate different incidents.

The following example also shows the tactical differences in extinguishing residential fires: in Hungary, the use of piped gas is predominant for cooking, while in most parts of France or Switzerland, electric heating is almost exclusive. While in Hungary, a problem of gas leakage may occur at any time, it is virtually ruled out in the above countries, but the danger of electric shock may be greater.

2.6 Summary of the results of the chapter

In the first part of chapter I performed the *decision-specific elaboration* and *analysis* of *damage value - time function*. I proved, based on analysis, that the purpose of more efficient professional decision is not for itself, the means to society a real value-creating "*investment*" (*creating saved value* and *reducing damage value*). Since the function is a fundamental cornerstone of the education of firefighters, its decision-specific adaptation can promote not only understanding the objectives of the dissertation, but also the use of its results in education.

I explored in the next subchapter, what kind of essential difference exists between *professional efficiency* and *economy-aspect efficiency*, and these may represent interests can even conflict with each other. I pointed out that the current system handles decision-making as a static fact and does not take into account its significantly influencing affect on the outcome of the intervention. Based on my conclusion, if we are able to professionally more efficiently apply the means available, with more advantageous decisions, i.e. to reduce damage value and increase the value saved, it is logical that we increased the rate of economic efficiency as well. In other words, the decisions of the person responsible for the management of fire fighting are not static, but dynamic factors significantly affecting the economy-aspect efficiency.

After the above, I examined the process of firefighting based on the valid *Rules of Firefighting*[29]. I found that it *records practical experience as professional corner points*, crystallized over the years, logically structured in its context and significantly simplifying the management of information during an intervention. I referred to the limitation of the possibilities of the simultaneous process of information, I pointed out that the structure of the Rules, logically built on each other, not only simplifies decision-making, but *its points also provide guidance* for the implementation of the necessary activities.

[29] MoI Decree No. 1/2003. on the Rules of Firefighting.

Overall, *the provisions of the Rules do not undermine, but on the opposite, rather promote and facilitate the decisions of firefighting managers, enabling the continuous maintenance of his decision capacity.*

The subchapter on the training of emergency decision-makers is divided by me into three parts: first, I pointed out the characteristics of the *work environment* of decision-makers, to what extent they are complex and complicated. Second, I examined the *quality of training* for the tasks to be performed in this special work environment. On this basis, I concluded that they do not sufficiently address, neither in the domestic nor in the international environment studied, the *peculiarities of the decision mechanism*. Finally, as last, based on my own experience as well, I concluded that there is no preparation for the characteristics of emergency decision-making mechanism from a management theory or decision theory aspect, in the different disciplines, we experience them in practical life, and then automatically apply them. My further conclusion is that, first, this automatism certainly helps us make quick decisions, even at a time, when we are or can be aware of it, on the other hand, exactly this well (and automatically) operating assistance results in not having to devote greater attention to the characteristics of the decision-making mechanism.

In the next subchapter, I pointed out that the complete penetration of the classic decision-making mechanism can be justified by the syllabus of training materials under consideration, with its exclusive strategic approach of higher-level fire officer training, by the use of decision support systems that proliferate on all decision-making levels and by the approach of operational planning, stipulated in military doctrines.

Notwithstanding the foregoing, advanced decision support systems can cause serious problems, highlighting the need that in the case of emergency decision-making, based on experience, certainly well-established mechanisms have been studied and more thoroughly understood, its opportunities exploited for thousands of years.

3 RESEARCHES BASED ON MY OWN SURVEYS

3.1 Research methods

I excluded the possibility of applying quantitative methods for researches, based on own surveys, due to the special topic of the dissertation. The main reason is, firstly, that there are no databases available to measure of effectiveness of emergency decisions, based on which they could be directly analyzed, on the other hand, I could not have adequate resources to set up databases, already used and derived from existing databases for the dissertation, for objective reasons.

The topic of the dissertation, in Hungarian circumstances, are researched in a quite unfairly incomplete way, due to which, in the selection of the method, I did not feel a guiding trend, generated by earlier results, however, the study methods of available international literature (Klein, 1989; Wolgast, 2005) and *my research intuition* also proved the application of qualitative methods more advantageous. This fact also confirms the latter that in the focus of the dissertation there is an analysis of the *process* of emergency decisions, i.e., a mechanism, difficult to quantify, rather than then study of the *effectiveness* of decisions, which concepts are not far apart from each other, but the quantification of the latter would have been obvious easier.

From the qualitative methods, I used basically four. One of them and perhaps the most important, inspiring the writing of the dissertation is the formulation, systematization and interpretation of my own experience. The other is the analysis and assessment of the existing literature and basic sources. As a third method, I applied the elaboration of an essay, prepared by the members of a group of firefighters, while the fourth, an association study was performed by me, based on themes prepared by myself.

In the previous chapters, I presented my conclusions, deducted from the literatures, and gave account of my own experience, relating to my earlier works. In this chapter, I describe the method of processing the essays, as well as setting up hypotheses

necessary to implement my association studies, objectives and results of my studies, and the conclusions that can be drawn from them.

3.2 Participants in the research

A substantial support for my surveys at the time of my researches was the fact that I was in regular contact, as an invited lecturer, with the *Defense/protection administration specialization* students of ZMNDU, being trained in Ózd. One of groups consists of correspondence, senior (third year) Bachelor of Science students studying at the *Fire protection specialization*, performing full-time professional service as firefighters, while the composition of the *Disaster management specialization* students, in terms of studies, was quite inhomogeneous. I held lectures to each group on topics related to firefighting tactics, weighted rather for firefighters (e.g., *Firefighting tactics I, II, III*).

Due to my responsibilities as a teacher, it used to be my duty even earlier to give the students tasks that helped their preparation, on the other hand, made it possible to recheck the learned material. Students in order to fulfill the requirements of the first semester, must submit interim studies; an instructor receives a relatively free hand in the determination of the topics. In the *academic year 2011/2012*, without prejudice to any of the university rules, nor the implications concerning the ethical aspects the students, I used this opportunity in a way that as one of the developers of the themes, I prescribed for my Fire protection specialization students to *elaborate the firefighting manager's decisions*. I determined the method of using the format of an *essay*, all other aspects were freely chosen (case study, elaboration of self-experience, opinions, etc…), but I limited its extent for reasons of expediency, minimum 3 pages and maximum 10 pages. The grading of the materials submitted, according to central requirements, was limited to *satisfactory* or *unsatisfactory levels* (no numeric marks), thereby I could avoid the consequences that would affect the result, i.e. a pressure on the students greater than the minimum needed for the study, in a way otherwise not to be followed. By ensuring the widest degree of freedom, I was specifically interested in the spontaneous, free expression of opinions of the students.

Another part of my research aimed at carrying out an *association study*. To do this, I invited students of both the Fire protection and Disaster management specialization, on a voluntary basis. I was essentially curious about the results of the Fire protection specialization students; however, I used the students of the Disaster management specialization as a control group. The results of the association studies can be evaluated by themselves, that is, they do not require comparison or the use of a control group, however, one of the aims of my research was to precisely show the difference between the immediate reactions of those familiar, to a certain extent, with theoretical knowledge of the discipline, but as yet having no practical experience and deeper knowledge. Thus, the application of the control group seemed logical and expedient to achieve my objectives.

3.3 Analysis of an essay freely compiled

3.3.1 Analysis of an essay freely compiled as a research method

It is well known that it is difficult to define the genre of an essay. Those attempting to do so will certainly fail (Kerner, 2009). Bakó's opinion is that "*it is easier to define what an essay is not than to compact it in one sentence*" (Bakó, 2002). Due of the nature of the genre, essays have several divisions, groupings, however, the reflection is a common feature of all (Gyergyai, 1984), that is, its author freely explains his own views on the subject, which can shift even in the direction of self-expression and self-confession (Szabó, 2001).

According to Samuel Johnson (1709-1784), an essay is no other than "*The free flow of thoughts of the mind, a single raw work, it is not an orderly, organized work.*"[30] The analysis of the free flow of ideas is obviously not easy; however, there was a need for this spontaneously appearing expression of opinions for my researches. I was curious about the information on qualitative processing, in which firefighters with more or less experience mention the difficulties of their own decisions and of their companions, and their specialty.

[30] http://hu.wikipedia.org/wiki/Essz%C3%A9

I wanted to draw up characteristics from them, which are able to generally demonstrate and express the difficulties, the circumstances of one of the specific types of emergency decision-makers, of firefighting (rescue operations) managers.

The analysis of various written works is a commonly used method; the analysis of literary works, poems, novels, etc… is well known, which we all were part of during school-based courses. The analysis of an essay is a widely accepted qualitative research method, during which we can acquire logical conclusions, and general statements can be made (Miller and Fredericks, 1994, McLean et al., 1997, Kerner, 2009).

The comparison and critique of the application of qualitative and quantitative methods can be a subject of discussion in individual cases amongst researchers, which is studied and analyzed by McLean and partners in their work entitled *Qualitative Research Methods: An essay review*, in five chapters (McLean et al., 1997). The work gives an overview of the development of the methods, details, amongst others, the application of the theory of *qualitative confirmation* (Carnap, 1962, Hempel, 1965), providing guidance to the non-quantitative research strategies, grouped in items, and in several topics, it confirms, supplements, explains or perhaps disputes the ascertainments of the work with a similar title by Miller and Fredericks (1994): *Qualitative Research Methods: Social Epistemology and Practical Inquiry*.

I found a summarizing analysis of the comparison and concentration of methods amongst Hungarian researchers in Juhász's thesis (2008). The depth of the difference in opinion between the followers of the methods capable of supplementing each other is shown by the fact in the above work of Miller and Fredericks preferring the qualitative study method they even doubt that the quantitative data gained through experience can be regarded as really quantitative and also the questions relating to reliability and validity can be decided exclusively in a quantitative way (Miller and Fredericks, 1994).

Several researchers (e.g., Smith and Heshusius, 1986, Wolcott, 1994) call the attention, in the same way, to the weaknesses, perhaps uncertainty of qualitative methods, furthermore, Shinbone confirms the possible changes in the fulfillment of the hypotheses depending on the number and quality of evidence (Swinburne, 1973). In order to reduce clear uncertainties, I found suggestions with almost all the authors dealing with the method, but even organization-like examples on guidance, the latter can be a 10-element series of evaluation questions for the *CAS Program*[31] for the assessment of qualitative studies, the former is the *four-item research strategy* developed by McLean and others (McLean, 1997).
Considering the above, the justification of the qualitative method when analyzing essays, is apparently not disputed; both Hungarian (Lehota, 2001, Juhász, 2008) and the international literature clearly demonstrates its applicability and uses it as well (Miller and Fredericks, 1994, McLean et al ., 1997).

Applying the method of analyzing essays, I share Thorn's (2000) view that a researcher following the qualitative method "*does not always exactly know what and how to ask, but entrusts himself to the characteristics of the phenomenon researched, lets it control the research according to its own internal logic*" (Juhász, 2008). It is not the undemanding state or lack of interest qualifying the preparation of the research, but on the contrary, it is a predictive factor, which allows to ensure the extent of freedom, which the researcher needs (in this case the author), for the sake of achieving the goals of the study. With response to this thoughtfulness, I wanted to take advantage of the freedom of opinion of firefighters by ensuring the extent of freedom provided by the essay during the research, and based on the above, and by the possibility that is proven suitable, researched by others.

3.3.2 Applied method of analysis of the research hypotheses and the essay

Research hypotheses

Considering my own experience, explained in the earlier chapters of the dissertation, and my previous statements on the teaching of the fields of management and decision

[31] CASP- Critical Appraisal Skills Programme – making sense of evidence

theory, I undertake the following assumption: **Based on my hypothesis, students will give account of a variety of knowledge, but I rule out that complex answers or solutions would be given on the context of special decision-making characteristic of their work, taking into account the formal education framework.**

Using also the well-known regularities of my own experience, as well as of the adherence to practical activities, repeated many times, I have another assumption: **based on my hypothesis, the cornerstones of practical experience will be outlined from the content of the essays and the factors will be formulated that affect or limit their decisions in the most disadvantageous way.** I regard it as a clear result, if emergency or the related notion, **limited time** in a commonly understood sense, appears in the papers predominantly and in large numbers.

Method applied for the analysis of an essay freely compiled

In order to perform the analysis, 13 students of the Fire protection specialization, having several years of practical experience, submitted essays feely compiled. The least experienced person had been a firefighter for five years, the most experienced one for 24 years. Most of them, based on engagement, had gained significant experience in the management of firefighting before. Their task was to formulate a short essay (minimum 3, maximum 10 pages) on their experiences and lessons learnt relating to their decisions made during interventions, everything or anything that pops up in their minds, freely without limits. The fact that I did not give them any other restrictions or guidance, I intended to ensure the broadest possible framework for their free and spontaneous expression of opinion.

They received a one-month deadline to write their essays. 12 papers were sent on deadline; 10 could be evaluated by their quality; 2 were obviously completed with minimum targets in mind necessary to meet the requirements of the semester. The shortest content without compulsory elements (front page, contents, declaration on own sources) was expressed in 3 pages (2 essays), but there was an essay exceeding the maximum (1 essays with 11 pages of content in merit).

The average extent of the content in merit of the papers was 6.4 pages. All essays, as a compulsory element, also contain a declaration, by which the students certify that the material was compiled by themselves.

I referenced marking with at least one but no more than two codes during my analyses, after each core or specific findings, as justification, but in cases where they are acceptable and easy to retrieve from the papers, clearly as the opinion of the vast majority of students (reference to e.g. time pressure or professional experience), I did not see the need.

I store and safeguard the completed essays, bonded together in my library, to ensure the authenticity of the study. I can show them to anyone on request. I assure the retrievability and the factuality of data and findings in the essays by assigning a code sign to the students in my dissertation, generated by a separate system, providing anonymity (using the abbreviated version of the *Neptune* code of the students, giving its *first three signs*). This ensures the retrievability of the respondent if needed, without prejudice to the personality rights of the students, but the reference may remain anonymous in the dissertation.

3.3.3 Results of the analysis of essays freely compiled

The content of the papers is a good lesson learnt for a variety of reasons. Students refer, in almost all the cases, to classic, founding psychological, sociological, management theory, decision theory knowledge, studied earlier. Thus, the role of *Maslow's needs hierarchy* (DPF) and of *stress* (D5C, SX9) influencing decision is available in field of psychology, the 1920's *feature theory* (DPF, BYM) characterizing the topic of management theory, however, from a developmental point of view, by this it ends vividly with the *style theories* associated with the names of Lewin and Likert in each case! One paper referred to my earlier elaboration (Restás, 2002) relating to the topic (D5C). Based on the above, it shows from the essays that the training of firefighters in subjects like management (leadership) or decisions did not keep pace with the teachings of later schools; they end with the style theories preferred in the 60's.

As one of its obvious reasons, confirmed by my own experience as well, an explanation can also be found or understood in the writings. It regularly appears in the papers that firefighters, while performing their 24-hour duties, live their lives permanently "locked up", radically different from other types of jobs. This affects their mood and daily activities to the extent that it is desirable in a normal operation, and the importance of democratic leadership style, culminating in style theories is over-emphasized compared to autocratic requirements expected at incidents (G87, FEG). This is, of course, logical from the point of view that firefighters spend most of their time, after all, without interventions, in a "normal" working regime imposed on them.

In addition to logical explanation, I tried to resolve the above contradiction in another way. As set out in the essays, I prove and support with my own experience the view that the position of a chief fire officer, in charge of the management of the daily service, qualitatively changes when a incident occurs, that is, his responsibility is twofold: first, as the manager of daily tasks (as chief duty shift officer[32]), because of the period spent in close existence, there is natural significant demand against him for democratic leadership, while at incident sites, as a person managing intervention (firefighting manager), the application of command-and-control management method is inevitable. This latter finding can be consistently demonstrated in military decision-making, from the works of both Hungarian (e.g., Ribárszki, 1999 and Mezey, 2009) and foreign authors (e.g., Wolgast, 2005; Strunz, 2011), but examples to firefighting interventions can also be found (Bleszity, 1989; Cziva, 1999).

To resolve the above, that is the differences between the decision-making position of a chief fire officer, responsible for the daily management and at the incident sites, however, I have not found a clear separation or an indication thereto in the essays, judging from the papers' contents, the students accept it as natural functional characteristics of the organization. Based on my own experience, this duality is resolved by the quality change. The denomination of the group leader is *chief duty shift officer* until arriving at a fire. By starting the intervention, he becomes a

[32] Senior fire official responsible for performing and controlling the daily standby duty shift.

firefighting manager, by the force of law[33]. This has a significant role, because due to this quality change he acquires not only a managerial role, but also receives the right to be able to even restrict constitutional rights (personal freedom, property rights, etc.)[34].

Along with granting constitutional rights, however, the law[35] imposes obligations on the firefighting manager, whose stringent performance is inevitable to meet the technically proper implementation of the intervention. Therefore, special requirements are clearly spelled out in the papers against a firefighting manager. These show that *students attach primacy to professionalism*, to which the link *the hands-on experience* (SX9, BYM) or explicitly or implicitly express it the context of their message (BJS, C84). This primacy can be attributed to two factors fundamentally interrelated, one of which is the *constraint to decide*, emphasized in almost all cases, the other is the *time factor*, declared in all the papers, without exception. They set out counter-examples consistently conflicted to emphasize experience, in which they present the lack of professionalism (BJS, C84), or refer to its impact causing inability to decide (G87, PDS).

They show the effects of the start of an intervention, influencing the efficiency of the entire firefighting in different ways, but all mention professional experience and time factor:

- *„I think this is the moment when the success or failure of the elimination of the incident is decided. Most depends on the first 3-5 minutes"* (BJS)
- *„there is no time or possibility for compromises, one has to act immediately"* (RWL)
- *„ (a firefighting manager) has only minutes, moments to make his decisions."* (RWL)

[33] Act XXXI of 1996 on the protection against fire, on technical rescue and on the fire service, Sec. 7, par. (1)
[34] Act XXXI of 1996 on the protection against fire, on technical rescue and on the fire service, Sec. 7, par. (1), and MoI Decree No. 1/2003. on the Rules of Firefighting, Annex, item 31.
[35] MoI Decree No. 1/2003. on the Rules of Firefighting, Annex, item 32.

- *„we feel the decision is burden on us as we approach the irreversible moment”* (PVR)
- *„ (the personnel) having arrived at the site faces the facts. The majority of our static decisions are discarded, dynamic decision processes commence.”* (DPF)
- *„it is essential that (a firefighting manager) assesses the situation in a short time and not be protracted in issuing instructions”* (SX9)
- *„the chief fire officer on site has only seconds and in many cases little or misleading information to make his decision.”* (D5C)

They search for solutions in the essays to clarify and explain the features of decision-making without any request. Thus the attempt to establish a static division of decisions (e.g. drills) before an intervention or dynamic division at the incident sites can be found (DPF, SX9), the static arrangement of decision support tools (BJS), the scrutiny of the conceptual differences between decision and selection, keeping in mind time factor (PVR, SX9), the gradual learning process (G87), but also the evolvement of programmed and routine decisions (RWL, FEG).

3.4 Aggregated results and the verification of the hypothesis

Summarizing the above, I ascertain that firefighters clearly know their special decision situations, that they are forced to make them under time pressure even if its expression or appearance can be quite different in each paper. Despite this fact, or exactly because of the significant differences, it is obvious, however, that they are not able to create a uniform image or provide satisfactory explanation to its real background.

The above facts justify my hypothesis, according to which the students' knowledge is considerably diverse; however, they do not know the interrelations or the background of their special decision-making, characterizing their work.

The activity of firefighters, the primary aspects the circumstances of intervention are quite distinct in the essays and can be expressed as follows:

As the primary aspect of interventions, all unambiguously identify *lifesaving*, but *safety* (C84, D5C) and *professionalism* (RWL, FEG) are also present. There is a firefighter, who pairs safety with *special knowledge*, *experience* and *routine* (SX9), and there is another one, who attaches a greater role to avoiding *stress* (C84, D5C).

