

REVIEW OF THE DOCTORAL (PHD) DISSERTATION

NATIONAL UNIVERSITY

OF PUBLIC SERVICE

Doctoral Council

Major SÁNDOR RÁCZ

**Increasing the efficiency of the interventions during firefighting and
technical rescue**

The author's descriptions and official reviews of the doctoral dissertation

Budapest

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THE SCIENTIFIC PROBLEM

Increasing the efficiency of the firefighting interventions is a requirement for both citizens and firefighters. So the topic requires constant development. Today, technology is developing rapidly, including the industrial, the agricultural and the IT changes, but there are countless improvements in our everyday lives as well. Whether we are examining the modernization of our transportation or our home, we can see that thanks to the development of the industries, previously unusual mechanical design and IT support can be found in our immediate environment. From the transport viewpoint, we can mention the development of the hybrid technology and the pure electric vehicles. The construction progress of the "high-rise building" in cities is based on the fact that the large population will be more urbanized than before. Economic and social reasons both justify the development of cities, but our actions to the safety have to follow these new trends.

From the point of the firefighters, the diversity of tasks must be increased, in the technical area and also in the education. Improving the efficiency of firefighting interventions can mean on the one hand financial questions on the other hand change of attitude or focusing on the analytical aspects closely linked to efficiency. How is it possible to improve the firefighting within short time, to make it safer and more cost-effective? Of course these questions need to be investigated. We only get answers if we continuously examine the professionalism of our measures and make further corrections and improvements.

In the shortest possible time, the ability to get the right skills (technical, qualification) and quantity is the key for the effective firefighting interventions. Based on my assumption, the investigation of the on-the-spot control, the reflection of management protocols, the more accurate consideration of the tasks and the method of the management can be improved. Further training methods need to be investigated in order to obtain a level of usefulness. In order to acquire the level of knowledge.

RESEARCH PURPOSES

The interventions and tasks of the firefighters of the disaster management are often complex. and the circumstances in which firefighters must carry risk hazards as interveners in the given activity. The circumstances in which the firefighters must intervene is a real risk. Different tasks and new challenges pose risks not only to firefighters, but also to citizens and contributing organizations.

My purpose at writing the thesis is to examine the tasks and conditions of the interventions during firefighting and to determine the impact of some factors on the evolution of events. Within this I found it necessary, to identify the most important, performance-defining organizational options. I will examine our tools, and its usability, the topic of effectiveness I will also make an overview of the legislations and internal controls and their impact on work of the firefighters.

My aim is to carry out the device systems and the implementation protocols with the potential development of the different levels of operational activities in line with the new capabilities provided by the technical acquis. My aim is also to examine and make proposals for the preparation of firefighters for theoretical development. These results can create a development process based on measurability and efficiency.

During my research, I set the aim of the rational transformability of the fire management system of power management, in optimum use of tools and human resources, and in the context of their management. So I would like to determine the basic conditions of the various rescue tasks and the magnitude and direction of the risk elements. In addition, I intend to consider organizational options to increase the safety, from which it is possible to develop safer, more efficient and more economical processes.

In view of these considerations:

C1: I will examine the possibilities and conditions for the development of a leading principle requiring individual strength, tools and control.

C2: I will identify and investigate the basic firefighting tasks of the interventions I have chosen. I look at their importance, resource requirements, and organization, as well as the most important elements that determine effectiveness from the point of view of resource management.

C3: I will investigate the attitude of firefighters regarding technical and qualification requirements for general firefighting activities and fire-fighting interventions related to hidden hazards from these I would like to draw conclusions on technical and training developments.

C4: By examining the preparation of the firefighters and the leaders of the firefighting, I want to define the options that will make the preparation more effective in measurable ways.