It is unambiguous that they regard as important the role of the *knowledge of the site* (BYM, G87) and *„clairvoyance"* as well, the ability with which they comprehend the site and the given situation (D5C, RWL). It is remarkable how important role they attach to calmness by using different expressions like *„laid back"* (BYM), *„cool head"* (DPF), which obviously refer to the danger of their opposite as well. To explain it, I could list my own experience as well, but the statement may be experience, in which one expressed: *„It is important that it is not events which should drift the personnel, but the person in charge should control and direct the activities on site."* (G87)

The inevitability to comply with the law is mentioned in 7 essays, 6 out of them tried to emphasize it by copying the rights and obligations of a firefighting manager stipulated by law word for word. This strict compliance with the law, also justifiable by other researches, is obviously characteristic of all order-controlled organizations (e.g., Mezey, 2009). Despite the above fact, we can see in the essays some examples of forced but conscious and necessary infringements of rules:

„One may not order something that is against the law. My personal opinion is that some exceptional cases, however, may give reason not abide by the rules. These may be cases when all the experience and individual skills of a leader are necessary in a given situation to be able to find a solution, which legislators could not have in mind or it is not properly regulated." (BYM)

As a summary of the above, I ascertain that my hypothesis, based on which the cornerstones of the practical experience are highlighted by the content of the essays, and all the factors conceived that influence or limit the decisions of firefighting managers the worst, is fulfilled.

My assumption, according to which the role of *time* is sensibly predominant, even by expressing the concept of *constraint* in different ways, can be justified in each essay.

As a circumstance influencing a decision or defining its professionalism other cornerstone can be conceived, e.g. the *primacy of lifesaving* overriding everything, the importance of *safety* and professionalism, or preserving calmness by avoiding *stress*, i.e. the continuous maintenance of decision capacity.

The latter, i.e. the maintenance of decision capacity clearly ensures the fulfillment of the previous cornerstone; ranking and arranging them, and the aspects of the target function of interventions logically supplemented, the principles of firefighting (rescue) can be ascertained.

Another issue also emerges from the papers that a fire or incident appears in the thoughts of the students in the form of images very clearly. They regard as unambiguously important the role of *knowing the site* (BYM, G87) and also that they be able to immediately see through, assess and comprehend a given situation (D5C, RWL). I draw the conclusion from this that situation exercises at different locations and the detailed analysis, "*scrutiny"* of previous cases, can also significantly increase the efficiency of later decisions. To facilitate it, an excellent opportunity is provided by plotting boards (sand tables) designed and set up for different situations, but even the use of 3D imagery IT programs. Through these assets one could illustrate the movement of responders and vehicles step by step, the progress of events, the different opportunities, and just as well the emerging dangers.

Based on the essays, I ascertain that students not only have general organizational and managerial knowledge, but they aware of their importance as well. They regard the anomalies between the stipulations put down in conventional education materials and the mechanisms experienced during decision-making under the pressure of time as job-specific features. They link the classic knowledge mostly usable in the periods between incidents to the maintenance of the daily operational order of an organization, which means, as concluded by me, that the operational mechanism of a fire brigade, from several aspects, is identical to that of other organizations.

3.5 Results derived, the principles of firefighting

I have not found an example of the *declared* ascertainment of the principles of firefighting. Despite this fact, it can be justified both by elaborating the essays and the relevant statutes[36] and accepted without dispute that the first and foremost principle cannot be other than saving and protecting *humans* lives. This is defined in the Rules[37] as a primary role, but any firefighter's immediate response can only be the same, obviously; this is clearly justified by the elaboration of the essays. Accepting lifesaving as the basic principle, putting the following tasks in a logical order, we come to a hierarchic structure.

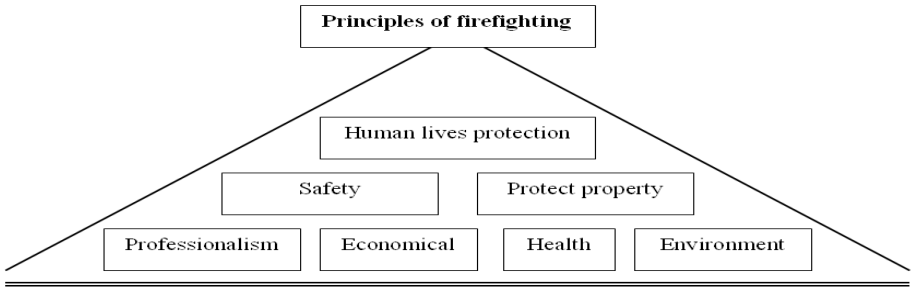


Figure 12 The principles of firefighting. Source: Author.

Based on the above, the first principle is the *protection of human lives.* In the hierarchic structure, the most important task after lifesaving is to maintain *safety*, which includes both subordinates and the victims of an incident. Looking at the orientation of the organizational objectives, the performance of the mission, the efforts made to *protect property* should be regarded as of equal value. The maintenance of safety can be ensured by *professionalism*, which, logically, must also certainly fulfill the expectations of *being economical*. The efforts made to protect property may not incur the disproportionate deterioration of *health* or *the environment*, so, these concepts, in my opinion, should also be regarded as principles. The principles hierarchically built are in interaction with each other; however, the horizontal order is not fixed on an identical level. Therefore, *professionalism* during the *protection of property* is also authoritative, just as *health*

[36] Act XXXI of 1996 on the protection against fire, on technical rescue and on the fire service.
[37] MoI Decree No. 1/2003. on the Rules of Firefighting.

or *environment protection* belongs to *safety*. I illustrated my recommendation on the hierarchic division of the principles of firefighting in figure 12.

3.6 Association studies

3.6.1 Association study as a method applied for my researches

We rank association studies amongst the methods of projective procedures, whose first methodological description was provided by Galton[38] (Rózsa, 2006). It was first used systematically by Freud (Freud, 1934), then by his disciple Jung (Jung, 1995), who used this method for their different psychological researches (Woodworth and Schlossberg, 1966). The essence of association studies is that a person examined under properly isolated and calm circumstances is given oral stimuli, to which he must respond by saying the first thoughts crossing his mind. The fast response serves to reduce the possibility to consciously formulate his thoughts. This also facilitates the exploration of hidden complexes and subconscious information. (*No response* or perhaps its delay functions similarly, which is also valuable information in the hands of an expert.) The stimulus list used for the method can be of general use, e.g., Jung's 100-stimulus-word association test (WAT[39]), or a characteristic searched is consciously composed, to measure e.g. creativity (RAT[40]) (Mednick, 1962), but often one elaborated by experts to the given person, circumstance and study purposes (Rózsa, 2006).

The efficiency and simplicity of the method is proved (Szabó, 1990) by the fact that today, besides previous therapeutic treatments, the scope of use is very broad and pragmatic. Linguistics (Lengyel, 2008) and education (Szabó, 1990) like to use word association tests, but Dazinger and Ward examines with it the diversity of the Arab-Israeli mindset (Dazinger, 2010), or Nosek and others, during the Obama-McCain election fight, shows, using this method, a hidden, but strong preference of voters, who claim themselves as politically uncertain (Nosek, 2008).

[38] Sir Francis Galton (1822-1911) English polymath, explorer.
[39] WAT – Word Association Test; acronym for Jung's 100-word association test.
[40] E.g. RAT: Remote Association Test (Mednick, 1962)

Pléh, based on his analysis, shows that association as an explanatory term went through centuries of development until it could fulfill its role in the early 20th century in experimental and practical psychology (Pléh, 1992). Today, it is one of the cardinal methods in the toolkit of qualitative data collection, the most profound analysis of which I have found during my researches in the work of Stüttgen and others (Stüttgen et al., 2011).

Based on the above, I did not find a reason to discard the use of the method with firefighters. I feel that having appropriate knowledge, due to its minimal requirement of means, can be sensibly used for individual researches having scarce budgetary sources. In my judgement, the fact that I have fulfilled posts as a subordinate and a chief fire officer, and that I taught subjects relating to firefighting tactics earlier at the Disaster Management Training Center, MoI[41], at the time of my studies, at the "Zrínyi Miklós" National Defense University[42], appropriately justifies the presence of special knowledge needed for the assessment of the studies.

3.6.2 Association method applied and the hypotheses of the study

During my association studies, students were divided into two parts. In one of them were those, who have completed the essay as well, they were all firefighter students of the Fire protection specialization; another group of students studying at the Disaster management specialization, formed the other part. Their task was to write down on paper the words, according to the test method, which immediately cross their minds on the "*call words*" told by me.

The conventional method of the association test accepts the first word or expression crossing our mind as *one response to one call word*. This can be a word, a phrase or a short sentence too. The method used by me differs from it in that I accepted several responses and even wanted it explicitly. I wanted to achieve this goal by this that on the impact of the call word a multi-modular *set of ideas* emerge, by the help of which

[41] Between 1998 and 2001, as senior instructor of the Firefighting and Rescue Branch.
[42] Between 2008 and 2011, as guest lecturer.

I can compare the elements in a more complex way, the interpretation of the given incident is accepted as technically correct. The above, otherwise, do not contradict the methodology of conventional study either, since the element first written down logically satisfies the requirement that it reflects the thought first appearing.

The use of a multi-element set of thoughts may be more advantageous, also because thus I can receive a deeper insight, which is conceived in the head of a firefighting manager in the first minute. I provided strictly 1 minute time for the response, due to which, obviously, there was only a possibility to formulate thoughts spontaneously crossing their minds; the retrieval and statement of knowledge provided by school-type of training, obviously, cannot be predominant or to a lesser extent in such time.

I used a procedure similar to the above method, applied several times and perhaps subconsciously during my teachings. By mentioning the call word of a typical fire, e.g., *basement fire*, the students could freely mention the tactical elements, closely linked to the fire and fighting it. It is actually a joint association game, explicitly appearing, at which the meaning of a "call word" is the fire or incident itself.

In this "game", in a few minutes, the students mention, *"shouting in"* practically all technical features, which can be drawn up by the characteristics of the elimination, neatly matched together. To the call word "basement fire", mentioned in the example, immediate responses were the following: *breathing apparatus, safety lead, darkness, smoke, soot, ventilation, evacuation, ashes, raising alert degree, gas bottle, rubbish*. Based on my experience, this can generate absolutely new situations very quickly and may result in an outcome entirely different from the initial and teaching trend. During the exercise, it was always a challenge to me to keep the streamline of rolling the thoughts possibly in the chronological order of firefighting and to provide an added value to the students all the time, but I should admit that this method went astray several times towards the resolution of problems keeping mostly the students in doubts. To satisfy the latter, it is inevitable to continuously develop the professional skills of the leader of the exercise.

I store and safeguard the completed response sheets, bonded together in my library, to ensure the authenticity of the study. I can show them to anyone on request. I ensure the retrievability and the factuality of data and findings in the association study by assigning letter T and an ordinal number (e.g., T01) in case of Fire protection specialization students, and with Disaster management specialization students letter K and an ordinal number (e.g., K01) to the students in my dissertation, generated by a separate system, providing anonymity (in a random selection order). There are no names on the response sheets, but the *Neptune* code of the students. This ensures the retrievability of the respondent if needed, that is, the source of opinion is authentic, but the reference may remain anonymous in the dissertation.

The total number of attendees in the study was 30; 12 persons were firefighters and 18 persons were students of the Disaster management specialization. Before the experiment, they did not receive any information on the task. I received a total of 9 expressions to be evaluated, before starting the experiment I prepared them with a neutral oral tuning (*apple*) and a written one (*laptop*). I pre-arranged the call words, which symbolized different fires and incidents. I relied on my own professional experience when selected them. They all referred to a special characteristic firefighting operation or technical rescue that means a peculiar decision situation for the persons in charge of an intervention.

I tried to separate the cases from each other that could be linked together as far as content (e.g., "*PB gas bottle under the effect of intensive flame*" and "*Intervention in the environment of a dissolved gas bottle*", or "*Fire in a country dye house*" and *"Chimney fire"*) that they should not be able to significantly affect each other when being responded to. During the process of the response sheets of the participants I used the markings, in the case of firefighters, "T" (e.g., T01), in the case of the control group, "K" (e.g., K01). When illustrating the individual examples I also use these markings.

The call words pronounced were as follows:

1. Fire in a country dye house;
2. Budapest–Győr Intercity derailment;

3. Apartment house, 8th floor, kitchen fire;
4. Foreign military aircraft crashed into a hill;
5. PB gas bottle under intensive flames;
6. Chimney fire;
7. Car falls into a ditch;
8. Bus collides with a truck transporting HAZMAT;
9. Intervention in the environment of dissolved gas [43] bottle.

Replies to the call words were categorized into three groups, based on the terminology of laws[44], defining the framework of an intervention, the literature used for training (e.g., Bleszity, 1989) and my own professional experience:

- *neutral*,
- *characteristics*,
- *intervention*.

The replies which did not match the professionalism of a given fire or incident were categorized in the *neutral* group. Some of the examples are: if the words *dye house* result in replies that can be linked to an artifact in the reply to the first call word (e.g., K14: *artifact*), or as the 6th call word *chimney fire* generates the words *stove* and *warm* (K09).

When there were doubts in categorizing the replies, I relied on my own professional experience or the interpretation of other replies (e.g., the reply "*explosion*" to the last call word from respondent T05, together with the words *sniper* and *confinement* fell into group "*intervention*", while in the case of K09, with the reference to *welding* it was logically put into group "*characteristics*").

[43] The commonly applied name, within the profession, of acetylene used during flame welding.

Replies were categorized in the group of *characteristics*, which are acceptable in connection with the case, with reference to their general professional characteristics (e.g., at the second call word with respondent K15 the replies *mass disaster* or *injured* were categorized by me into this group, but in the case of K10, replies *HSR* and people were put into the *neutral* group). When in doubt, I used the method already introduced at the neutral group; I relied on my own professional experience or the interpretation of other replies when categorized.

Strictly only the replies could be categorized in the group of *intervention*, which surely prove, either by themselves or together with other replies, the technical elimination of the given incident, specific actions in relation with it or the direction of the efforts to solve the problem (e.g., in the case of K08, the reply "*evacuation of a building"* given to the 3rd call word relating to a fire in a mid-high building).

Based on my hypothesis, the division of replies by firefighters, both as far as first and all the replies, compared to those of the control group, sensibly shifts towards intervention, i.e. overrepresented. Based on my assumption, the division of the replies of the control group in the three categories is the same or almost the same as far as the results of both the first and all the replies, perhaps with a slight underrepresentation in the intervention group.

In order to demonstrate the dynamics of the replies, I also used linear trend lines **only for illustration**. This method mainly receives a role in business planning, however, because of its simplicity and the absence of deeper analysis, I regarded as the most expedient to set it up in order to illustrate the trends of thinking. The results of my surveys show so distinguishable values in the three groups that I deemed the trend lines acceptable even without their thorough analysis to define the trends.

[44] MoI Decree No. 1/2003. on the Rules of Firefighting.

3.6.3 Results of the association studies

I show the numeric process of the replies in *table 1*, where, beyond the absolute values of the results, I indicate their average and percentages, sometimes using rounding for the sake of expediency.

1002 replies arrived on the nine call words, 12 students of the Fire protection specialization gave 530 replies, 18 students of the Disaster management specialization provided 472 replies. In average, the firefighters gave 44.2, the disaster managers provided 26.2 replies. Considering the professional motivation, I accept this significant difference as natural.

Table 1

Summary table of the results of the association studies

		Total	Neutral	Characteristics	Intervention
Disaster management specialization					
Aggregation	First reply	162	79	65	18
	All replies	472	193	172	107
Average	First reply	9 (100%)	4.4 (48%)	3.6 (40%)	1.0 (12%)
	All replies	26.1 (100%)	10.7 (41%)	9.5 (36%)	5.9 (23%)
Fire protection specialization					
Aggregation	First reply	108	12	49	47
	All replies	530	30	167	333
Average	First reply	9 (100%)	1.0 (11%)	4.1 (45%)	3.9 (44%)
	All replies	44.1 (100%)	2.5 (41%)	13.9 (31%)	27.7 (63%)

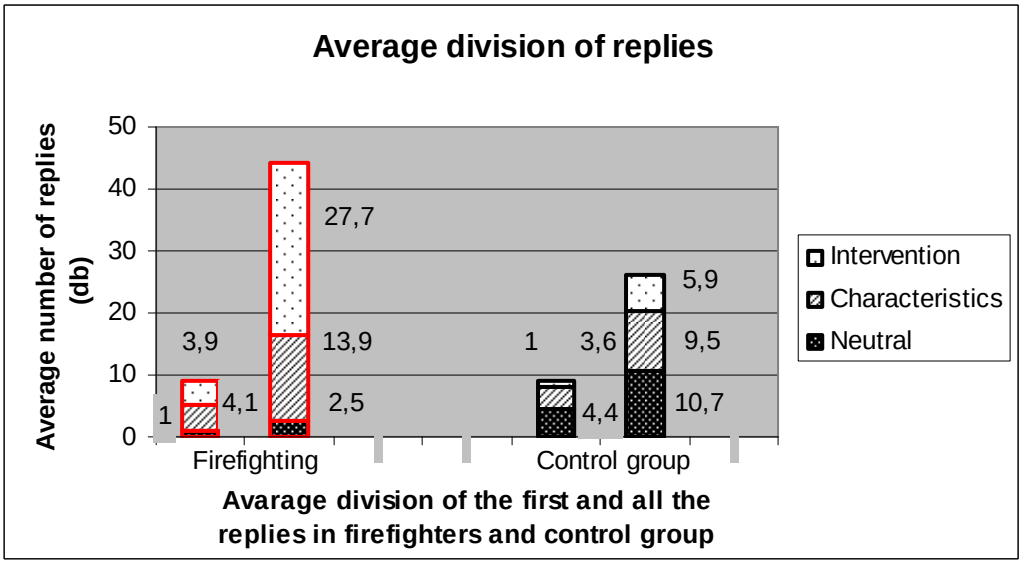
I examined the replies with two kinds of divisions: during one I looked at how the *first replies* to the call words are divided in the three groups (*neutral, characteristics, intervention*), then I did the same with *all the replies*.

Based on the first division, I supplemented the requirement against association study, according to which the studies should focus on the first response, spontaneously given to the call word.

The second division promotes the judgement, whether the spontaneous first replies receive further confirmation or mean the expansion of its range of interpretation, though they also greatly determine the trend of thinking of then respondent. The second part of the studies do not conflict the authenticity of the results of the first division, however, using them, its easier to clarify the trends of thinking of the respondents, the potential of the immediate reaction capacity. The latter is possible because the very short reply time limits the systematical recall of knowledge acquired in earlier school-type of training, but not the recall of knowledge provided by practical experience.

I demonstrate the results of the process of the replies also graphically. To mark the quantitative values of the tables, in the case of firefighters, I chose, expediently, the red *color* framing, and *black* in the case of the control group. The marking of the domains, in the case of the *neutral* group, is done with white spots on a dark background, in the case of *characteristics*, with oblique hatching, while ion the case of the *intervention* group, with rare white spots.

I laid a linear trend line on the graphs, where I thought it would be expedient or illustrative, which intends to show the trend of the reply instead of its deeper analysis.



Graph 1 Average division of the first and all the replies in case of firefighters and the control group. Source: Author

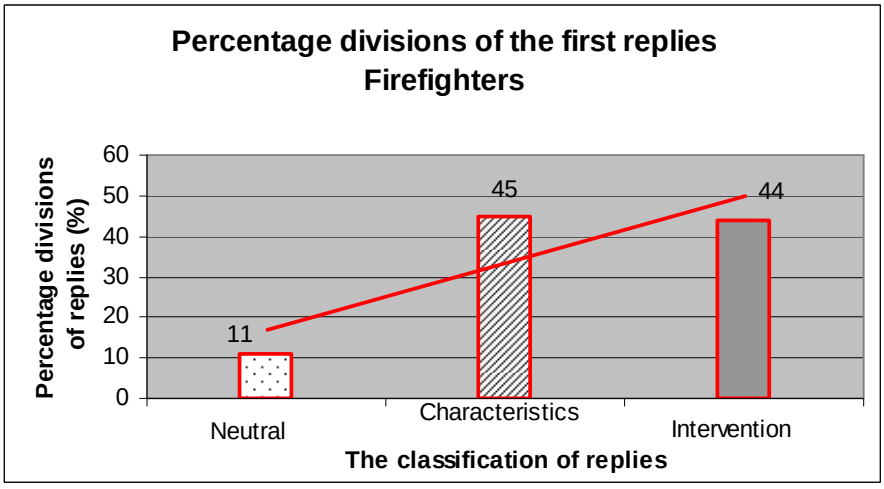
Results of the first replies of the Fire protection specialization

Division of the first replies of the Fire protection specialization students in percentages:

- neutral: 11 %,
- characteristics: 45 %,
- intervention: 44 %.

The ratio of *neutral* replies can be regarded as very low, out of which the greatest number of replies (4) was given by a firefighter with 5 years of service, a relatively short time from the aspect of the profession (T04). Replies to be categorized here were not given by the others at all or only in a very few cases. In the groups of *characteristics* and *intervention*, the ration of replies is approximately the same, within the margin of error it can be certainly regarded as identical, and both represent a high value. The linear trend line clearly shows dominance towards intervention.

I draw the conclusion from the values, i.e. from the trend of the replies, that the members of the studied group concentrated through their reactions, in the vast majority, on the professional aspect of the incident. I find as its obvious explanation that the group members have several years of operational service experience to do so, which generates that the experiences and tasks fixed by experience receive a predominant role in their replies.



Graph 2 Percentage divisions of the first replies in case of firefighters. Source: Author

Results of the first replies of the Disaster Management Specialization

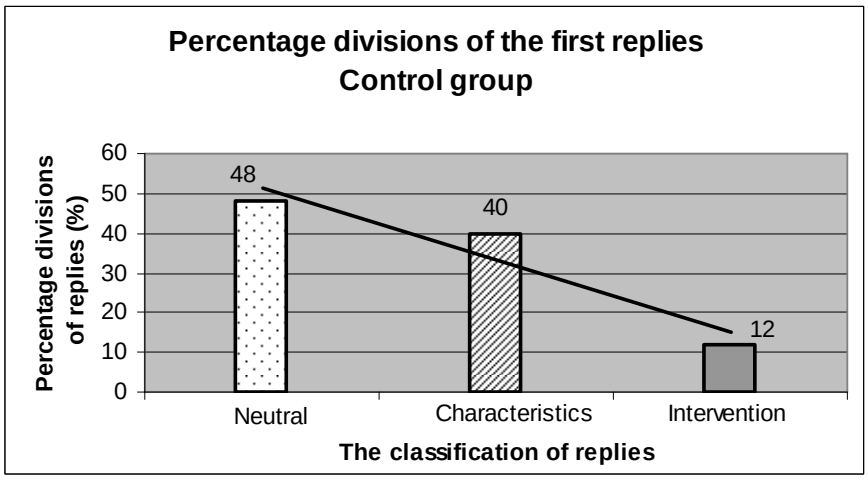
Examining the division of replies in the case of the control group, i.e. of the students of the Disaster management specialization, I found the following division:

- neutral: 48 %,
- characteristics: 40 %,
- intervention: 12 %.

The above division is almost the reflection of the previous one: the values of the *neutral* and *characteristics* groups are high, the differences are not so great, the extent of replies connectable to a specific intervention is very low. Maximum one reply each was received to the latter, 3 students gave 3 replies that may be categorized here (K07, K09, K17) and only 1 who gave 4 (K12).

I draw the conclusion from the values, i.e. from the trend of the replies, that this group also associates with the characteristics of the profession in great numbers, but its solution, in the absence of experience, is obviously not automatic. The linear trend line clearly shows the dominance of neutral replies.

The high proportion of the group of *characteristics* justifies my assumption that the knowledge, relating to the topic, of students of the Disaster management specialization is adequate to consider them a control group.



Graph 3 Percentage divisions of the first replies in case of the control group. Source: Author

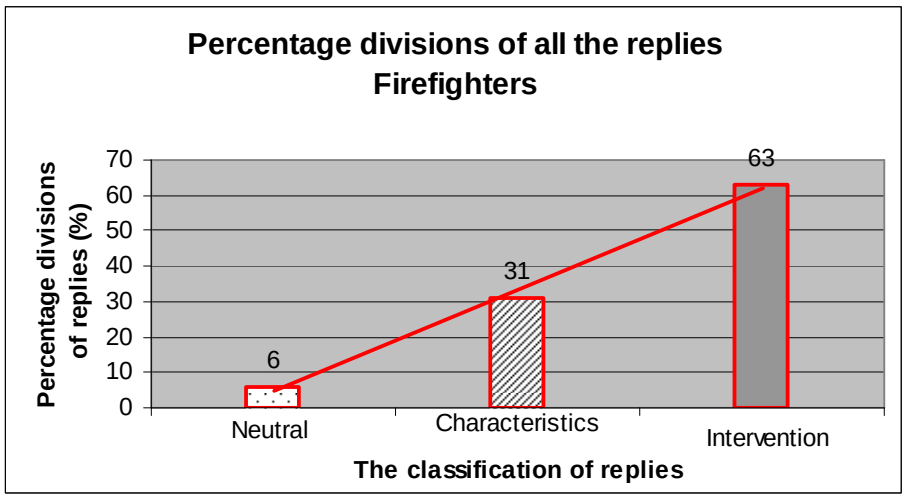
Results of the aggregated replies of the Fire protection specialization

In the study, I received the following values for the replies of firefighters in the context of all the replies:

- neutral: 6 %,
- characteristics: 31 %,
- intervention: 63 %.

Comparing this result with the first replies, I ascertain that *neutral* replies are scarce (in average 2.5 - *6%*), *characteristics* are strong (in average 13.9 – *31%*), but interventions are visibly and clearly predominant (in average 27.8 – *63%*). Aggregating the greatest number of neutral replies (a total of 9 replies), it was given by a firefighter, who had a relatively short service time, 5 years and little practical experience (T04).

I explain the predominant shift of the replies, i.e. reactions that the firefighters concentrated on intervention with their reaction following their first ones; for them the call words mean the search for the possibility of an immediate solution, professional solutions. This is generated by practical experience just as at the first replies. The linear trend line, similarly to the first reply, shows the dominance of the trend of intervention as well, with an even greater intensity.



Graph 4 Percentage divisions of all the replies in case of firefighters. Source: Author.

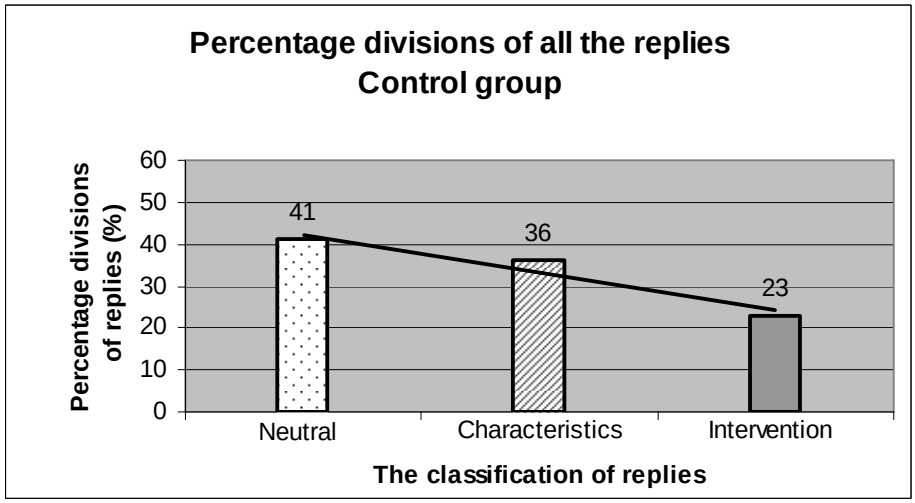
Results of the aggregated replies of the Disaster Management Specialization

I received the following values having studied all the replies of the control group:

- neutral: 41 %,
- characteristics: 36 %,
- intervention: 23 %.

The above data show that the vast majority of replies of the group belong to the groups *neutral* and *characteristics*. The students, in the absence of practical experience, only associate, to a little extent, with the words in the interpretation domain of *intervention*, with all that could really serve for helping the persons in trouble, solving the problem as soon as possible. Despite the fact that the number of replies given to *intervention* is low, the 23% value yet only shows that they have knowledge and concept to the solution, even it does not dominate in their spontaneous replies. The linear trend line shows the dominance of the replies towards neutrality with a continued convincing intensity.

The continuing high ration of the group *characteristics* and *intervention*, compared to the first reply, confirms my assumption that the knowledge of the students of this specialization relating to the topic is adequate to consider them control group. Another natural reason for the increase of *intervention* is, to my opinion, the possibility provided by the 1-minute “thinking” time.



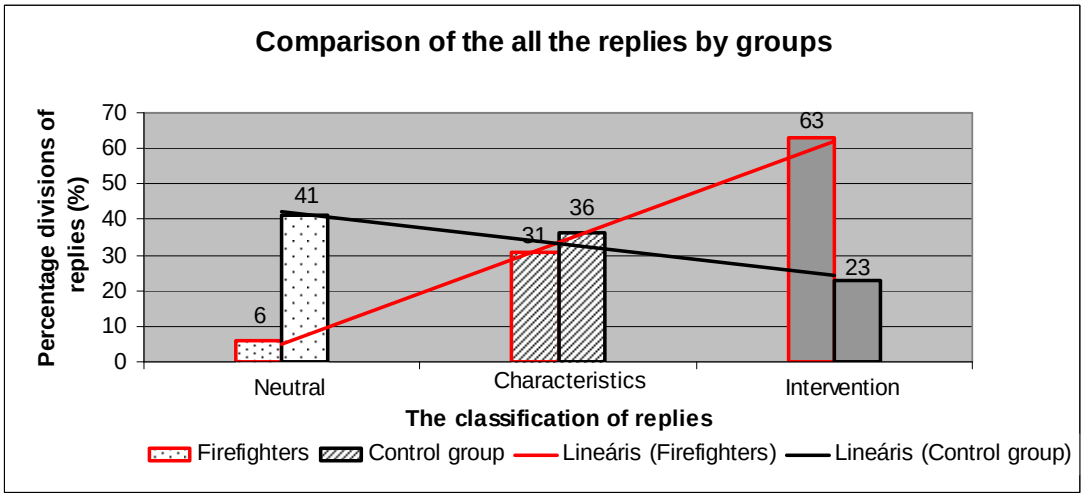
Graph 5 Percentage division of all the replies in case of the control group. Source: Author.

3.7 Aggregated results and the verification of the hypothesis

Comparing the ratio of the first replies of the two groups, I ascertain that the firefighters primarily and immediately focus on the *characteristics* of the incident and on its solution (*intervention)*, while with the control group features *neutral* from professional aspects and general features (*characteristics*) dominate. The replies of the group of firefighters, with respect to the *first* and *all replies*, shifting towards intervention, became even more predominant (44% → 63%); the growth, looking at the ratio of first replies, decisively originates from the group of *characteristics*.

Comparing the results of the *first* and *all replies* of the control group, I ascertain that replies belonging to the category *neutral* (in average 10.7 - 41%) and *characteristics* (in average 9.5 - 36%), although to a decreased extent, but remained predominant, with some advantage of the *neutral* replies (5%), however, the number replies in then group *intervention* (in average 5.9 - 23%), facilitating the elimination of incidents, doubled, within the margin of error (12% →23%).

The latter is significant even if its extent can be regarded as relatively low compared to the other changes. The above numbers clearly show that *characteristics*, in the case of all replies, i.e. when the students had more time, are closer to each other (31% ≅ 36%; difference 5% point), however, the difference in values is double in the case of the first, that is, immediate reply (10%).



Graph 6 Comparison of the all the replies by groups. Source: Author.

I justify with the above information, with the professionalism of replies that both the academic readiness and motivation of the Disaster management specialization students applied as a control group, are appropriate to make my methods admissible I used for the study of the decision-making mechanism of firefighters and make its results credible.

In the case of firefighters, the dominance of professionalism of immediate replies is shown (*characteristics* and *intervention* with a total of 88%), which, together with the other replies, clearly increases towards thinking facilitating intervention (*intervention*: in the case of first reply 47%, of all replies already 63%). My above statement can be further confirmed by the fact that *neutral* replies were made by mostly 2 students (T04 – 9 replies; T03 – 7 replies), who, together, gave more than half of the total of such replies (a total of 16 neutral replies out of 30 = 53%).

I can only interpret the above that the firefighters, in connection with a fire, besides their characteristics, but even preceding them, focused immediately on the possible solutions; calls words referring to fire immediately *thrust* their thoughts towards solution, or *suck* their thoughts *as a vacuum*.

The absolute comparison of the average replies (5.9) by the control group, with an *intervention* categorization, with the number of average replies (44.1) by the firefighters is especially interesting. We can see in this case that the ratio of replies given by the control group compared with those given by the firefighters is only 13.4%. This certainly shows the advantage of practical experience, the dominance of the generating effects of recollection, created by it, affecting solution.

My hypothesis was that the division of replies made by firefighters, both with regard to the first and all the replies, compared with the replies of the control group, sensibly shifts, i.e. is overrepresented towards intervention. I regard it as clearly proven through the absolute value of the results, their comparison with each other, and the direction and dynamics of the trend lines.

The second part of my hypothesis related to the division of replies made by the control group, according to which it will show identical or close to identical division, in the three categories, both at the results of the first and all the replies, perhaps with a slight underrepresentation towards the group of intervention. The justification of this hypothesis, based on the results of my studies, was well over my expectations, since I received a very clear and strong underrepresentation instead of a slight underrepresentation of permissive type, expected towards intervention. The absolute value of the replies of the control group, based on their comparison with each other and the direction and dynamics of the trend line, I regard this part of my hypothesis as clearly proven, with the supplementation that instead of permissive type of underrepresentation a certainly strong underrepresentation can be experienced.

The comparison of the replies of two different groups is especially demonstrative. The ratios of the replies compared to each other are almost reflections of each other; *neutral* replies are clearly characteristic of the control group, while those relating to intervention are characteristic of firefighters. Accepting the ascertainment, earlier justified that the members of the control group are adequately motivated and have the basic professional and academic knowledge in relation to the topic, ***based on the above, I regard as clearly justified the effects of practical experience that it immediately thrusts the thoughts of the decision-maker towards solution, or in other words, towards the possibilities of solution that engulfs the decision-maker almost like a vacuum.***

4 RECOGNITION-PRIMED DECISION

The background of recognition of a special decision-making mechanism in the focus of the dissertation, in the way already discussed above, was given that, in some cases, no sufficient time is available, necessary for classic decision-making. Therefore, strategists sought to design and plan the details of military operations in advance, just as today, however, their proper implementation, the application of different decision support instruments in live situations, designed for optimal decisions, failed many times in spite of these. Decisions made in reality, often not harmonized, could not be harmonized, considering the circumstances, with the pre-formulated strategies, mostly because there was not enough time needed to achieve them.

In this chapter, showing the malfunctioning of analogical thinking, the tragedy caused by USS Vincennes is a great example of the limits occurring in an emergency, and is unbridgeable arising by conventional ways of thinking. In my own researches, by analyzing the essays, I have proved that *time* is a limiting *factor*, the most typical of intervention also for the firefighters, whose emphasis was to be found or detected in each paper.

In the chapter, I illustrate with examples the limits of the possibilities of analytical decision-making. I present the general operating mechanism of recognition-primed decision-making, elaborate its special model relevant to firefighting managers, as well as explore and systemize the factors that facilitate (catalyze) the processes.

4.1 Characteristic circumstances of emergency interventions

An important element of the activities of emergency responders is that they cannot or only to a very limited extent can modify the terms of the task, improve them as desired. I was able to justify the fact, through my own experience and the studies I carried out that this kind of environment is very complex and uncertain, depending on the specifics of the task, it may be even ambiguous and easily and rapidly

changing. I illustrate the seriousness of some of the above examples, which I take from various disciplines:

1. An emergency surgeon should decide on the immediate surgery of an elderly patient suffering from hypertension and certain drug intolerance, but also struggling with communication disorders, so that he does not know the exact circumstances of the emergence of the accident and the accessibilities of relatives.
2. A battlefield commander has to decide, under limited communications circumstances and in the absence of direct support, on deviating from the mission pre-specified, or from its implementation if success is certainly limited.
3. A firefighting manager, in a road accident in a built-up area, must decide to save lives in the presence of an intensively evaporating unknown hazardous material, and depending on the weather conditions, to evacuate.
4. A police officer, in the ambush position of a bank robbery, must decide that the robber captured hostages in the building, most probably carries a firearm, while the attempt of the negotiator starts to come to a dead end.

The above, of course, are quite different situations, yet the common features can be found, by which the conditions of work of emergency decision-makers can be described. A physician always faces a vulnerable person whose intention to improve his own status obviously harmonizes with the doctor's will (perhaps only passively due his unconsciousness), while in the case of a battlefield commander and a police officer, the intentions of the opposing parties are explicitly contrary and hostile. In the case of firefighters, the situation can be evaluated as rather passive compared to the above (*figure 13*).

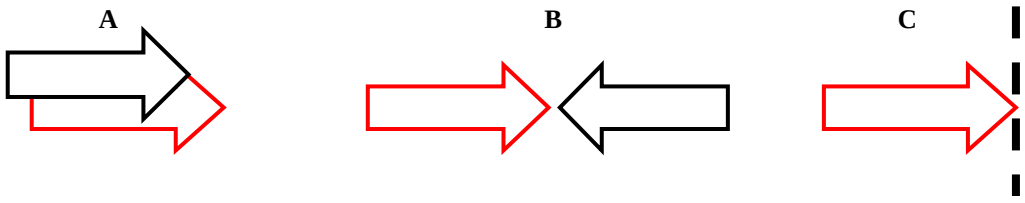


Figure 13 Relationship between decision-makers and the subject of decision in different cases A) Physician; B) Military, Policeman; C) Firefighter. Source: Author.

Despite the above differences, indications of the *complexity* of the situation, the possibility of the *radical change* in the given situation, *uncertainty* and *ambiguity* of the information available can be recognized and well identified. The peculiarities of each specialized branch can be illustrated through the examples of several authors: Klein dealt with the analysis of the decision circumstances of the military using the examples of firefighters (Klein, 1989), Killion took examples from the navy (Killion, 2000), Bruce shows his own medical case (Bruce, 2011), Johansen simplifies difficult circumstances (Johansen, 2007).

Based on characteristic *examples* demonstrated in beginning of the chapter, *the works of the above authors* dealing with the topic, *my own experience*, and my research results detailed in the previous chapter, ascertained to similar situations, the following can characterize the tasks of those under constraint:

- time pressure to start or finish the tasks, i.e. limited time for implementability;
- poorly structured, certainly under-informed, perhaps over-informed or deliberately misinformed task and environment;
- uncertain environment, which changes dynamically or incalculably;
- poorly defined goals that perhaps change during implementation;
- demand on multiple feedback loops, partial or perhaps complete lack of possibility thereof;
- high-value or significant “stake” as far as its future impact, unforeseeable or perhaps fatal impact of material (human) losses;
- the possibility of disruption of the previous order in space and time, and of the formation of chaos;
- high knowledge intensity environment.

Most of these factors are present; occasionally all of them may be present at a certain level of emergency decisions: including the strategic, operational and tactical levels, but certainly with a different focus or at different times. On strategic and operational level, in general, not only more time is available, but also human and technical resources are at hand more broadly, and decision support instruments as well to reduce uncertainties occurring.

The extinction of fire in a smaller dwelling house requires the implementation of a completely different, simpler scope of tasks than to control fire in a mid-high building. The different scopes of tasks exist in different environments and structures, so the solution of similar basic problem also exists in other dimensions. Based on my own experience, the more extensive case we are dealing with in time, space and from the aspect of involvement in the incident, the more the above factors cumulatively prevail, but because of the protracted implementation, it is, however, easier to solve them.

Instead of the detailed consideration of influencing factors, a simplifying grouping can also be created by essentially expressing them. An example is provided by Johansen, who takes into consideration the following as characteristics of the decisions of those under constraint (Johansen, 2007):

- rapid change or volatility of the situation;
- uncertainty,
- complexity;
- ambiguity or misapprehension.

The *volatility* of the situation is determined by its change originating in its nature and the dynamics of the change together. *Uncertainty* implies unforeseeable consequences, the possible surprises, the lack of awareness of the questions and situations arising. The *complexity* of the situation is characterized by inadvertence and/or a variety of resources available, a multitude of questions remaining unclarified or new ones emerging, disintegration of previous orderliness, seeming like chaos. A*mbiguity* may refer to the opaque, hazy reality (Clausewitz's "fog of war"), the possibility of incorrect interpretation of facts and circumstances, false-oriented assessment of cause-effect relationships.

US forces inserted the simplified characteristics, created to describe complex situations in their official terminology at the end of the 90s, and applied it to describe the work environment of implementers of operational and tactical tasks, having named it after its initials VUCA[45].

[45] Volatility; Uncertainty; Complexity; Ambiguity

The most limiting factor from the above is *time*, proven also in my own studies. This provides a framework impossible to burst and a forced drift, a *pressurized channel* for the decision-maker, entangled in which one can no longer break free.

Most of the features and problems could be solved even by devoting time to them, i.e. through analytic thinking method of classic decision-making, and could resolve it with adequate resources. In the wake time, however, the decision-maker cannot do this, which basically influences and clearly limits the "planning" process of task execution, that is, it has to apply the decision-making procedures, based on another mechanism.