HYPOTHESES OF THE RESEARCH

1. I suppose that the interventions with complex tasks which are diverse in space and in type of work, shall be led by a non-staff member person of the firefighting. Chapter 1
2. I suppose that the resources, powers and tools which are needed for the interventions, have to be examine by area, task and time based considered criteria. This test allows for more accurate force determination, which increases the security of the intervention, reduces damage and increases the rescued value. Chapter 1-2
3. I assume that firefighters have a different view of their preparedness for some intervention activities. This enables us to identify which areas can be developed. Chapter 3
4. I suppose that the system of preparation for the fire departments can be improved by the integration of the new elements, these may affect the success of firefighting interventions. Chapter 3

METHODS OF THE RESEARCH

During my scientific work I preferred to use technical-based and measurement-based methods. Quantitative and qualitative test methods were also used.

In the process of cognition as a general method:

I used logical methods, such as induction, by processing individual phenomena until generalization, by deduction from the overall findings to the conclusion of the parts, by analogy, on an agreement based on similarity, by analysis on characterization and break up and by synthesis on the summary.

I used philosophical items with dialectical thinking by discovering contradictions, by solving them to the recognition of the truth. I also used with rationalism, the thinking based on the intelligence and with empiricism, I learned the experience of the objects, events and contexts of the environment.

Regarding to the processing of my knowledge and my research:

I have reviewed, systematized and analysed the legislation and the relevant literatures in the field of the topic. I participated in domestic and international conferences (Romania, Serbia, Germany) and in other professional events, symposia, scientific workshops and university excellence programs.

I have been consulting with various firefighters and leaders who have great experiences in the remediation process. At international level, I have examined the results achieved in similar fields and I have drawn conclusions about their adaptability to the fire departments of Hungary. Chapter 1

I have analysed some knowledge about the technical rescue activities of the disaster management based on available printed and electronic literature, visual and moving material as well as other descriptions, studies and my own investigations. Chapter 1,2,3

I analysed the dangerous interventions in case of firefighting, as well as their circumstances and the resources used during the interventions.

During the scientific cognition process, I preferred the technical-based and the measurement-based methods. Chapter 3

I conducted questionnaire studies by using a self-constructed questionnaire, mathematical and statistical methods. During my questionnaire studies, I applied both quantitative and qualitative test methods. Chapter 3

SHORT DESCRIPTION OF THE COMPLETED EXAMINATIONS

In the **first chapter** I reviewed the organizational structure of the fire protection, the principles of the organization of the damages as well as the legislation background of the topic. In this chapter I examined the organizational and resource management issues of the main force-determining events. I have examined the possibility of applying the new principles of the power management. I investigated the main tasks related to the leader of the firefighting. I have defined the key leadership functions associated with the management levels. I also examined the applicability of the task and area-based power sharing methods. In this chapter I examined the formation of the rescue order, by using value-based ranking options. For security reasons I analyzed the necessity of a task-leader principle

In the second chapter, I investigated through three examples the centroids situations during interventions and the tasks associated with them. At medium-high and high residential buildings, I examined the tasks created at the same time, which determines the required amount of force – device. Regarding to the interventions in the vicinity of radioactive isotopes, I have investigated the related physical knowledge, health risks, measurement and defence possibilities. I have analyzed the validity of laws and radiation protection principles during remediation. I have proved the possibility of time-based power management principles during practical examples. For the purpose of more precise determination of the firepower strength of the fireplaces of large-scale facilities, I have looked for links to the applicability of the field-based core weight determination.

For field-based power determination, I made calculations using a model, which made the results obtained by using internal professional regulation. I have used the results of this in order to clarify internal professional regulation.

In the **third chapter**, I examined the opinion of the leader of firefighting in the previous periods, mainly the special and the general interventions, the technical conditions and the trainings. I also examined the relationship between the professional experience of the firefighters and the evaluation of their own knowledge. as well as training areas. For the development of the preparation methods, I have analyzed the educational principles that can have a positive impact on the preparation process. I applied a validation test to solve the problems. This justified the problem exploration of the intervention circle and the importance of a model-worthy environment.

SUMMARY OF THE CONCLUSIONS

In the **first chapter**, I stated that the professional organization and operation of the fire departments is only possible if we identify the active processes during the interventions and the power demand, which is needed for it. These are also the centroids of the intervention. In this chapter, I defined the processes that require independent powers of the firefighting, tools and some control. I consider introducing the definition of "centroids", which can be the basis for later organizational development directions. I determined the principles of the power and tool sharing, which is based on areas and tasks. Thus the centroids of the intervention and the necessary resources can be more precisely developed to eliminate the disasters. I will later look at these elements as the main process controls. In this chapter, I divided the centroid tasks into categories, then I set up a rescue order with the help of a value-based ranking.

In this chapter, I determined that through the organizable posts the coordination of the responsibilities is the primary function of the leader of the firefighting. In such a case, an area of the intervention, or a task associated with it, is not directly controlled.

In this chapter I also identified the management levels of the leadership in the firefighting organization, as well as I determined the leadership functions in the firefighting during interventions. I have explained the interaction between management, leadership and personal leadership during the elimination of the interventions.

In the **second chapter**, I have described, through three examples, the centroids and the related tasks. Fires at middle-high and high residential buildings, in many cases there is a strong separation between area-based and task-based centroids situations. In case of residential buildings, life-saving and firefighting are always considered as a centroid. Tasks will shift to one of the main centroids.

The chapter dealing with the problem of radiological interventions focuses on the work safety issues. During an intervention in radiant areas, it is also necessary to apply the three main principles of radiation protection. These are the justification, the optimization and the dose limitation. I complete the previous mentioned field and **task-based** power determination centroids with **time-based** power determination centroids. In case of firefighting at nuclear risk areas, the interveners must count with exposure. One way of protecting against it is time-saving that must be ensured in the initial phase of the intervention. When researching this topic, it became clear that, in the absence of the measured values, firefighters can not comply with the provisions of the legislations, so they can not make the appropriate decisions and can not meet the radiation protection principles.

In case of fire at large facilities we have to prepare for field-based power sharing. I made calculations using a model and based on it, I suggested the application of the required forces. I suggest a more accurate power determination of the size of the area and the firepower and technical capacity of the stored material.

In the **third chapter** I conducted a questionnaire survey. The investigation has shown that, in terms of technical conditions and training concerning special firefighting interventions, opinions of the leader of the firefighting differ from the assessment of general firefighting interventions by similar considerations. I also examined the relationship between the professional experience of firefighters and their answers values. By doing this, I concluded that, in the case of some special interventions with the increase of professional experience, the evaluation of their own knowledge is inversely proportional. Accordig to my research, we can define the areas of the training, which need to be improved.

Regarding the preparation I stated that the key details of the exercises should be examined in advance. To do so, you need to match the options during the planning period. In the case of the exercises, we develop this element of our procedures that we have deliberately selected and considered to be effective. The system of the firefighting exercises can be developed by studying, practicing, measuring, analyze, repeating the principles, which requires an **intervention circle** approach. After excersising the practice in **model environment** or theoretical trainings it is easier for firefighters to associate with real events. This has a direct positive impact on the elimination of incidents.

As a new element I proposed comparative or measure-based exercises as an easily measurable kind of practice. Exercises based on comparative measurements (installation and radiological and technical rescue practices), processed by the chapter, examined time gains on the one hand, and time limit on the other hand. I have stated that the possibility of the direct assessment in this type of exercise, increases the safety and efficiency of the firefighting interventions.

NEW SCIENTIFIC RESULTS

1. I have proved that interveners doing different activities in space and in work, require personal leadership in the firefighting organization. This cannot be fulfilled efficiently from the leader of the firefighting because other tasks. Therefore, it is necessary to provide the presence of a leader of the firefighting during the whole intervention.
2. I have set out the concept and the principles of „focus power sharing” in firefighting interventions and I have proposed the first to apply it. I have proved that the area based, the task-based and time-based power sharing is suitable, to refine fire forces to the incidents. Thus more effective leadership can be done for the necessary forces.
3. By making questionnaires, I have proved that there are differences between firefighters in the assessment of their own qualifications and general interventions requiring special expertise. I have also shown that there is no correlation between the professional experience of the firefighters and the judgment of their own qualifications for interventions requiring special expertise.
4. I have proved that increasing the efficiency, the speed and the safety during intervention measurability is needed. It is also important integrating the comparative practices into the preparation system of the firefighters.