4.2 General model of recognition-primed decisions

The above proves that, in certain situations, the multi-criteria, analyzing, evaluating decision-making simply cannot be used or in a limited manner. However, it can be seen that managers, directors or commanders are many times in situations that they simply *cannot elude from their decisions*; they should make them in a short time. The functional background of decisions made in a short time, their mechanism different from the conventional was first studied in depth by Klein, who gave the name *recognition-primed decision*[46] to this special decision procedure (Klein, 1989). Related to the topic, I found a single research in Hungary, conducted by Radnóti and Faragó within a tender[47], and the results of which were published with the title *"The study of risk perception and risk-taking at an armed agency"* (Radnóti & Faragó, 2005).

I refer, at the general model of recognition-primed decisions, mostly to Klein's work (Klein, 1989; Klein, 1999), which is analyzed by Cohen with others from the direction of critical thinking (Cohen et al., 1996). Killion supplements and combines with his multi-aspect decision-making model, (Killion, 2000). Based on Klein's work, **the essence of recognition-primed decisions is that the decision-maker, through his previous experience, has several different solution schemes in his mind, which he is capable of recalling in a new situation from memory.**

[46] Mezey uses the term *situation sample recognition-primed decision-making* (Mezey, 2009).
[47] OTKA TO 37 607

The decision-maker immediately applies the first pattern that matches the typical features of the given problem of, that is to say, makes decisions fast as a result of previous experience. Klein finds basically two ways to recognize the situation in his work:

1. *prototype*: if the entirety of the situation cannot be identified based on typical features, previously experienced;
2. *analogy*: if we are able to find whole, similar or closely similar, perhaps identical partial elements for the situation from memory.

In the case of analogy, the emphasis is on the characterization of the same or nearly the same situation, while in the case of prototype, individual elements of the situation generate the possibility of applicability of certain schemes. At the former, the action version can be started immediately; i.e. the assessment of the "stand-up" plan based on the scheme, after recognition; at the latter, further brief analysis follows the situation. In this case, the decision-maker tries to clarify what *expectations* are established in the given situation what *acceptable goals* there may be. Besides, he must take account of the *information available* in the given situation and also of *action versions* based on them.

The above elements of the clarification of the situation - of course, with a different time frame - can be found on the conventional decision-making level, to which noting examples in Hungary, Ribárszki and Radnóti and Faragó suggests, introducing the psychological background of military decisions (Ribárszki, 1999; Radnóti & Faragó, 2005). Mezey analyzes mainly concerning defense areas (Mezey, 2006), and Bukovics the area of disaster management, by introducing the possible of decision support instruments of crisis management (Bukovics, 2006).

After the action version has been chosen, either in the case of *analogy* or *prototype*, the decision-maker imagines its implementation, impact and consequences. If it satisfies the requirements of decision-maker, set against the efficiency, the implementation can start. If problems arise against the effectiveness of the first action version, the decision-maker discards the scheme representing it, and considers the one nearest to him. The process is repeated until the decision-maker accepts the solution of appropriate quality. At this latter, much shorter time, the maximum of a

few minutes can be at the disposal of the decision-maker compared to conventional decision-making; so, it is not based on the principle of consideration of options according to the assessment of analytical thinking.

The graphic illustration of the *general model* of recognition-primed decision, sketched by Klein, can be seen on *figure 14.* Based on this, the decision-maker takes a scheme from his memory, recognizing the given situation, which satisfies the minimum requirements, expectable in the given situation, performs the acceptable goals, matches the guidance of information available and offers a viable action version.

Supplementing the general model with the assessment of action versions, we receive the model of *analysis of possibilities* (Killion, 2000). In this case, if the action version is not satisfactory, a new action version will be modified or assessed.

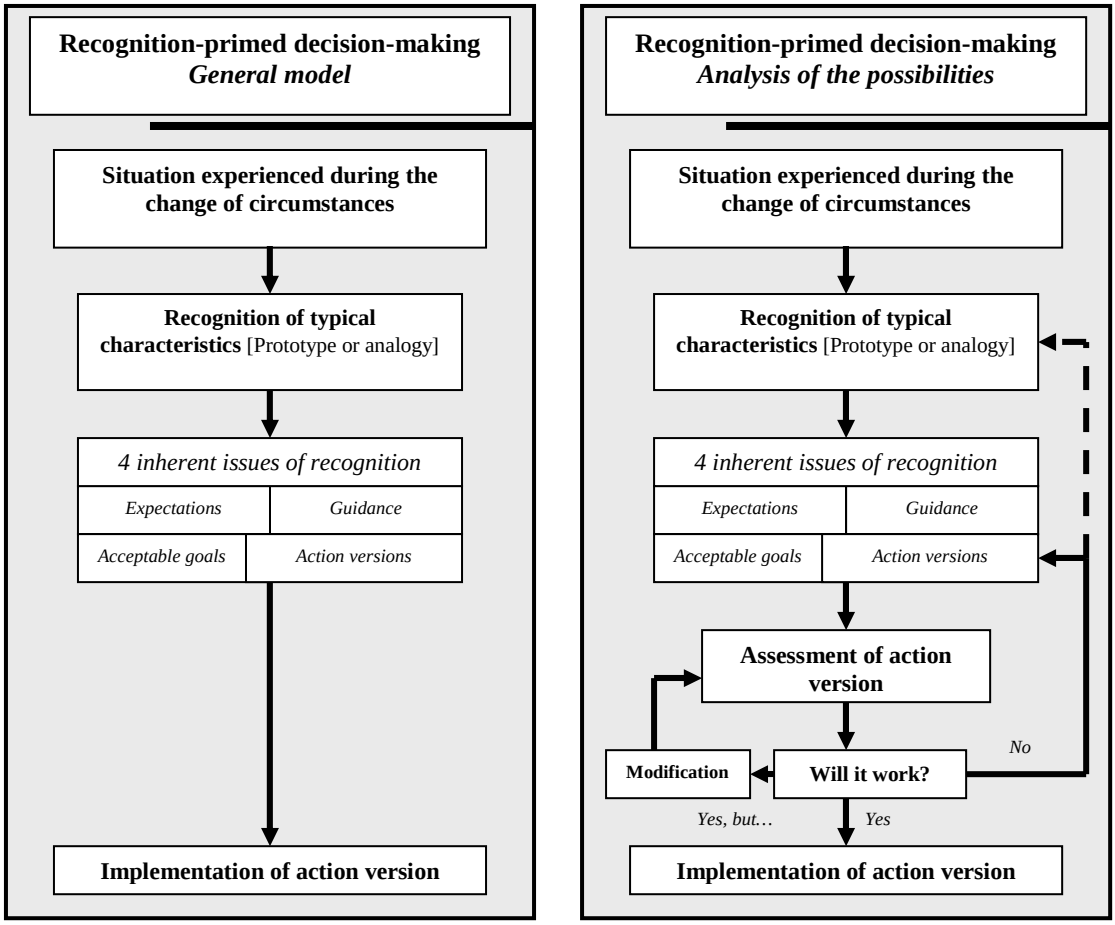


Figure 14 General model of recognition-primed decisions and the analysis of possibilities. Source: Author, re-edited based on the works of Klein (1989) and Killion (2000)

If the decision-maker has a significantly longer time to assess his concepts, naturally within the framework offered by a recognition-primed decision, there is the possibility to assess on the level of critical analysis (Cohen et al. 1996), or according to options characterizing analogical thinking (Killion, 2000).

Recognition-primed decisions do not exclude the possibility to amalgamate conventional, analyzing decision-making (Killion, 2000; Radnóti & Faragó, 2005). At complex tasks, where a given situation is examined from several aspects – and choose from the options with analogical thinking – recognition-primed decision-making can be automatically applied by experienced decision-makers while solving some partial tasks to reduce the time of the decision process (*figure 15*).

The above issues harmonize with the observation that decision-makers simplify complex problems, i.e. create partial problems, until the elements broken down become manageable and resolvable (Simon, 1960; Paprika-Zoltay, 2002). By enlarging its interpretation range, of course, we can reach the point where the decision-maker may say the problem does not exist until he sees its solution (Duggan, 2002), or the problem does not exist at all if it does not have a solution (Ribárszki, 1999).

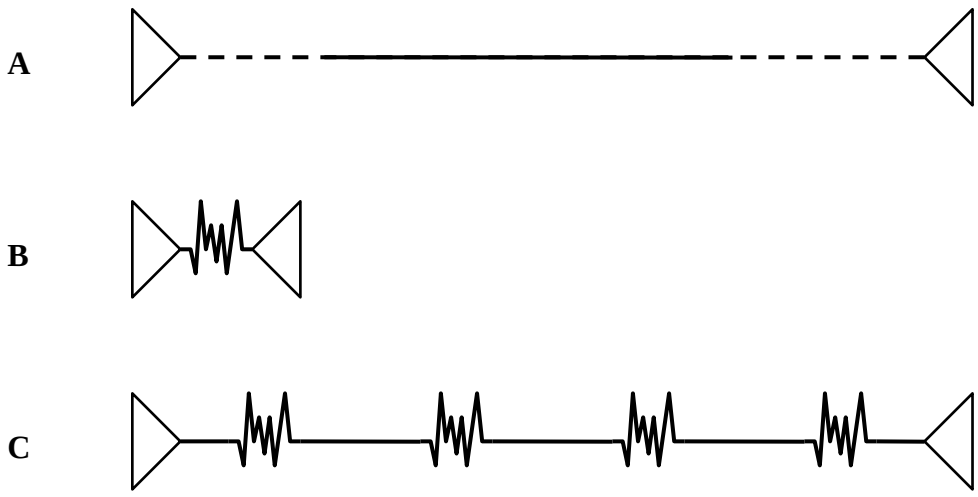


Figure 15 Conventional decision process (A), recognition-primed decision (B), and their amalgamation (C). Source: Author.

It springs forth from the above that the relative position of multi-aspect decision-making and recognition-primed decision-making is not constant. Recognition-primed decision can be the partial process and decision unit of analogical thinking. In this case, the main decision-making mechanism is analogical thinking, recognition-primed decision is the additional element. A Hungarian research also indicates the advantages of the mixed use of recognition-primed decision together with other trends using cognitive decision psychological approaches (Radnóti & Faragó, 2005).

If recognition-primed decision is the main mechanism, analogical thinking can supplement it in two ways (Killion, 2000). In one of the cases, the start of the decision process allows thinking, with concessive temporal condition and with the assessment of options, i.e. recognition-primed decision derives from and originates in conventional decision mechanism (*figure 16*).

In the other case, the result of recognition-primed decision, i.e. the action versions are assessed by analogical thinking in a conventional way. The time demand of the latter is by far greater than the rapid test of action versions generated by the schemes during recognition-primed decision-making, i.e. regarding their mechanisms they cannot be identical. In one of the cases, the assessment of action versions means the *comparison of options*, in the other, *the acceptance* or *abdication of matching the scheme* in the other.

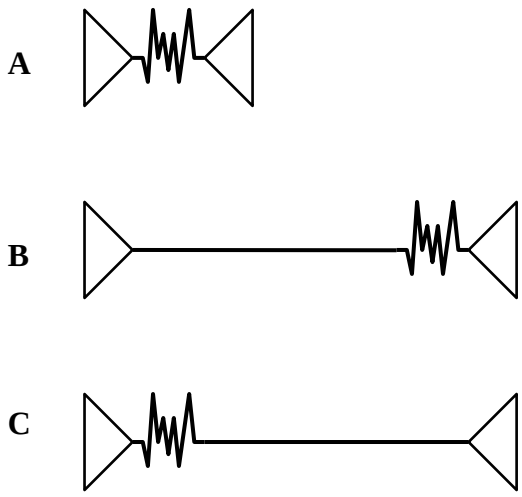


Figure 16 Forms of recognition-primed decisions. A) Decision based on pure recognition; B) A recognition-primed decision is born from a decision mechanism initially conventional; C) The result of a recognition-primed decision is assessed by a conventional mechanism. Source: Author.

4.3 Decision-making mechanism of firefighting managers

4.3.1 Impacts of practical lessons learnt

We would often like to search for a justification through finding a stable point in various branches of science or in everyday life. Even if we think we would find such, many incredulous people turn up and try to annul our previous attempts. The history of science shows us so many similar examples (Simonyi, 1986), but even nowadays we can find some examples (Ötvös, 2011). Thus many people would like to find eternal truths how, through which methods should we make the most correct decisions of our life. Why is this interesting and important? Because according to the general judgment of experts dealing with decision theory, the decision-making method applied initially determines the outcome (Paprika-Zoltay, 2002).

Accepting the above golden rule, in the case of emergency decision-makers like firefighting managers, this can have a special meaning. With classic decisions, the decision-maker usually has enough time to choose the method itself, perhaps modify it in the case of undesired outcome, while in an emergency, due to the shortage of time, it is dramatically limited or not possible at all. Therefore, it is especially important for emergency decision-makers to make their method possibly the most suitable to manage the given situation; and to have a clear picture of the mechanism already used by them involuntarily.

For the vast majority of firefighting managers it takes years to get to the point to command and control the intervention in fires and other incidents as a single person in charge. The majority of firefighters start their career in lower positions. Here, they get acquainted with the practical skills based on the theoretical material of basic training and acquire experience in firefighting as well.

Persons deemed suitable will sooner or later find themselves in management assignments. Based on many years of so-called *deployment* experience they get acquainted with the basic features of firefighting and rescue (accidents).

During this, the characteristics of interventions have crystallized, which give a framework in any future case. The characteristics can be well described, many times parallel with the fire alarm, which I can prove through the justification of my hypotheses, but also with the multitude of personal examples as well.

A part of the night alarms were so-called *false alarms*. Their characteristics are that after the closure of nightclubs, persons under alcoholic influence of different degree warmed their dinner after arriving home. Obviously, under the influence of alcohol, some of them fell asleep. In the meanwhile, the water content of the meal being warmed evaporated, the remains started to slowly burn and emitted a thick smoke.

In these cases, although the danger prevailed, there was no "real" fire (technically correct: they were *false alarms*). The smell of the smoke generated could be felt in the drafty stairway, but the exact location could not be identified. Despite this fact, we could usually find the persons affected in the building, having asked others about their whereabouts. The above does not refer to tactical characteristics but to features of circumstances of firefighters.

Another characteristic feature of mid-high buildings[48] is that after some time the central exhaust system becomes stuffed up with grease to an extent that a fire occurring in the kitchen may spread through it to other flats. Therefore, in the case of such fires, a thorough check is performed after extinguishing, to some people even too detailed, but in a technical sense very correctly.

Although according to the Rules of Firefighting[49], all reports must be regarded as fire alarm, signs indicating playful deeds in calls by children (e.g., based on background noises) can be immediately screened, so they are naturally not followed by approach. Although the Rules do not allow it, in fact, they expressively prohibit it, unambiguously, the reference to a large fire with children having fun in the background is not too realistic, therefore, its rechecking starts immediately even before ordering alert.

[48] Houses with the top structure level of 13.65 m and 30 m are categorized as mid-high buildings. MoI Decree No. 28/2011. (IX.6.) on the National Fire Safety Regulation.
[49] MoI Decree No. 1/2003. on the Rules of Firefighting.

Its reason is that one of the characteristics of real fires is that others confirm the credibility of the first fire alarm, almost immediately after the first call but certainly within 0.5 to 1 minute. In this case, a chief fire officer can be sure of the content of the alarm even before starting the approach with the necessary personnel.

During approach, we use the smoke generated as point of orientation, one of the obligate physical phenomena of fire. Although not in every case but many times it is a good basis for orientation, secondly, the intensity of fire can be determined by its characteristics and also by some of the properties of combustibles. Black soot relates to compounds with high carbon content, grayish smoke may indicate the evaporation of the water content of materials of vegetable origin.

Continuing the above, we could mention the multitude of examples, which are arranged in a logical order in books and notes used for teaching firefighters (e.g., Bleszity, 1989). The examples shown prove that previous interventions crystallize characteristic images, based on which firefighters are able to determine, with great certainty, already at fire alarm, what kind of professional tasks they will face. Logically, the characteristics of decisions made by a firefighting manager are crystallized, based on which they would certainly receive a role later in his decisions.

4.3.2 Decision-making mechanism of a firefighting manager

Limited time frame allows the elaboration and management of limited amount of information. We know from Miller's researches that the *short-term memory* of the vast majority of people can only process simultaneously 7±2 units of information (Miller, 1956). This information, of course, can be quite different, e.g. a characteristics of fire, the capacity of the response unit, a number, or even the absence of information searched. Our memory handles the combinations, "operations" between the information units as information units (Ribárszki, 1999), from which clearly springs forth that the capacity of the short-term memory of a firefighting manager is exhausted very quickly.

Previously I have proven in multiple ways how complex the tasks of emergency responders are; this shows that in several cases, simultaneously, there is or would be a need to process many more units of information than the capacity of our short-term memory would allow. *The maintenance of our decision-making capability, i.e. our short-term memory, based on the above, clearly requires that we should omit analyzing and evaluating decision-making processes protracted and use the recognition-primed decision-making procedure, based on previous experience.*

I demonstrated in the previous chapter, that the essence of recognition-primed decision is how we can match the schemes based on experience and in our long-term memory with the characteristics of the specific intervention. I wish to create a model element to demonstrate the decision-making mechanism of firefighting managers, which takes into account the limits of the simultaneous processing of information, that is, it also illustrates *Miller's decision-making capacity*. Since the information units may be qualitatively independent of each other, I chose the simplest *graphical representation of the unit-based discrete difference* to separate them from each other. Based on my judgement, a model element must be such, which can graphically demonstrate the schemes based on earlier experience, the characteristics of different fires, and the interlocking of the former as the application of the scheme, which represents the technically correct solution of the task, i.e. effective decision.

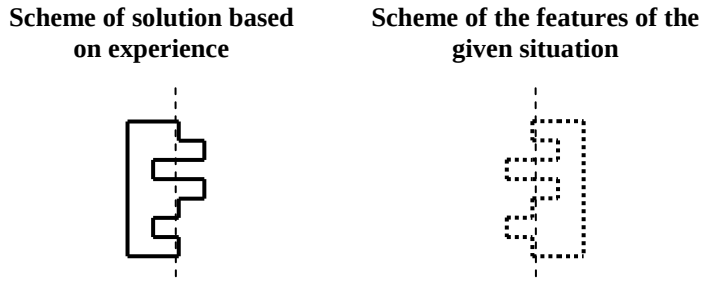


Figure 17 Graphic representation of the empiric scheme of recognition-primed decisions matching a given situation. Source Author.

The schemes in *figure 17* represent 7 graphical discrete values each, which are marked by positive or negative protrusions and their “center line”; these values indicate the amount of simultaneous decision-making capacity. Thus, the “negatives" of the schemes can be matched as a given situation and the solution necessary therefor.

As an integration of above processes, decision mechanism functions as follows: an experienced firefighting has performed the elimination of a large number of and different fires. Despite the fact that as far as the parameters each fire is different from another, some characterizing features can be well conceived (*figure 18*).

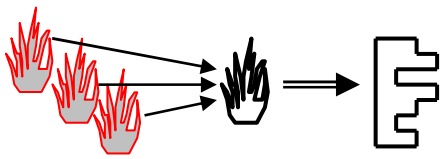


Figure 18 Evolvement of the scheme on fire. *Source: Author.*

The characterizing features of identical types of fires are crystallized by experience, and are fixed in our *long-term memory*. Similarly, to the characteristics of a fire, the characteristics of successful extinguishing, the facilitating decisions are also fixed (*figure 19*); just as the mistakes desired to be avoided and the unsuccessful procedures and failures. Experience gained through many years, based on the features of fires, formulate the system of schemes, behind which we can find actions (decisions) efficiently applicable to eliminate them.

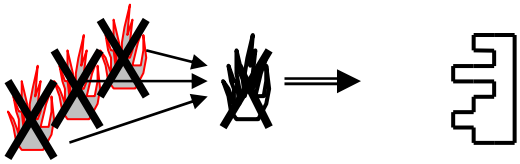


Figure 19 Evolvement of the scheme on the lessons learnt from extinguishing a fire. Source: Author.

If another incident has almost the same circumstances as one already many times successfully eliminated by a firefighting manager previously (*model of positive confirmation*), he will attempt to use the same ones in the procedures. Therefore, another fire, quasi bearing the typified properties of previous similar fires, a decision-maker involuntarily immediately recalls the typified decisions in his conscience. ***The properties of a fire and of previous successful extinguishing operations, based on the above, are closely interlinked; they are each other's "reflections"*** (*figures 20 and 21*).

I proved with the results of my own association studies that the above, i.e. the characteristics of a fire and the thoughts directed towards its extinguishing, the schemes of response, in the case of firefighters, are very closely connected in a complex way.

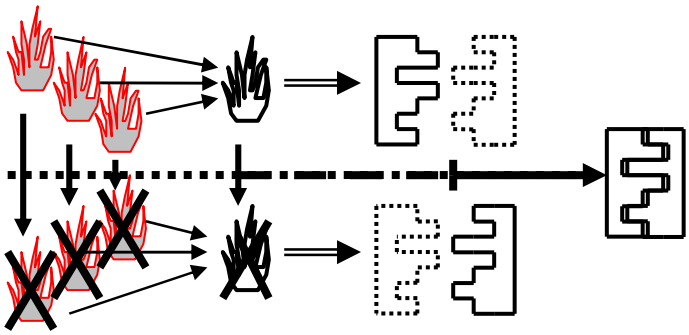


Figure 20 Aggregated scheme on fire and the evolvement of the lessons learnt from extinguishing it. Source: Author.

When a firefighting manager identifies a fire, he imagines what would happen if he applies the usual tactics to fight it. If the scheme of solution matches, he accepts it, if not, he rejects it and thinks of the next most typical action. Thus, it is a recognition-primed, model-matching process, which can be followed by a quick and almost automatic decision.

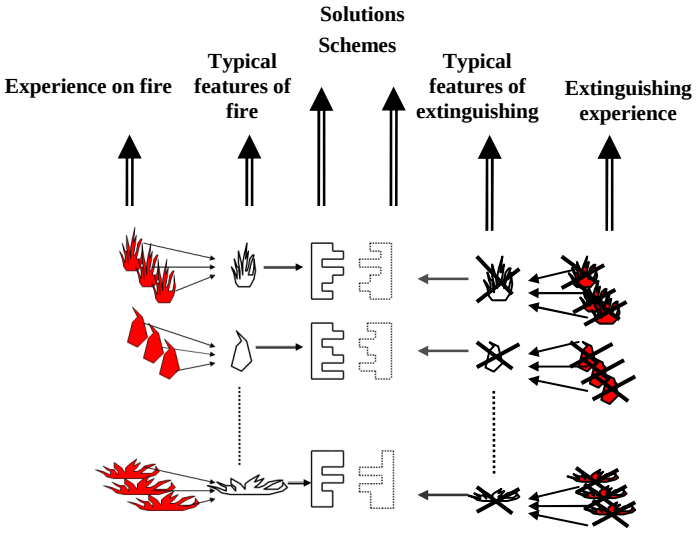
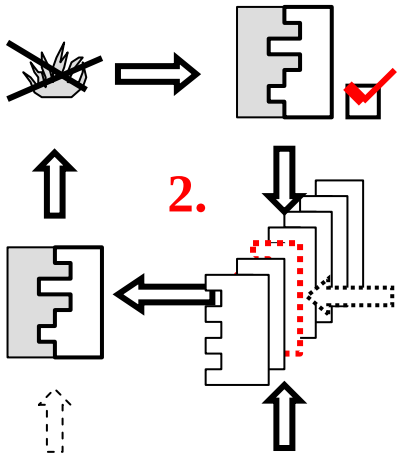


Figure 21 Evolvement of decision schemes of a firefighting manager. Source: Author.

The amalgamation of previous schemes into a given incident is shown in *figure 22.* The long-term memory of a firefighting manager, through practical experience, has the schemes of both different fires and their extinguishing characteristics. During another alert, information available and collected on a fire automatically generates the recollection of the scheme necessary to solve it, based on which a firefighting manager defines the firefighting tactics necessary. ***However, the results of my*** association ***studies clearly point in the direction that at a given fire (problem) managers do not focus on the fire as a problem but rather on its immediate solution.*** From this, I make the conclusion that a decision-maker will not follow the change of the characteristics of a fire, but the validity of solution scheme, that is, the dynamics of the implementation of the extinguishing process. This does not mean a contradiction with the previous, but rather a difference in views, the shift of emphasis of the focus of attention.

Recollection and matching of solutions (fighting tactics) according to the type of fire, and confirmation in case of successful extinction



A fire and its solution schemes exist together in the memory of fire-fighting managers.

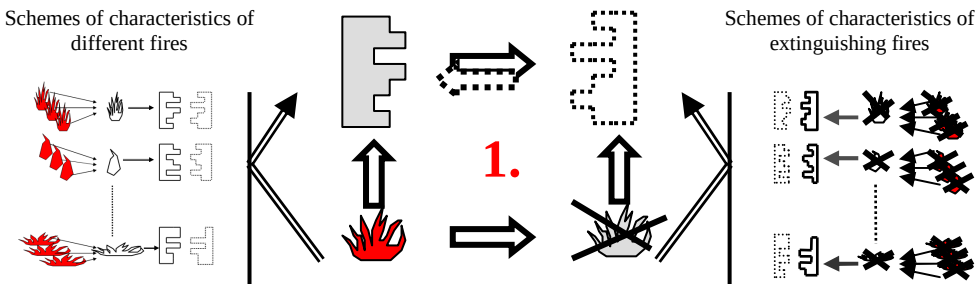


Figure 22 Decision-making mechanism of a firefighting manager. Source: Author.

The difference in views, that is, the shift of emphasis means that a firefighting manager does not focus on the change of characteristics of a fire, but rather on the expected evolvement and dynamics of the scheme selected, i.e. extinguishing tactics. Based on the previous, these are, of course, inseparable from each other, however, I find the dominance of the *interventions* trend in the results of my association studies in the case of firefighters so strong that, based on it, I judge my above conclusion to be justified. ***The thought sequence fire–characteristics–solution is attractively logical, however, the decision capacity of our memory is facilitated if it manages and reduces the necessary information in the simplest possible way. Since the schemes of characteristics relating to a fire exist together with the schemes of solution, there is no real need for it to appear in our short-term memory. Thus, the function appearing is modified to the simplest and shows the format fire–solution.***

The above do not contradict Klein's model, they rather complement it. Klein, in his model, evaluates (imagines what will happen) the results of matching schemes by the decision-maker prior to performing action version, which, based on my own experience, is so without doubt, however the aftermath of the decision, in my opinion, is much more significant in case of firefighting managers. Since the problem immediately and automatically generates both the direction of the solution and start of the action version, rather the process itself is important in terms of efficiency, which is caused by the decision. ***The schemes based on experience certainly contain the information on the dynamics of the process of fire, so if it meets the expectations, we do not have to modify the original firefighting tactics.*** However, if the dynamics of the process does not suit the expected, the change is inevitable in the performance of efficiency. ***Based on the above, the recognition-primed decision is not just an individual act before extinguishing the fire, but it is also the continuous accompaniment as needed.***

By doing this, I share the view that the experienced decision-maker perceives the problem together with its solution, ***furthermore, I extend the continuous co-existence of the problem and of the whole process of solution of an emergency (firefighting and technical rescue).***

4.3.3 Evolvement of recognition-primed decisions

At the study of recognition-primed decisions, observations included both routine and non-routine type of decisions. It was ascertained that even in non-routine cases, experienced decision-makers used, in about 50 to 80 percent of the decisions, recognition-primed procedures, without effort, with a view to compare two or more versions (Ribárszki, 1999). The rookie firefighters obviously cannot see through the complexity of an intervention, it may seem to them initially even chaotic.

Taking into account all decision-making situations, of routine nature and irregular ones as well, the ratio of recognition-primed decisions exceeded 90%. In the case of beginners, however, the ratio of recognition-primed decisions decreased to 40% (Klein, 1989). The examiners found when considerations occur, the more experienced decision-makers rather weigh the *nature* of the situation, while beginners contemplate *what response* to choose, that is, the less experienced decision-makers focus on analytical thinking towards better options (Ribárszki, 1989).

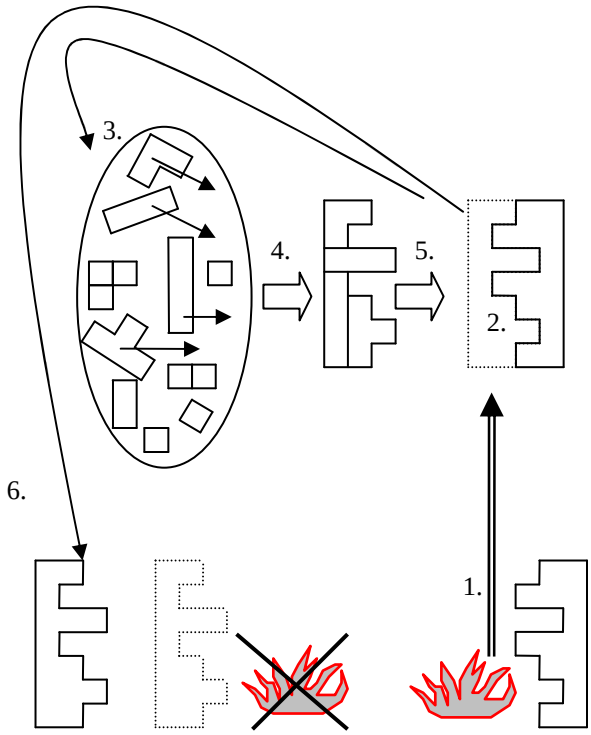


Figure 23 Evolvement of the scheme on firefighting.
Source: Author.

The development of the schemes begins with the leaders by arranging the individual tactical elements, experienced in practice. Based on the *figure 23*, the simply matching scheme (2) of the technically correct decision is not yet available for characteristics of fire (1), the decision-maker, from his memory, selects it first by tactical elements (3). It happens slowly compared to the dynamics of the events, many times, making the decisions of routineless leaders apparently cumbersome, they are rather followers of events than foresighted, they seem mentally tired, and it worries externally as well (Restás, 2012).

The reason for the above is that they do not try to manage the entirety or the nature of the problem, but the individual elements separately, which obviously results in significant additional time. At the analysis of the essay, I found several references, which are edified from the example of firefighting directed by inexperienced decision-makers, they are best summarized: *"It is important that it is not events which should drift the personnel, but the person in charge should control and direct the activities on site."* (G87)

After the elements are selected, the elements are arranged (4) and matched (5), always at the rate so as the decision-maker is able to manage it; initially by elements, then arranging them into groups, until finally the whole scheme develops and attains its final form (6).

Based on the above, the question arises how long time it takes a firefighting manager to become "mature" to fulfill the position of a chief fire officer, with the necessary competences and duties. Such a survey has not yet been done, but Ribárszki compares the evolvement of tactical schemes of military leaders with the representation of chess-players (Ribárszki, 1999) and refers to Mérő's researches, who estimates the schemes of grandmasters to be in the magnitude of tens of thousands; it takes approximately ten years of experience to collect it (Mérő, 1989).

The acquisition of sufficient experience, I believe, in the case of firefighters depends on the amount of active participation in the liquidation of damages, on the characteristics of fires, rather than on the service time. Of course, the former is also dependent of the time of service.

Practice shows that a significant part of fires liquidated is technically not complicated; extinguishing can be performed sufficiently with little experience as well. However, to entrust a person with leadership not having sufficient experience in management functions, represents an excellent talent-recognition ability of the chief fire officer, or gambling with little risk, provided by the statistics (Restás, 2001).

4.4 Triggers of a recognition-primed decision

Different triggers, internal resources ensure the operation of recognition-primed decisions. Klein, in his work, assumes 5 markedly distinct abilities, these are *intuition, imagination, perception of the invisible,* the *ability to formulate, metaphors* and *analogies* (Klein, 1999). In the joint work of Cohen, Freeman and Thomson (Cohen et al., 1996), draws the attention to the importance and benefits of critical thinking as criticism of actions planned by ourselves. I detail the latter as a complementary procedure of recognition-primed decision.

4.4.1 Intuition

Klein, in his work, defines *intuition* as the *use of our experience, when we recognize their core processes by perceiving the dynamics of the situation* (Klein, 1989). This includes, with parallel scenarios, recognition as well what there is a given situation, which is certainly going to happen and what is not. This shows the direction as a guideline to the essential processes of an event. This trigger only works in possession of appropriate experience, which will develop the advanced situation assessment ability of the decision-maker. With this, as well as with its innate ability, a decision-maker is able to react instinctively in a given situation.

The above are confirmed by several descriptions on the capabilities of military decision-makers, and I would like to support them with my own research results as well. Clausewitz's concept of the "coup d'oeil" that is, *a blink* or *review* (Clausewitz, 1984) demonstrates this unique ability, the efficiency of actions based on intuition. I think it is about the ability of the "*piercing eyes*", which is an *internal visual skill,* through which reality becomes instantly recognizable.

Similarly, Duggan discusses this intuition capacity at length as the power of "*internal vision*" in his work on *Napoleon's Glance*: *The Secret of Strategy*. He explains in his work of his that, according to his interpretation, successful decision-makers do not see or perceive the problem to be solved as long as they are able to define its solution at the same time (Duggan, 2002).

The way we solve a given problem, is based on *expert intuition*, which is based on the decision-maker's experience (Wolgast, 2005). The decision-maker sequentially takes into account the action versions appearing expedient and immediately stops, at which he thinks he can solve the current problem (Duggan, 2002). This assumption is in harmony with the decision-making process seeking to be satisfied.

Expert intuition is a special combination of *internal vision*, *composure*, *precedence* and knowledge of their *outcomes*. Piercing eyes or the ability of internal vision quickly recognizes the processes; composure provides the ability, which is inevitable in handling of unexpected situations, while the knowledge of the outcomes of past events makes us confident, so we are able to adhere to our original intentions (Clausewitz, 1984). The synergy of the above capabilities constitutes the ability of expert intuition.

4.4.2 Imagination

The other trigger of recognition-primed decision-making is *imagination*. Klein attaches a particular importance to this ability, he devotes his work *The Power of Intuition: How to Use Your Gut Feelings to Make Better Decisions at Work Currency* exclusively to study it (Klein, 2004), although earlier, in his work entitled *Sources of Power How People Make Decisions* (Klein, 1999) has analyzed it together with the other triggers.

Based on his studies, "*imagination is the ability during which we consciously think of people and objects and to transform them in our thoughts even several times, eventually we embody them in a form certainly different from the initial state*[50]". In Wolgast's opinion, the imagination of a decision-maker is not different, in fact, than

[50] Translation by the Author.

the integration of its *creativity* and *innovation* (Wolgast, 2005). During recognition-primed decision - making, according to Klein, we use imagination for three purposes:

- assessment of the action version, in case of error, to be able to modify it;
- estimation to be able to predict the expected outcome of our action;
- testing, which exists is nothing else than the trial of action version (mental).

The above targets are very much in harmony with the process of *critical thinking* (Cohen et al., 1996), which I show in the future as an additional mechanism of recognition-primed decision-making. One of the most fundamental challenges is, in imagination, that a decision-maker should always be aware of the details that arise in the meanwhile, but not matching the process. With the help of this mechanism, a decision-maker does not need to change his position constantly, but will be able to follow the course of real events.

4.4.3 Perception of the invisible

Another source of power of a decision-maker is the ability to be *able to detect the "invisible"*. I see two aspects to this: a decision-maker perceives real "invisible" elements in one of them, which could only be born by experience, knowing the underlying content of processes. Klein associates its other aspect with the thorough knowledge of specialized areas, but he explains it by the perception of small signs not to be detected by others (Klein, 1999). Experts are able to notice tiny details, by a wide knowledge of the field, which can remain to others, even after long observation, phenomenon of subliminal stimuli, simply invisible (Barlay, 1990).

The recognition of small details helps, combined with intuition, imagination and situation awareness capability decision-makers to assess correctly the ongoing processes or spot the anomalies an untrained eye would leave aside (Klein, 1999).

Another generated effect can be observed as well. Experts, while knowing the rapidly changing, uncertain, complicated and unambiguous circumstances well (VUCA environment), they are able to outline their limitations much easier in an identified knowledge environment. In such cases, not bothered by the difficulties, they understand and accept their personal limitations; i.e., experts much easier recognize the situation, when it exceeds the limits of their own abilities (Wolgast, 2005). Not disputing the above phenomenon, it may sometimes be dangerous, even on himself, the decision-maker as well. In a plane crash, a number of members a medical team stuck inside the burning wreckage of the aircraft, because they expected, with overconfidence, help to arrive and trusted its success (Barlay, 1990).

Based on my own research as well, I would like to confirm the shortcomings of the above process. One of the essay-writers refers to a case (BJS), where the newly appointed superior with non-firefighter education and inexperienced in interventions was moving, not understanding and seeing through the situation, etc., in a confined and explosive environment of a gas bottle, in the absence of protective clothing and without any sense of danger. He tolerated and accepted, although with difficulties, the junior firefighter's intention to raise his awareness of it. It can be shown in the example of the latter as well that firefighting interventions in a complex environment require the rapid integration of the building blocks of expert knowledge in the decision-making mechanism.

4.4.4 The ability to formulate

Klein regards the narrative as a trigger and resource of recognition-primed decision-making, *the ability to formulate what has happened*. Based on his studies, a decision-maker should be able to formulate his message from thoughts, concepts, objectives and contexts that help others as well to understand the events, their circumstances and the lessons learnt (Klein, 1999). After telling the story several times, it becomes easier and easier to understand it. Thereby, the links between the parts of information will be closer and, if necessary, become recallable by both the narrator and the audience. I can confirm the importance of discussing the details of an intervention, based on my own experience and confirmed with a st atement of one of my students:

"I think and I experienced it as well, what you hear during a spontaneous discussion remains deeper in the minds of responders than if they hear it at an obligatory lecture. The experience gained is somehow imprinted better in practice, in everyday life. It is easier to remember what you've seen there." (SX9)

4.4.5 Analogies and metaphors

Another mechanism for arranging thoughts is the ability to create *analogies and metaphors* relating to events. This mechanism allows the decision-maker, on the one hand, to provide a frame easy to understand, for its current message, on the other hand, to be able to link past events to the present ones, or perhaps get entangled in any predictions for the future (Klein, 1999).

We can find many examples of the procedure in the media. Usually, this happens when, in connection with an event just taken place, without real investigation, the report chains the previous similar ones and common threads, raise or leave open questions seeking for reasons concerning the future as well. An example of such firefighting-related topics can be a report on forest fires regularly occurring during dry periods, in the end of which they usually address the likely trends in the weather like one of the most important characteristics of fires of the given type. In military terminology, these mechanism also regularly occur, where, the differences and similarities between e.g. the Vietnam and Iraq wars are taken as a basis, (Record and Terrill, 2004), or at the series of events become known as "*Arab Spring*", analyzed the similarities and the differences between the processes in different countries.

4.5 Summary of the results of the chapter

In this chapter, I presented the working conditions of emergency decision-makers and pointed out the most characterizing factors, including *complexity*, the possibility of the *radical changes* of the situation, *uncertainty* and the *ambiguity* of information available, in all cases recognizable and clearly identifiable.

It would be even possible to solve most of the characteristics and problems by spending sufficient time on it, i.e., by analytic thinking of classic decision-making and could be perhaps resolved by adequate resources, but in the wake of time, the decision-maker does not have the possible to do so. This basically influences and clearly limits the "planning" process of the implementation of tasks, that is, must apply another decision-making procedure based on the mechanism.

Basically, referring to Klein's work, I presented the general model of *recognition-primed decision-making*, which means that a decision-maker, based on his past experience, has several different solution schemes, which he evokes and uses in new situations, basing his decisions on them.

In the course of my researches, I also proved by analyzing the essays that for firefighting managers there is not enough time for analyzing thinking by developing options, for applying decision mechanisms based on them; accordingly, recognition-primed processes dominate when making decisions.

I proved with association studies that in the memory of firefighting managers individual fires immediately generate ideas to extinguish them and solve the problem. Compared with the results of the control group, I clearly proved that the characteristics of fires and their potential solutions (e.g., lifesaving, firefighting) perfectly co-exist in the memory of experienced firefighters, but also that its orientation is strongly overrepresented in the direction of the solution. It also became apparent that a scheme develops the solution scheme to display, characterizing the given fire, but out of the two, the solution scheme is predominant. I regard it as proven by the clear high rate of replies categorizable in the *intervention* group, in the results of the association studies, by itself, but also by comparing the replies listed therein by the control group, without a doubt. The extent of difference illustrates that the solution is almost like a vacuum for the decision-maker, involving him.

Taking into account that decision-making capacity is limited, and that the ideas on the solution are usually in majority, I drew the conclusion that firefighting managers are not interested in a fire or its characteristics, but rather the process by which he can terminate it. This shows that the mentality of a firefighting manager uses the

even simpler pairing *fire–solution (extinguishing tactics)* instead of the logical sequence of *fire–characteristics–solution (extinguishing tactics)*.