RECOMMENDATIONS

1. With the results of my dissertation, I am able to determine more precisely power and tool numbers, thus providing safer and more effective interventions. The identification of active processes, including the recognized centroids in the intervention, and the required human and technical needs, help to reconsider the resource management of multiple firefighting and technical rescue procedures. This approach can be applied to both the alert system and on-site event rating.
2. Providing separate leadership in the initial phase of the intervention gives suitable elbow room to the leader of the firefighting in developing the steps needed to solve the basic firefighting tasks.
3. Adapting this approach (by changing the legal frameworks and taking into account human resource issues) can lead to more precise formation of firefighting organizations in the event of intervention requiring more force and equipment.

4. The option established in the training system would lead to the development of more advantageous solutions. This can be integrated into the training system because recognizing the usability of measurement-based protocols in a variety of "live" locations allows immediate intervention feedback for the participants.

APPLICABILITY OF THE RESEARCH RESULTS

1. Safer and more efficient execution of tasks and resources on demand can be elaborated as a result of fire-fighting intervention.
2. More precise intervention-evaluation and practice-planning options are implemented. They can be used in the field of preparation.
3. In case of several firefighting methods, a force determined on a scientific basis and a tool calculation can be formed for events. As a result of this, the time of the intervention and the environmental impact can be reduced.
4. A new element integrated into the training system can be used to increase the efficiency of preparation.

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3. Érces Gergő, Bérczi László, Rác Sándor:
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SCIENTIFIC CURRICULUM VITAE OF THE DOCTORAL CANDIDATE

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EDUCATIONS

2015- 2018 National University of Public Service, Doctoral School of Military Technical

2009-2010 Miklós Zrínyi National Defence University, Faculty of Military Technical János Bolyai, Department of Defence Administration, specialization for fire prevention and firefighting (BSc)

2007-2009 Miklós Zrínyi National Defence University, Faculty of Military Technical János Bolyai, Department of Defence Administration specialization for Disaster Management – Defence Administration Manager (MsC)

2006-2008 Miklós Zrínyi National Defence University, Faculty of Military Technical János Bolyai, Department of Defence Administration, specialization for local government - Defence Administration Officer

2002-2006 Miklós Zrínyi National Defence University Faculty of Military Technical János Bolyai, Department of Safety Engineering– Safety Engineer

PROFESSIONAL TRAININGS:

2012 Law Enforcement special course

2011 EDR DWS-C course

2011 Fire Investigation course

2007 Firefighting Headquarters in Budapest – fire training - firefighter (basic)

PROFESSIONAL CAREER:

2015- NDGDM- National University of Public Service, Institute of the Disaster Management, Department of the Fire Protection and Rescue Control, Assistant Professor.

2012-2015 Budapest District VI. Defense Committee Deputy Chairman of Disaster Management

2012-2015 Metropolitan Disaster Management Directorate, Deputy Commander at the Professional Fire Department, District IX.

2011-2012 Firefighting Headquarters in Budapest; Deputy Head of Department, Department of Control

2010-2011 Firefighting Headquarters in Budapest; Fire Investigator at the Department of Fire Investigation.

2008-2010 Firefighting Headquarters in Budapest; Diver at the Diving Service

2007-2008 Firefighting Headquarters in Budapest; Firefighter, at the professional fire department in Middle Pest Region.

LANGUAGES

English — Intermediate, type „A” (2011)

English — Intermediate, type „B” (2015)

German— Intermediate, B2 complex language exam (2018)