Based on the above, emergency decision-making has two essential elements: one is the application of the scheme enabling an immediate decision; the other is the evolution the dynamics of the situation. The selection of the scheme, which includes the future expectations concerning the development of the situation, is almost automatic for an experienced decision-maker; however, the course of the dynamics of the situation will confirm the correctness of the decision.

The feedback of the result of the processes developed is of course not a new idea to justify the correctness of the decisions, this is a well known theorem of management theory; however, in the case of emergency decision-makers, due to the shortage of time, firstly, this obviously has a greater role, on the other hand, they are behind this as well recognition-primed mechanisms. Based on the above, recognition-primed decision is not just an individual act before starting to extinguish a fire, but, if required, is its continuous accompaniment.

By doing this, I share the view that an experienced decision-makers detects the problem together with its solution. In addition, I extended the joint and continuous existence of the problem and its solution to the entire process of an emergency (firefighting and technical rescue) as well.

At the end of the chapter, I reviewed the internal resources of recognition-primed decision, so I presented *intuition*, *imagination*, *perception of the invisible*, *ability to formulate*, as well as the background and use of *analogies* and *metaphors*.

5 MECHANISMS COMPLEMENTING A RECOGNITION-PRIMED DECISION

Despite the fact that one could assume, based on the previous issues, that recognition-primed decision-making enjoys exclusivity on a tactical level, it is absolutely not true. We can compare it with several fires or incidents, still, one of the essential features is that it protracts in time. It allows the decision-maker to think through the situation, collect information, develop action versions and consider.

Forest fires, peat fires, or in many cases, fires of storage facilities or other hall-type buildings, burning for several days and covering a large area are categorized specifically into the above types. Examples of the latter may be the fire of the Budapest Sports Hall on 15 December 1999 (Balázs, 2000), or the fire of the Zalaegerszeg refrigerating facility on 24 August 2004 (Heizler, 2004).

In the above cases, there was not just an opportunity for classic decision-making, a thorough consideration of the situation or setting up options, but without them, it certainly would not have been possible to make a correct decision. When talking about the example of a warehouse fire, you have to take into account the properties of the substance stored (e.g., development of toxic gases), the storage method (e.g., the use of ammonium as refrigerant and its release), the combustion characteristics (e.g., large-scale, intensive combustion), the proximity of residential houses and the weather conditions (wind direction, speed and expected future developments) as well. Many circumstances should be noted, when extracting a single case, depending on the situation, which gives the uniqueness of the situation. Firefighting and mitigation certainly requires a longer time in such situations, therefore, there is time to establish and assess options, during which it is not only possible but also necessary to build on experience acquired in similar situations.

During protracted decision-making, the recognition-primed processes, based on my own experience, proved to be irreplaceable assistance rather in solving partial tasks.

5.1 Analytical thinking

We have already come across Franklin's sentence that has become a slogan. Now we can look into its details as a typical example of analytical thinking, where we can see how the elements of the classic task solution culminate:

Since I do not know the precedence enough, I cannot tell you what to decide, but if you want I can tell you how. (...) I do it like this: I divide vertically a sheet of paper into two columns: on the top of one I write Pro, on the top of the other Con. Then (...) I write the essence of the motifs under these two headings, which cross my mind time to time, pro or con making the given step. When, by doing so, I have the entirety before me, I try to judge their weights related to each other (...) finally I determine where the balance tips. (...) when I balance all of them, one by one and compared to each other, I feel I can make a decision better and am lees exposed to making an unthoughtful step.[51]

Hammond and others provide the possibilities of the modern era and the summary of the above thought in his work entitled *Smart choices* (Hammond et al., 1999). Classic decision-making mechanism can be divided in two different ways, as a well definable process. In one of the cases, the qualitative changes of the process should be taken into account as turning points, in the other, the phases as a temporal processes between turning points.

In the division of classic decision-making, based on turning points, the following steps can be ascertained in general:

1. recognition of a problem situation,
2. conception of a problem,
3. determination of action versions,
4. feasibility study of versions,
5. assessment and qualifications of versions,
6. selection of the best version, (DECISION)
7. implementation of the version.

If we regard decision-making as a temporal process, we should consider the periods between the above steps. Based on this, decision-making can be divided into the following phases:

1. initiative phase,
2. search phase,
3. analysis, optimization phase,
4. selection phase (decision),
5. implementation phase.

Many literatures process analytical thinking in a more detailed way than the above, with various approach modes (Kindler, 1991; Bakacsi, 1996; Dobák, 1996; Paprika-Zoltay, 2002), and there are also profession-specific developments, thus, concerning the fields of defense (Ribárszki, 1999 and Mezey, 2006) and law enforcement (Molnár, 2003). I show the above in a uniform way in *figure 24*, where the red numbers indicate the turning points of the decision-making process, the black numbers indicate the phases.

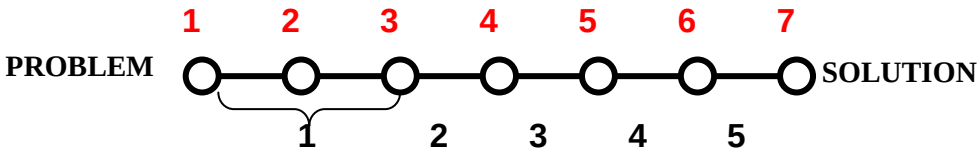


Figure 24 Classic decision-making process with the demonstration of turning points or temporal processes. Source: Author.

Killion sees the combination of recognition-primed decision-making with the analyzing and evaluating procedure in two ways (Killion, 2000), I have already demonstrated it at the presentation of the general model (*chapter 4.2*). In both cases, the conditions are that adequate time should be available for analyzing the options. In the first case, prior to recognition-primed decisions, focusing on the given circumstances, we set up options and analyze them. In the second case, a more detailed analysis of the action version of our recognition-primed decision may take place. In the latter case, the spectrum of the task is obviously significantly narrower

[51] http://technoqua.hu/tortenet_old_5.html

than in the first case. The two mechanisms, depending on the situation, can be harmonized or one of them may become predominant.

Mezey, in his work, also discusses how the possibilities of multi-criteria analysis work. Here, the use of static decision support tools also prevails, which assist decision-makers based on pre-loaded data, through special search engines. (Mezey, 2009).

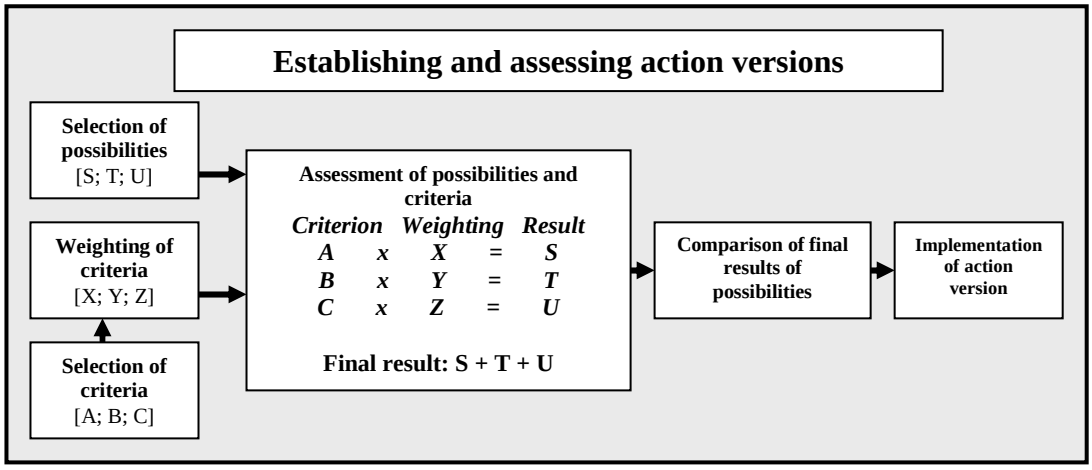


Figure 25 Multi-aspect model for managing action versions.
Source: Author based on Killion's work.

The observation of the elemental parts of multi-aspect decision-making shows that decision-makers divide complex problems to smaller and smaller partial problems until they become such a basic level problem that a decision-maker is able to solve even with little effort (Simon, 1960; Paprika-Zoltay, 2002). This latter process can also be a recognition-primed decision-making, but logically we can find Duggan's view, previously referred, at the end of thought list, according to which successful decision-makers not perceive a problem until they can solve it (Duggan, 2002).

5.2 Critical analytical thinking

5.2.1 On critical analytical thinking in general

The critical analytical thinking is one of the fashionable tools for strategic decisions, one of its independent methods in certain cases, processed by a number of different

authors in different depths and perspectives. The simpler versions of the procedure promise significant efficiency growth and the regular use of 7 criteria. Versions with few perspectives determine (e.g., Kenedy, 2005), in fact, the basic stages of analogical problem solving like necessary elements of critical analytical thinking.

The researchers of topic dig much deeper to reach, by thematic processing, different classifications (e.g., Lorenz, 1994) or strategies (Paul et al., 1990). Referring to the work of the latter author and others, bearing in mind the 3 main strategic directions in Myatt's elaboration (*active strategies, cognitive strategies on the macro and micro level*), it summarizes 35 dimensions of critical analytical thinking (Myatt, 2010). In the above works, they keep in mind the solution of problem of business life, intend to help its decision-making.

5.2.2 Critical analytical thinking on a tactical level

Cohen, Freeman and Wolf studied the possible decision support role of critical analytical thinking on a tactical decision-making level (Cohen et. al., 1996). In their work, active naval officers and case reports were studied, based on which they state that experienced emergency decision-makers, in new situations, using their previous experience, make decisions with help of recognition-primed mechanisms.

Cohen’s model explains in detail the critical analytical strategies that contribute to the operation of recognition-primed thinking. Systematic situation models often based on informal narratives as schemes, organize our information in cause and effect relationship in individual cases and underpin the development of recognition-primed thinking. I can illustrate it in my own researches, with a reply of a student:

"I think and I experienced it as well, what you hear during a spontaneous discussion remains deeper in the minds of responders than if they hear it at an obligatory lecture. The experience gained is somehow imprinted better in practice, in everyday life. It is easier to remember what you’ve seen there." (SX9)

Recognition supplemented with critical analysis as a complex mechanism includes the following elements and processes (Cohen et al., 1996):

Facts based on evidence

Facts based on evidence as cornerstones in the ongoing processes should be identified and compared with the earlier plans. This formulates the difference, in a very simplified way, between reality and an intent. Its depth is determined by the time available.

Critical analysis

The exploration of defects and problems related to earlier arguments is done through critical analysis, identifying the difference between the expected and the situation developed, resulting in promoting the development of a final conclusion. Critical analysis may result in the exploration of three problems that can be formulated:

- *failure* or *incompletion* of the process,
- the *unreliability of the results*,
- existing *conflicts*.

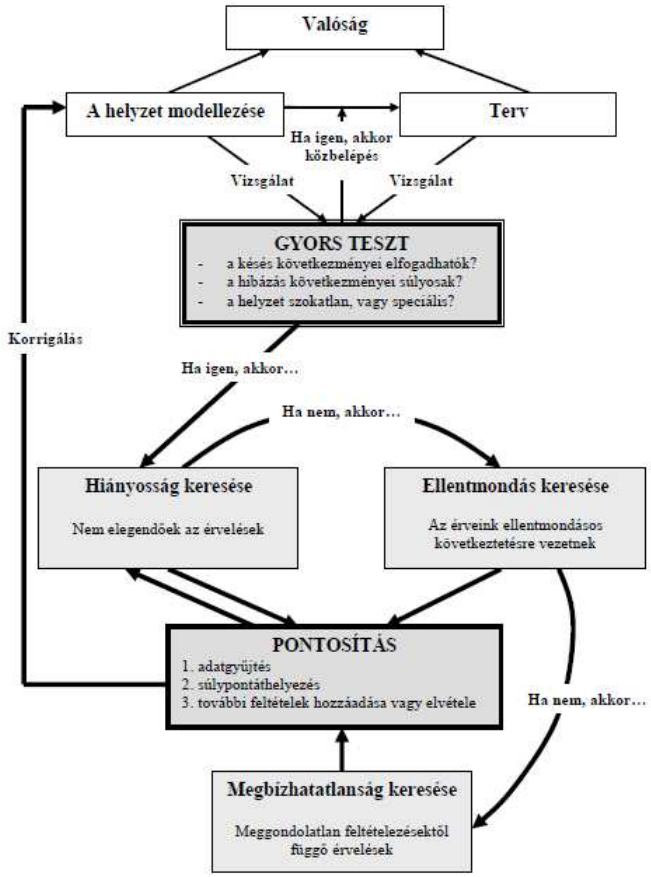


Figure 26 Process of critical analysis. Source: Author, re-edited based on Cohen's model.

Evidence can be regarded as *insufficient* or *incomplete* if it can neither support, nor contradict our suppositions. If *one* of the arguments *supports, the other one contradicts*, i.e. they would end up with a result from both sides by the way, it would be rather acceptable from the point of view of the decision as if neither of them would end up with a result. At the end of the day, arguments are *unreliable* if their qualification is although of support character, they depend on uncertain conditions and do not bear any future responsibility. Unreliability is not static, it can move or even disappear if, later, its circumstances are clarified.

Mechanism of correction as a response to problems

The mechanism of correction as a response to problems is connected to one external and two internal actions. The external action can take place by the *collection of additional information*, one of the internal actions by the *shift of the focus of attention*, the other by the *review of assumptions*. Shift of the focus of attention or the transfer of the center of gravity stimulates the retrieval by the emergence of new and relevant information in our long-term memory, and can provide other arguments for the analysis of complex recognition-primed procedures. The addition or deletion of conditions makes it possible to pursue our argument based on "*if-then*" type of assumption, through logical derivation of options of causes and effects of, and adaptation of simply matching models or plans.

Rapid test

A rapid test is a higher-level control mechanism for critical analysis and its accuracy. Its recognition strategies are formed, similarly to other decision-making processes, by the success or failure experience of past events. The complex recognition mechanism comes to the fore when the demand on time and resources for critical analysis is overweighed. It is possible in three well-definable cases (Cohen et al., 1996):

- When the extra costs incurred by the delay of decision is still acceptable, i.e. adequate time is available for critical analysis;
- When the given situation is uncertain or has significant novelty value, that is, the consequences recognized are to be perfected;
- The cost of damage caused by actions implemented based on a recognition-primed mechanism is high.

A rapid test considers the conditions in the light of the above factors, and if they appropriate, prevents recognition-primed decision, and focuses on critical analytical thinking. When circumstances are not adequate, a rapid test will allow for an instant reply. Figure 26 summarizes the relationships between the above processes, and highlights the difference between recognition-primed thinking and critical analysis (Cohen, 1996).

The recognition-primed part and the complex cognitive process are in a strong interaction with each other. The former supplies the latter with information, while the latter keeps the former continuously monitored. In Cohen's model, complex recognition continuously monitors recognition-primed mechanism, maintains, repairs, or even redefines the model (e.g., identifies the cornerstones and the problems of gaps in the arguments, contradictions and unreliabilities), alters or modifies the recognition actions, while inhibiting implementation, transfers the center of gravity, accepts or rejects the hypotheses. The above functional differences, from time to time, are appropriate, but may contradict the structural or psychological differences (Nelson and Narens, 1994).

During critical analysis the resolution of a problem, if not always, but often may lead to revealing another one and the necessity of its solution (Cohen et al., 1996). For example, when filling the gaps between the arguments require data collection and it is not possible, we have to use assumptions. Therefore, our arguments may become more specific, through which they may become contradictory with other arguments of ours, previously correct. Such conflicts may result in uncertainty over our former arguments. In such cases, the focus of complex recognition-primed mechanism itself can be transferred to the basis of argument instead of the assessment of the consequences, as a new problem.

The above mechanism terminates when the result of the rapid test indicates that the advantages of the further complex recognition process probably counterbalance the risks caused by delay and the action based on the present model or plan is implemented. The result will be a coherent model or plan, recognizing and accepting its strengths and weaknesses too.

5.3 Satisfactory procedure mechanism

According to the economic decision-making theory model, a decision-maker behaves rationally and always chooses the optimal version. We have seen previously that a firefighting manager's time, just as the time of other decision-makers in an emergency to make a decision is limited. Since this time limit precludes the possibility to carry out the necessary analyses of the classic model, objectively the choice of an optimum option is not achievable for a decision-maker[52]. In response to the difficulties of the collection of information and the reduction of the costs in relation, a decision-maker does not strive for optimum results, but, depending on the circumstances, settles for satisfactory solutions.

The above mechanism, however, is nothing else than a administrative model created to resolve contradictions of the classic decision theory model, developed on the principle of limited rationality, based on which it is not possible to take into account all the circumstances, not only objectively, but there is no intention of a decision-maker to do so (Simon, 1957).

The above process, different from analytical thinking, is enforced by several factors. Some of these factors are the impossibility of obtaining all information necessary to select the best solution, or the shortage of time; the latter induces a compulsion of decision-making. The limited nature of the processing information available is also of significant influence. Filtering of information, and by this the selection of response to the tasks is necessary because the capacity of our short-term memory is quite limited. According to Miller's studies, previously referred to, it allows the parallel processing of only 7 ± 2 bits of information at one time (Miller, 1956). If a firefighting manager made all the basic decisions, his decision-making capacity would be immediately exhausted at a complex firefighting task. This is all the more so because to examine a relationship at least two elements and an operation are required, which already exhausted half of the memory (Ribárszki, 1999).

[52] Except the single case when the random choice exactly coincides with the decision made with the method of analysis. Its magnitude can be identified through statistical methods.

Despite the small capacity, thanks to recognition-primed mechanisms, correct decision is made in most cases (acceptable, given the effectiveness of firefighting). A firefighting manager, using his experience, in situations not requiring decisions different from the previous solutions, implement automatic measures, protocol procedures, thus continuously maintains his decision-making capacity. In this case, using his own experience, a firefighting manager is not interested in by which series of best elementary decisions he can eliminate fires, but only in satisfying the conditions of professional firefighting through the decisions made as a whole.

The series of best elementary decisions obviously result in more effective firefighting (e.g., use of less extinguishing agents causes less secondary damages). To make this decision, however, would require analyzing and evaluating thinking already outlined, which reconnaissance simply does not allow in 1-2 minutes or the immediate decision constraint of unexpected situations during extinguishing. The series of ideal elementary decisions would follow the course or process of fire, moment by moment, and modify it (for example, the amount of extinguishing agent used in relation to fire intensity), however, using my own experience, it happens spontaneously in the lack of consciousness. This, of course, does not mean a series of professional errors, the difference of the effect of decisions between conscious and spontaneous, surely converges with the increases of experience.

Based on the above, a firefighting manager, although he would be able to, does not deal with making the best elementary decisions, but with others that meet the overall conditions of professional firefighting. This decision-making mechanism, however, is not static and does not imply its acceptance by the firefighting manager either, would be the allowed use of the simplest (primitive) responses. With the change of circumstances, the high quality standards imposed against satisfactory decisions have also changed, in case of unsatisfactory version easily found, quality requirements increase, but otherwise, reduce, until an acceptable balance is formed. The development of this equilibrium is similar to the term of *aspiration level, known in psychology* (Paprika-Zoltay, 2002).

5.4 Decisions based on exceptions

The elaboration and conscious use of the *management method based on exceptions or deviations* (management by exception), based on systems (management by systems) together with management methods through target objectives (management by objectives) is the achievement of the development of the science of management after the Second World War. We have been using the method since ancient times, however, it was first Dale, Drucker, Koontz, O'Donell, and later Mackintosh (Mackintosh, 1978) who dealt with its scientific descriptions. The aim of the application of the method is that the leadership responsibilities of managers should be drastically reducible; its essence is that we should only intervene into processes having permanent characteristics in majority, if they cross the pre-specified lower and upper limits. They further developed a method later (management by sensitive exception), so derived from the dynamics of the processes, the necessary interventions are now possible even before crossing the borders (Hoványi, 2002).

Dekker and Woods studied the use of the method, in terms of one of the groups, classified as emergency responders in the focus of my dissertation, of air traffic controllers, exploring its possibilities and limitations, exploitable in air traffic control (Dekker & Woods, 1999). I also mentioned the characteristics of the application of the method in the course of firefighting, using my earlier experience. (Restás, 2001).

Management based on exceptions, in this case, consists of the several momentums proceeding protocol like, so you do not necessarily have to control them; on the other hand, not all the moments of processes require direct managerial decision. All of these take place in a particular communication medium, where we experience either the use of a unique way of speaking, jargon, or the lack of explicit control mode.

The method of management (decision) based on exceptions, based on my experience, is the greatest help for a firefighting manager to continuously maintain his decision capacity.

5.4.1 Protocol procedures

Firefighters learn many elements of the damage mitigation process at the beginning of their practical training, and afterwards, they drill it according to the annual training plan. Thus the implementation of tasks in real fires, often take place under routine protocol, allowing the firefighters' attention not to be burdened by following the sequence of movements. Examining as examples the *preparation of firefighting*: a firefighting manager, as provided by law[53], defines its *manner*, in case of so-called *base pressure hose mounting*, marking the location of the *distributor*, but the actual assembly process, the necessary increase of the number of hoses, or the so-called *mounting of the water feed*, ensuring the resupply of water, takes place according to the previously drilled motions, in a protocol like way. Based on the above, a firefighting manager may only issue instructions if they differ from the usual protocol, that is, his measures are necessarily focused on the exceptions.

We can see many other examples of the declared use of protocol rules, e.g., in health care management or air traffic control. The general cases are manageable very efficiently and in great numbers with help of the above, the expenses can be provided at a lower cost (e.g., paramedics). ***By using protocol rules, a firefighting manager has the opportunity to only give instructions in the case of necessary deviation from them, i.e. exceptions.*** The decision-making capability can be continuously sustained so that his attention should be focused on the perception of and the response to exceptions and special moments, different from the general ones.

5.4.2 The arrangement of information processing in zones

The experience and competence of the persons performing a given activity allows that every firefighter make his basic decisions in his own field of work. This shows the arrangement in zones of information processing (*figure 27*). Of course, not every incident or moment requires response. This zone does not require action that is practically ignored by a firefighter, because it is a natural consequence of extinguishing.

[53] MoI Decree No. 1/2003. on the Rules of Firefighting.

A significant part of problems outside the zone, as a result of a firefighter's decision in that location, is solved by intervention (firefighting), this information now reaches the firefighting manager, but he usually does not require a decision yet.

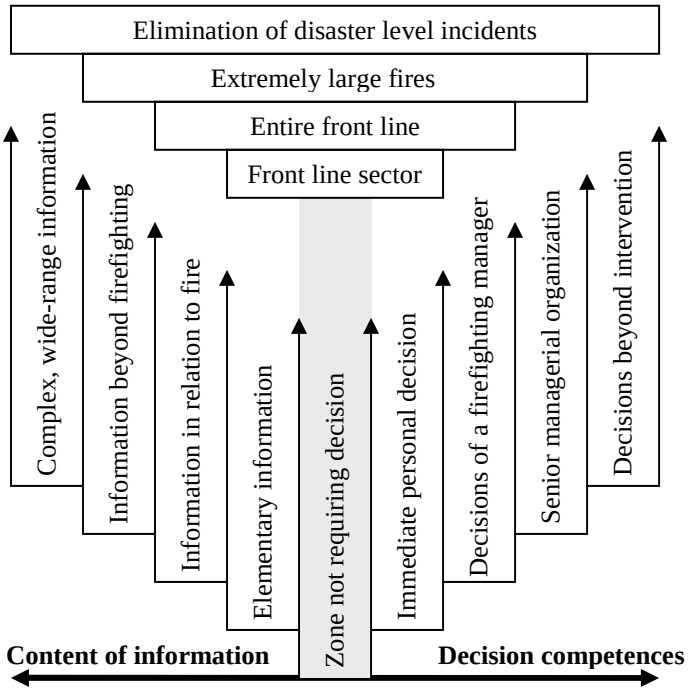


Figure 27 Decisions based on exceptions.
Source: Author.

A firefighting manager manages the problems outside this zone that exceed the decision-making competence of subordinate firefighters. This originates in the fact that, on the one hand, based on the information from reconnaissance and radio traffic, he can create a comprehensive and dynamic picture of the entire process, the evolvement of fire or the efficiency of extinguishing, on the other hand, legislation entitles firefighting managers to take actions.

Of course, there are also decision zones that exceed the competence chief fire officers, first arriving in an organized way, starting direction of extinguishing. His obligation to take over the management is clear at the time of establishing this higher management level. The expansion of the fire (e.g., forest fire), or the development of disaster (e.g., unintentional leakage of large quantities of dangerous substances) requires longer coordination of control, of the activities of the entire firefighting unit, exceeding the decision-making competence and zone (disaster management).

5.4.3 Individual way of speaking

For the professional liquidation of damages, accurate reconnaissance is inevitable. To issue instructions based on reconnaissance there is no more than time than 1-2 minutes, according to the previously established ones. This time is obviously not enough not only for decision-making based on conventional analyzing and evaluating thinking, but, in many cases, neither for the formulation of series of orders needed to initiate the work phases. Issuing of instructions necessary for the implementation of tasks happens often in an abbreviated form, using *jargons*. On the use of jargon, we can list examples in almost all technical fields; practice proves the efficiency of its use (Mezey, 2009). Mezey, in his work, gives the example of the management method of German tactical staff work, where the issue of commands is always explicit, by the use of jargon loudly expressed. Mezey draws the attention to avoid the use of body language, having regard to its ambiguity, and defines its prohibition.

I do not dispute the efficiency of using jargon and issuing commands expressed in a loud way, in fact, I can confirm it from my experience gained as a helicopter pilot and a firefighting manager, however, I do not accept its exclusivity. Both in flying (e.g., engine start) and the management of firefighting, body language will be used in a number of occasions. Decisions during work circumstances, making voice communications impossible, such as high noise or underwater work (firefighter divers) can only be made based on conventional signs by hands. In addition to standard signs, of course, we can also find here as generally in verbal communication, a statement providing supplementary information in addition to the intended signal, such as e.g., with the momentum of an arm signal, nodding, etc., showing the confirmation of a given session, the completion of the result of previous decisions, or its correctness. The above circumstances aim at reducing communication to the minimum during work, but should make sure it is safe enough to work. The work processes take place at this time, often in a pre-specified manner, or according to protocol, at which implicit management refers to both the acknowledgement of work processes of finished parts, or the start of new ones.

5.4.4 Silence approval

It is a *peculiar management mode, in which no real instructions are issued*; it belongs to the topic of communication, different from jargon. According to protocol rule of management based on exceptions, a firefighting manager can only issue a real command, when the activity of the personnel requires carrying out activities other than usual, based on exceptions. This is allowed by several years of working together; it develops the ability of "reading each other's thoughts." One of these characterizing manifestations is, when the personnel knowing the expected (yes) answer given to the specific event, in the field of view of the chief fire officer, begins the action, without issuing specific instructions but under visual contact (e.g., as a result of extinguishing moving towards the source of fire). ***The absence of issuing the instruction does not mean the lack of control, but the approval of the activity by the chief fire officer***.

5.4.5 Peripheral vision

We all utilize the beneficial effects of peripheral vision, day after day. I illustrate, with an everyday example, its mechanism based on perception of exceptions. When driving a car, probably very few monitor the indicator showing the temperature of engine cooling water. Its value is rather indicative for the driver, even though, technically, it is essential to maintain it between appropriate limits (especially under the upper limit). The mechanism is automatic, the driver should only perceive, to prevent damage to the engine, the upper limit being exceeded. To do so, however, no alarm or other warning system is connected, only the red range of the display call the attention of the driver to the danger. However, we can prove with our own experience that, without continuous monitoring of the indicator marks, we notice its shift into the red range. The reason is that the values of the normal operational range show on the display "midline" or neutral position. In this way, our eyes get used to it, that is, to the neutral operational value, but as soon as the indicator significantly differs from normal values (red range), our peripheral vision will detect it immediately.

Within the field of fire service, I justify the efficiency of above mechanism of the peripheral, with result of my own project. We displayed the real-time image of a camera mounted on a tower, in the communications center of a fire brigade, with in a research and development project[54], led by me, aiming at the early detection of forest fires. The display was placed in the peripheral field of vision of the duty officer, however, fire detection occurred through the system, always earlier than spontaneous reports would indicate, that is, it could provide very early warning. *The perception of exceptions by the peripheral vision served as basis of the operating principle*, since the smoke of the forest fire has a high moisture content, its light color is very contrasted compared to the relative dark tone of green color of the forest not burning. With the help of the method, the cost and operation of the system may be a fraction compared to systems providing automatic detection, there is only a slight difference in the average time of perception, but it does satisfy not only professional criteria, but also the economic efficiency.

A firefighting manager uses two types of peripheral perception-based decision-making. One of the significances is that, through experience, he can not help but perceives all the phenomena that do not match what is imagined, which ensures smooth continuous activities dung firefighting. He immediately detects non-matching elements of the scheme of fire as exceptions, and responds to them. The importance of this mechanism is justified by the fact that normal processes, just as in the previous chapters, ensure the sustainment of the decision-making capability of firefighting managers in the long run.

The above mechanism, though similar according to its interpretation, is not identical with the special perception mentioned in Klein's work, the capability of "seeing the invisible", regarded as one of the triggers of recognition-primed decisions (Klein, 1999). The latter refers to hidden fine-tuning perceivable only by experts, and supports the recognition-primed mechanisms of decision-makers, while the former serves to detect more obvious differences and it is not directly a recognition-primed mechanism, but is intended to guarantee the sustainment of continuous decision-making capability.

[54] KMFP-00025/2003 "Development of integrated environmental land monitoring and alert system for the early detection of vegetation fires"

5.5 Creativity

It can be seen from the above analyses that numerous external mechanisms help the limited decision-making capabilities of firefighting managers. The conventional, fixed procedures establish a unique standard in all firefighting managers, with the help of which they are able to manage the liquidation of damages easier. Let us call the totality of these norms and procedures *paradigms*. However, despite the fact that these paradigms can provide significant assistance to the chief fire officer in emergencies, the resolution of individual cases can end up in a full failure. The decision-maker should have basic capabilities, which, in case of circumstances not experienced yet (*prototype*) facilitate the appropriate decision. This ability is the creativity of firefighting managers.

Creativity has many definitions. Munteanu, in one of his works, presents 35, which approach creativity, in different ways, however, there is no single definition generally accepted or used, either (Munteanu, 1994). Analyses researching creativity show that there are three general directions of study (Csíkszentmihályi, 1996; Paprika-Zoltay, 2002). The first concerns the *nature* of creative thinking, the second one the *development* of creativity and the third one the *characterizing properties* of creative people.

Based on the psychological study of recognized creative personalities or individuals with excellent performances at creativity tests, it can be known relatively precisely what kind of properties creative people have:

stimulus sensitivity, good self-confidence, perseverance, diligence, sense of duty, initiative spirit, independent thinking, physical and mental activity, emotional stability, non-conformism, the ambiguity, to be fond of uncertainty, spontaneity, inventiveness, ingenuity, intuition, intuitiveness, inclination for setting up hypotheses, job commitment, metacognition, unique vision and essential vision, high-skill type of knowledge, logical thinking, divergent thinking, freedom from conformism, openness to unexpected or strange situations, orientation to ask novelty questions, inspiration to solving problems and making problems, passion, enthusiasm, self-involvement,

analyzing and synthesizing, abstracting and generalization abilities (Csíkszentmihályi, 1996).

Amongst the properties, there is practically none, which would not be advantageous for efficient work in a VUCA environment describing the working conditions of a firefighting manager. ***Based on the above, I made the conclusion that the creative capabilities of a firefighting manager can be explicitly beneficial for facilitating the technically correct decisions relating to firefighting and technical rescue tasks.***

Guilford and Torrance explicitly studied the expressions of creative personalities (Guilford, 1959; Torrance, 1974). The creativity factors ascertained by them are still valid and unambiguously accepted today, out which I consider the following:

- General problem sensitivity: perceiving and solving a problem;
- Fluency: speed of mental activity;
- Flexibility: ability to be mentally mobile;
- Originality: to be fond of the unusual and unknown;
- Synthesis: unifying into a whole, reunification of the elements of the whole;
- Elaboration: preparation; mode of processing;
- Analysis: examination;
- Redefinition: reorganization and rethinking of mental structures;
- Complexity;
- Assessment.

First, Taylor tried to distinguish the different levels of creativity (Taylor, 1959). Based on his great number of analyses of creativity definitions and own researches he concluded five creativity levels, built on each other:

- Expressive creativity. Characterizing the level of minors, appearing in drawing and construction type of toys and games as spontaneous and free expression. On this basic level, the question of utility or originality does not appear yet. Drawing and playing are excellent scenes for cultivating creative abilities.

- Productive creativity. On this level, we talk about creating different objects keeping conventional, well-known rules, in relation to specific job areas. The level of (two-hand) workers.
- Inventive creativity. Valid for only a small group of people, since here, we talk about finding the most hidden and unusual interrelations, elaboration of inventions, and the improvement and perfecting of existing products.
- Innovative creativity. We can talk about this level in the case of so-called talented people with exceptional abilities, since they are able to create products explicitly original, acknowledged on national and international levels.
- Emergent creativity. This is the highest level of creativity, characterized by genius novelties, human creativity resulting in radical changes or brand new and revolutionarily original product. All indicators show that this level can only be reached by the most exceptional and outstanding persons.

Based on my own experience, creativity can significantly increase professional efficiency of decisions made by firefighting managers in unexpected situations. This can be seen when firefighters are able to turn local conditions, in a moment, exploitable advantages. ***However, I found that a significant part of properties characterizing innovativeness do not prefer everyday work, free of interventions, in structured organizations, in respect of firefighting managers.*** This is confirmed by research findings as well, according to which it is explicitly problematic to follow strict rules for people producing creative results (The Reader's Digest Association Ltd., 1992). Maybe this is why it is a typical example that chief fire officers can safely trust the professional firmness of subordinates at incidents, in everyday life, even though the working relationships of *managers* and *subordinates* are burdened with tension.

Along with the benefits of everyday paradigms, there are many shortcomings recognized. The largest of these is that he can filter the real information too much, only accepting the phenomena that we imagined, the facts matching our expectations.

Thus, essential information may be lost concerning the outcome of the incident, or put aside unnecessarily. In order to reduce the above problems, we must be able to change the basis of common ideas and review them regularly according to need based on the results.

Beyond the general wording of the above, it is worthwhile to consider the ability to innovate depending on the time available. The study of creativity in this context has highlighted three key mechanisms (Unsworth, 2004). *Priorities* is one of them, the other one is *narrowing*, and the third one is the possibility of *increased risk aversion.* At the simple comparison of results of the studies, however, we can find a contradiction. Some researchers claim that creativity will certainly decrease at the effect of time pressure (e.g., Koestler, 1964; Farr & Forr, 1990), while others justify the opposite (e.g., Amabile & Gryskiewicz, 1987; Brunce & West, 1994). Due to the above, a further examination of the importance of creativity is inevitable at emergency decisions.

The role of creativity is a priority from another perspective, in the case of firefighting managers. This is related to the professional standards of preparedness. Researches show that if you intend to achieve creative achievements, it is necessary to have complete or extensive knowledge of experience, previously acquired, it is inevitable; that is, we need to know everything that was known before us; Pastuer's words "*Recognition honors the ready mind*" (Paprika-Zoltay, 2002). ***Therefore, a very thorough preparedness is inevitable in any situation, in terms of effective (creative) response capability of firefighting managers.***

I can confirm this with my own studies as well, the results of essay studies: it regularly appeared in the papers that firefighters formulate clear specific expectations about their own professional preparedness, so they *considered* it *priority for* the efficiency of their decisions, to which they either explicitly link *practical experience* (e.g., SX9, BYM), or implicitly express it the text environment (e.g., BJS, C84). As a result, although the correlation is undeniable, the period of service time is certainly primary in terms of effective decision-making, it is much more important, at what interventions and how often decision-makers participated actively in the past (Restás, 2001).

5.6 Heuristics

Heuristics means that certain distortions are not incidental and unarranged errors, but the results of simplifying mechanisms, with which decision-makers make the complicated tasks manageable for themselves, which cut the Gordian knot (Paprika-Zoltay, 2002). Based on researches related to the names Tversky and Kahneman, we distinguish 5 basic groups of heuristics (Tversky & Kahneman, 1974). These are *representativeness*, *availability*, *fixing (imprint)* and *adjustment* heuristics, *retrospective distortion*, as well as *overconfidence* and *calibration*. Studying the activities of firefighting managers, there are many examples of practical heuristics.

From the aspect of decisions, we are dealing with *representativeness heuristics*, when, in connection with a fire, aside from its uniqueness, we may well apply the fixed schemes, while insist too rigidly on its sustainability. They can appear at fire alarm, when the characteristics of previous cases dominate, ignoring that each of incident is independent from the previous ones. This also applies to the number of forces and assets deployed, their composition and classification (determination of the alert degree). Mentioning a recent example, after an alarm on the accident, firefighters automatically rushed to a road section where skidding into a ditch are regular (that is, where the frequency of incidents topped), although the reported case was exactly in the opposite direction. The result of this error caused an arrival 12 minutes later, which is professionally unacceptable, due to the nature of the incident, people were literally trapped in a burning car.

Retrospective distortion is also very characteristic. I do not consider it general, but I know from my experience, it often occurs after an intervention that the circumstances are recalled differently than reality, retagged by success matching their positions. One major drawback is that real errors, problems remain hidden before both subordinates and managers, they do not help prevent future similar situations.

In the case of retrospective distortion, researches highlight when considering the decisions of others, we should be more tolerant, since it is only an illusion that the consequences of decisions can be foreseen (Paprika-Zoltay, 2002). In the case of investigation following an incorrectly performed intervention, at the exploration of real errors, it may even be a relevant consideration. Of course, in this case, we should be able to distinguish intentional and unintentional distortion. In the latter case, we really face heuristics, while at the dissolution of the former, perhaps the adoption of *just culture* [55] may help (Székely, 2012).

The essence of *fixing* and *adjustment heuristics* is that we fix our final decisions to an earlier starting point. The location of fixation as an anchor from the optimal decision, can essentially determine the correctness of later decisions. The adjustment often takes place in inadequate or cascaded decisions, too far from our possibilities or dramatic modification, can even significantly exceed what is necessary and re-adjustment is necessary.

During firefighting interventions, we deal with typical fixing heuristics, when, based on the fire alarm, *alert degree* and its classification is determined. The Rules of Firefighting helps this at a few occasions, but is basically determined by the decision-maker, based on his previous experience. Based on reconnaissance on site, the rules later declares the confirmation of the correctness of fixation or the need for adjustment, otherwise at the feedback requirement as well.

Based on my own experience, we insist too much on the alert degree first determined and if, based on reconnaissance, it has not been modified, we see it as *carved in stone*. In this case, the danger of adjustment is unidirectional, i.e. the posterior alert of necessary personnel means a risk (the adherence to the personnel already there is merely a waste of resources). An adjustment too late, i.e. the late alert of the necessary resources can cause two problems due to the dynamics of firefighting. One of them generally characterizes the adjustment heuristics. Accordingly, a proper decision inadequate in relation not to the given but to the expected situation is made, i.e. the adjustment to the new situation will be inadequate.

[55] Just culture – new concept promoting the exploration of circumstances dangerous to safety.

The other problem can be generated from the previous one: because of the new situation, the decision-maker requires a gradual adjustment, due to which damage value will be higher than necessary, on the other hand, the extent of the posterior adjustment will exceed what would have been originally necessary.

Overconfidence, based on my judgement, is one of the greatest risk factors of the efficiency of decisions of a firefighting manager. A firefighting manager, quite often, stops searching for the information necessary for earlier than sufficient, based on his experience, he trusts his own judgement, many times, assuming unnecessary risks. The extent of rational risk assumed during interventions should be always chosen proportionate to the given task; a risk assumable at a fire in an agricultural grain storage facility is incomparable with a fight for the life of a human being.

Researches show (Lichtenstein & Fischhoff, 1977) that overconfidence means that the division between actual and putative knowledge is around 50%. We are best able to judge the certainty of our decisions around 80% of knowledge, over this value, we underestimate our abilities. The above have shown that our actual knowledge does not grow parallel with certainty, the increase of our knowledge does not automatically mean the growth of self-assurance (Paprika-Zoltay, 2002). During firefighting (technical rescue), the characteristic VUCA environment exactly expresses that the actual knowledge of a decision-maker can only be partial, he can only be sure temporarily of the reliability of his knowledge. Aggregating the above, we can see that the risk of overconfidence continuously prevails in the decisions of a firefighting manager.

The researches have indicated that the connection between overconfidence and intelligence is not close, and experience can only reduce it to a slight extent. (Lichtenstein & Fischhoff, 1977). The best way to avoid risks is to call the attention of decision-maker thereto, which, of course, cannot mean the inequitable criticism of tasks already performed, it means much more: too high risk-taking is unnecessary.

5.7 The complex model of decision-making of firefighting managers

In the chapter, I examined and showed the mechanisms promoting the more efficient decision-making of firefighting managers. I demonstrated the linking opportunities of recognition-primed decision procedure and analogical thinking, pointing out the fact that the two do not exclude each other. If an intervention is protracted or longer time is available for the decision, many times, firefighting managers may achieve more efficient firefighting by using the latter.

If not enough time is available for analyzing and evaluating decision-making, recognition-primed procedures receive a greater role. Critical analyzing thinking uses recognition procedures, during which the decision-making process can be accelerated or analyzed with the help of a rapid test and depending on the time available. The rapid test, considering the circumstances, hinders recognition-primed decision and prefers critical analyzing thinking. However, when the circumstances are inappropriate for critical analyzing thinking, the rapid test allows immediate reply.

Despite the limited decision capacity, thanks to recognition-primed mechanisms, in most of the occasions, correct decision are made by firefighting managers. Time limit precludes the possibility for the firefighting manager to carry out analyses necessary for the classic model, therefore, the selection of the optimal possibility is objectively not attainable by the decision-maker. The decision-maker is not striving to achieve ideal results, as a response to the difficulties of collecting information and reducing costs in relation, but depending on the circumstances, he is satisfied with the its satisfactory solution.

By reducing the time available for decision-making and for maintaining decision-making capacity, a firefighting manager applies the management (decision-making) method based on exceptions in numerous situations. Its essence is that several moments of interventions proceed protocol-like, thus, they need not be controlled all the time; on the other hand, not all the phases of the processes require direct management decision.

The method of management (decision) based on the principle of exception, according to my experience, is one of the greatest help to continuously maintain the decision-making capacity of firefighting managers.

During the study of creativity, I have concluded that there is no such a feature characteristic of the working circumstances of firefighting managers that would not be advantageous to perform efficient work in a VUCA environment. Therefore, it is sure that the creative capabilities of firefighting managers can be explicitly advantageous to facilitate the professionally correct decisions on firefighting and rescue tasks even if a significant part of the characteristics of innovativity does not favor the performance of an everyday work free of interventions with respect to firefighting managers.

Heuristics are not random-like errors or specific distortions facilitating our everyday activities. These are the results of simplifying mechanisms, through which decision-makers can make difficult tasks manageable for themselves. Besides the benefits of heuristics, the greatest challenge for a firefighting manager can mean the inherent erroneous distortions, which surely often help, but their uncritical acceptance, in certain cases, can end up in fatal dangers.

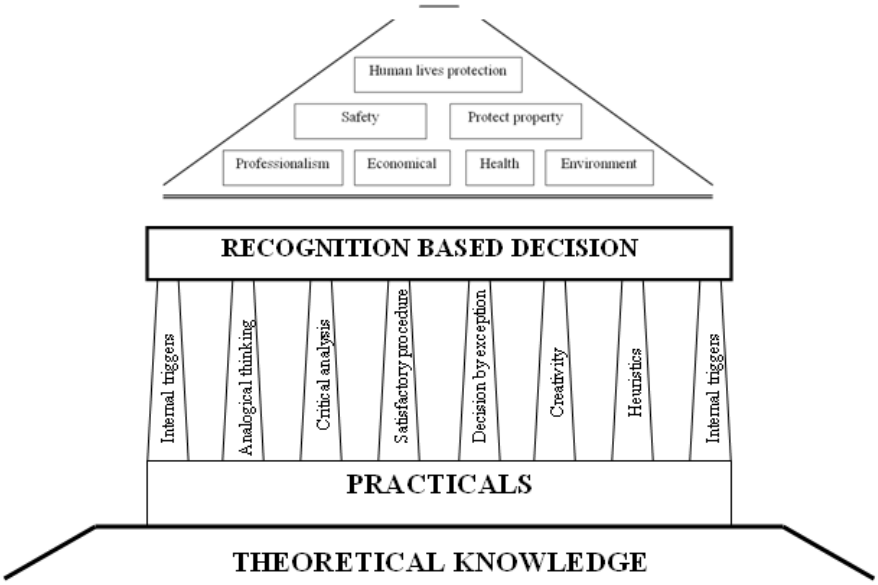


Figure 28 Complex model of decision-making of firefighting managers in emergencies. Source: Author.

The declared objective and sense of the decisions of firefighting managers is the efficient implementation of emergency interventions. It is symbolized by the principles of firefighting with structured division, on the top of which we clearly find the saving of human lives.

Firefighting managers certainly have less time to make their decisions compared to the time interval of classic decisions, so, their decision mechanism is strongly based on recognition procedures due to the peculiar environment (VUCA), and the limited process possibility of simultaneous pieces of information. **The competence of firefighters is based on the unity of theoretical knowledge and practical experience. Building on practical experience, the different mechanisms like analogical thinking, critical analysis, satisfactory procedure, decisions based on exceptions, creativity and heuristics, together with the internal triggers, hold as pillars and make recognition-primed decision procedure of firefighting managers operational.**

I illustrate the above as a complex system of emergency decision-making of firefighting managers in *figure 28.*

The research was terminated on 26 February 2012.

MY THESES,
SUMMARY OF THE ACHIEVEMENTS OF THE DISSERTATION

I have justified the selection of my topic and its timeliness in the introduction of the dissertation. I have chosen the topic “firefighting managers’ decisions” from the topic of the interpretation range of emergency decision-making. I have identified my research objectives, set up hypotheses and selected the main research methods, with which I intended to achieve my objectives.

In chapter one, I have given a short overview on the genetic relationship between decisions and actions. I have pointed out that during the evolution of man, in the beginning, our actions and decisions had not been separated from each other in time or just slightly, they had been instinctual and served the immediate satisfaction of needs. This has radically changed during evolution, the decisions have become conscious, they have diverged from actions in time; in the following, they have been determined by farsighted care.

In the following, I have pointed out that during history, strategists had shown through numerous examples the general military applicability of emergency decision-making; they, after the start of the battles, changed depending on the situation. It was only possible to preplan them in a limited way or it was completely impossible, however, their future impacts could become even an epoch-changing instrument.

In my dissertation, I have reviewed some of the stations of classic decision theory approaches in chronological order, e.g. the models of *economy*, *administration*, *strict confirmation*, *gradual proceeds*, and *organized anarchy*. The trend of the overview was designed by the extent of rationalism of decisions, gradually quitting which one can reach the model of regulated anarchy from the exclusivity experienced in classic models.

I have assumed that the mechanism of decisions could also be divided in a way, which ensures the entitlement of emergency decision-making. To justify my hypothesis I have created a decision matrix, in which I have taken the future impact of decisions and the time spent on it as a basis. Thus, I have arrived at four

fields, each describing a characteristic decision type: *classic*, *bureaucratic*, *routine* and *recognition-primed decisions*.

In the first part of chapter two of the dissertation, **I have elaborated and analyzed the function "damage value–time" in a decision-specific context.** Based on the analysis, I have proven that the objective of a decision professionally more efficient is not self-purposed, it is instead it means a true value-making *"investment"* for the society (*creating saved/rescued value*, and *reducing damage value*). Since the function is a basic cornerstone of firefighter training, its decision-specific revision can not only help understand the objectives of the dissertation, but can also facilitate the use of its results education.

In the following, I have explored how essential the difference is between professional efficiency and efficiency from an economic aspect, furthermore, that the present system handles decision-making as a static fact and does not consider its role influencing the outcome of an intervention. Based on my conclusions, if we are able to apply the instruments available to decisions that are more advantageous in a professionally more efficient way, i.e. reducing damage value and increasing saved/rescued value, it is logical that we are able to increase the extent of economic efficiency. In other words, **the decisions of firefighting managers are not static; they are dynamic factors significantly influencing efficiency from an economic aspect.**

After the above, I studied the process of firefighting based on the *Rules of Firefighting*[56] in effect at the time of the research. **I have ascertained that the Rules comprise the practical observations professionally crystallized during many years in a logical structure as cornerstones.** I referred to the limited status of the possibilities of simultaneous information processing, this **I pointed out that the logically built structure of the Rules does not only simplify decision-making, but its *items also provide guidance* to implement the necessary order of procedure.**

[56] MoI Decree No. 1/2003. on the Rules of Firefighting.

As a whole, the provisions of the Rules do not hinder the decision-making of firefighting managers; on the contrary, they facilitate and promote it, making it possible to continuously utilize its decision-making capacity.

I have divided the subchapter dealing with the training of emergency decision-makers into three parts: first, **I pointed out the peculiarities of the *working environment* of decision-makers**, how complex and complicated they are. Second, I studied the *quality of training* for the tasks to be implemented in this special working environment. Based on this, **I have ascertained that the *peculiarities of the decision-making* are not dealt with adequately either in Hungary, or in the international environment studied.** Finally, I have concluded, based also on my own observations, that no adequate training is carried out on the features of the mechanism of emergency decision-making from a management theory or decision theory aspect in different specialized fields. They are experienced during practical life, and then automatically applied. **Another conclusion of mine is that, on the one hand, automatism surely facilitates our fast decisions even at a time when we are not really aware or cannot be aware of it; on the other hand, just this well (and automatically) functioning assistance results in the fact that the peculiarities of the decision-making mechanism are not to attract more attention.**

In the following subchapter, I have pointed out that the entire headway of classic decision-making mechanism can be justified through the topics of the teaching material studied, the exclusive strategic aspect of higher command training, the use of decision support systems proliferating on all decision levels and the aspect of operations planning imbedded in the military doctrines.

Despite the above, I have illustrated through examples that modern decision support systems are able to cause very serious mistakes; therefore, it is expedient to examine the mechanisms of emergency decision-making, well functioning surely since millennia, to understand them more substantially and utilize the opportunities lying within.

In chapter three, I have set up hypotheses, then I continued my self-designed studies; first, I analyzed essays made and freely explicated by firefighters. Based on my observations, discussed in previous chapters of my dissertation and previous ascertainments on the education of management theory and decision theory of the specialized field, I assumed that the **students would give account of the diverse knowledge relating to decision theory, but I excluded the possibility that they would give complex replies or solutions to the interrelations of special decision-making, characterizing their work.**

Based on the essays, I have proven that firefighters exactly realize their peculiar decision-making situation: they must make the decisions, compelled by time, even if its appearance greatly differs in each essay. Despite this fact or in other words, exactly due to the significant differences it is obvious that they cannot conceive a uniform picture or provide a satisfactory explanation on its real background. **The above have proven my hypothesis, according to which the learning store of the students is quite diverse; however, they are not aware of the interrelations of special decision-making and its background, characterizing their work.**

Using the well-known rules of my own observations and the fixation of the practical activities many times repeated, I assumed that the **cornerstones of practical observations would be outlined from the content of the essays, and all the factors would be drafted, which would influence or limit their decisions the worst possible way.** According to my expectations, **emergency** or the concept term in relation, **limited time** in an everyday sense must be present in the essays in great numbers and predominantly.

As primary aspects of interventions, all of them unambiguously identified *life-saving*, but clearly dominant are also *safety*, *professionalism*, *specialized knowledge*, *experience* and *routine*, and the concepts in relation. It is unambiguously clear that they regard as important the role of *knowing the local circumstances and "clairvoyance"* as well, the skill, through which they understand the site and the given situation. It is ostentatious how significant role is attached to calmness, with different expressions like *"cool head"*, which obviously refers to the danger of the opposite.

The above clearly show the trend that all of them attach an important role to controlling issues, maintaining the decision-making capacity of decision-makers. Another finding of the essays is that they regard as essential to follow legislation, which, based on my conclusion, points in the direction of normative decision.

As a summation of the above, I have ascertained that my hypothesis, based on which the cornerstones of practical observations can be outlined from the contents of the essays, all the factors are formulated, which influence the decisions of firefighting managers the worst or limit them. My assumption that *time* has a sensibly predominant role, was justifiable in each essay.

From the results of the analysis of the essays and provisions of relevant rules of law **– as a derived result – I have undertaken to formulate the principles of firefighting in a declared *manner*.** Proven that the first and foremost principle cannot be other than saving and protection *human lives*; having accepted it, I have created a hierarchic system. I set as the most important task, after maintaining life-saving, *safety*, and of equal value, considering the orientation of organizational goals, efforts made to *protect property*. In the following line of the hierarchy, *professionalism* is the next one, which must surely fulfill, logically, the expectations of *being economical* as well. I regard it as of equal value with two latter ones the efforts made to avoid disproportionate deterioration of *health* or the *environment*. Principles, built up hierarchically, are in interaction, but I have not fixed their horizontal sequence on an identical level.

The rest of the chapter contains the description of the method of my word association surveys/tests, setting up of my hypothesis, the achievements and their assessment. The conventional method of association surveys uses '*one reply to one call word*', from which, using this method of mine, it only differed to the extent that I have also accepted several replies, moreover, I have explicitly requested it. By this, I have achieved that, as an impact of the call word, a multi-storey set of thoughts has appeared, with the help of which I could compare, in a more complex way, the individual elements with the interpretation of the given incident, professionally accepting it as correct. By the way, they do not contradict the methodology of conventional surveys either, since the element, first described, logically satisfies the

requirement that it reflects the idea appearing first. The use of the multi-element set of ideas was more advantageous, because through it I could receive a deeper insight into what is expressed in the first minute in the head of firefighting managers.

I have drafted a **nine-call word questionnaire**, through which it was planned to achieve the mental visualization of fires and incidents, professionally characteristic. **I sorted the replies** to the call words into **three groups: *neutral, characteristics and intervention***. The replies that were not insertable into the professionalism of a given fire or incident were transferred to the *neutral* group. The replies were acceptable in the context of the incident, with reference to the general professional characteristics of the incident, were transferred to the group '*characteristics*'. Strictly only those replies could be transferred to the *intervention* group that by themselves or together with further replies, have surely proven the professional elimination of the given incident, shown specific actions that may be brought into relationship with it and the trend of efforts to solve it. I have scrutinized the replies in two ways, in the beginning the first-word replies, later all of them together.

Based on my hypothesis, the division of the replies of firefighters shifts in the context of both the first and all the replies compared to the replies of the control group, demonstrably, i.e. overrepresented towards intervention. My assumption was that the division of the replies from the control group in the three categories showed identical or very similar division as the results of the first and all the replies, perhaps slightly underrepresented towards the group 'intervention'.

Comparing the proportion of the first replies of the two groups, I have ascertained that firefighters primarily immediately focus on the *characteristics* of incidents on their solution (*intervention*), while at the control group, *neutral* features from a professional angle and general features (*characteristics*) are predominant. The replies from the group of firefighters, in the case of *all* replies, with a trend towards *intervention,* have become even more predominant.

Comparing the results of the *first* and *all* the replies of the control group, I have ascertained that *neutral* and *characteristic* replies have preserved their predominance, although to a reduced extent, but with a certain primacy of *neutral* replies. *Intervention,* facilitating the elimination of incidents, on the contrary, has

doubled within the margin of error. I have justified with results received and the professionalism of replies that both the theoretical preparedness and the motivation of the students of the control group were suitable to make my methods used acceptable and its achievements authentic for the study of the decision-making mechanism of firefighters.

In the case of firefighters, the immediate replies have shown the predominance of professionalism (*characteristic* and *intervention*), which clearly increased towards thinking, facilitating interventions, with further replies as well. I could only interpret the above that firefighters focus, in the case of a fire, immediately on the possible, solutions, besides its characteristics, but even more, preceding them; call words referring to fire immediately *thrust* or *like a vacuum "suck"* their thoughts towards solution.

My hypothesis was that the division of the replies of firefighters, with regard to both the first and all the replies, demonstrably shifts compared to the replies of the control group, i.e. they are overrepresented towards intervention. I have unambiguously proven this based on the above through the absolute value of the results, their comparison to each other and the directions and dynamics of the trends.

In chapter four, I have demonstrated the working conditions of emergency decision-makers and pointed out the most characteristic factors like *complexity*, recognizable and well identifiable in all cases, the opportunity to *radically change* the given situation, the *uncertainty* and *ambiguity* of the information available.

I have demonstrated that the majority of problems could even be solved with adequate time spent on them, i.e. classic decision-making could resolve it with an analytical way of thinking and suitable resources, however, drifted by time, decision-makers do not have the opportunity to do so. This fundamentally influences and clearly limits the "planning" process of the implementation of the task, i.e. it must use a decision-making procedure based on a different mechanism.

I have demonstrated the general model of recognition-primed decision-making, whose essence is that decision-makers have several, different solution patterns based on their previous experience, which they recall in a new situation and make their decisions based on it. During my own researches, I have proven, by analyzing the essays as well, that firefighting managers do not have enough time for analysis-based thinking involving the elaboration of options, to use the decision mechanisms based on them; therefore, recognition procedures are predominant in their decision-making.

I have proven with association studies that in the memory of firefighting managers, individual fires immediately generate thoughts relating to extinguishing them, thus solving the problem. Comparing with the results of the control group, I have unambiguously proven that the characteristics of fires and their solution options (e.g. life-saving, firefighting) are perfectly present in the memory of experienced firefighters, but also that its trend is strongly overrepresented towards solution. **It is obvious that the pattern characterizing a given fire calls forth the pattern of solution and it is predominant of the two.** Undoubtedly, I have proven it with the clear high proportion of replies rated in the *intervention* group of the association surveys' results, on its own and also aggregated with the replies of the control group, rated in the same place.

Considering the limits of decision-making capacity and the fact that the ideas concerning the solution are usually in majority, **I have drawn the conclusion that firefighting managers are not merely interested in a fire itself or its features but much more in the process, through which they can terminate/extinguish it. It is shown that the mentality of firefighting managers, it uses, instead of the logical pattern *fire - characteristic - solution (firefighting tactics)*, an even simpler pairing *fire - solution (firefighting tactics).***

Based on the above, I have pointed out two essential elements of emergency decision-making: one of them is the use of a pattern, facilitating immediate decisions; the other one is the evolvement of the dynamics of the situation. The selection of the pattern, including future expectations, relating to the evolvement of the situation, is almost automatic for an experienced decision-maker; however, its

correctness will be justified by a decision through the dynamics of the evolvement of the situation.

Based on the above, recognition-primed decision is not only an individual act before starting to extinguish a fire, but also its continuous escort if needed. Thus, I am following the view, according to which experienced firefighting managers perceive a problem together with its solution, furthermore, I have extended the common and continuous existence of the problem and its solution to the entire process of the emergency as well (firefighting and technical rescue).

At the end of the chapter, I have given an overview of the internal resources of the recognition-primed decision-making like its background: *intuition, imagination, perceiving the invisible, ability to express oneself* and the use of *analogies and metaphors*.

In chapter five, I have studied and demonstrated the mechanisms promoting a more efficient decision-making of firefighting managers. I have demonstrated the linkage possibilities between recognition-primed decision-making procedure and analogous thinking, pointing out that the two do not exclude each other. If an intervention drags on or there is more time available to make a decision, firefighting managers can very often perform a more efficient firefighting using the latter.

In the last part of the chapter, based on the interrelations of the previous chapters, I have attempted to create a model, demonstrating the emergency decision-making of firefighting managers. This declared objective and sense of the decision-making of firefighting managers is the efficient solution of emergency interventions. This is symbolized with the division of the principles of firefighting, in a structured division, on the top of which we unambiguously find life-saving.

Firefighting managers, in order to make decisions, have surely less time than there is for classic decision-making; so, due to the peculiar environment (VUCA) and the limited processing opportunity of simultaneous information, its decision-making mechanism is based significantly on recognition procedures.

Professionalism of firefighters relies on the unity of theoretical knowledge and practical observations. Built on practical observations, different mechanisms like *analogical thinking, critical analysis, satisfactory procedure, decisions based on exceptions, creativity and heuristics, together with the internal triggers* hold the recognition-primed decision-making procedure of firefighting managers as pillars or make them functionable.

RECOMMENDATIONS

I make the following recommendations to utilize the results of my research:

1. The background of recognition-primed decisions, their operational mechanism and complementary procedures should be made known and taught to firefighting managers in the framework of organized training and advanced training of leadership theory and decision theory subjects.

2. Firefighters should analyze previous interventions, especially complex and special incidents several times; they should be recalled by less experienced firefighters and be repeated through radio transmission.

3. Simple, easily manageable mock-ups suitable for illustrating different situations for the training of firefighters should be established, on which both subordinate team members and the senior staff can track the process of an imitated intervention and the parallel actions, visualized in 3D.

4. A multimedia teaching program should be developed to facilitate the training of firefighters, using tendered resources, which is capable of teaching, further develop and assess the recognition-primed decision procedures of emergency decision-makers with 3D imagery and by random programming of special situations.

5. Based on my association method applied for the research a survey should be made, whose target group would be disaster management personnel and the senior staff of its firefighting units; the method should be adapted for the research of decisions of other emergency decision-makers.

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