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Situation and possibilities of technical development of fire and disaster management organizations

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Abstract

Both preventive and intervention rescue fire protection activities in the fire protection area require special technical equipment. There is a direct link between the precise use of the most appropriate technical equipment for the given incident and the success of the damage repair, including its quality. In this particular case, the quality of the intervention can be seen in the value saved, in the additional losses avoided, in the fewer or lesser personal injuries. This paper is primarily an overview of the technical means of protection and intervention, technical solutions used by fire brigades and disaster management, including an international perspective, recent developments and the possibilities available in the near future. The disaster management organisation, including the professional fire brigades, is very well supported by other fire organisations with different legal statuses, such as municipal fire brigades, voluntary fire brigades and even fire brigades in establishments, and is therefore also involved in the application of the technical tools discussed here. The technical equipment of fire brigades can be broken down into several areas. Firefighting equipment, various hand tools and small machines are essential for technical rescue and fire fighting. These are typically stored on the various fire engines, but there are also additional specialised tools in fire departments that can be available in non-time-critical situations or can provide additional good back-up during protracted damage clean-ups.

Taking the concept of communications technology in the field of fire-fighting operations, as it is understood here, the first area to appear is that of information technology, starting from the moment the signal is received. In very broad terms, and without going into details at the moment, three completely different technical issues (vehicles, special equipment and small machines, communications) are outlined, through which and with the highest possible quality of their separate and combined operation, fire brigade and disaster management interventions can be carried out, which operate within these frameworks throughout the world, with minor differences being due to local technical solutions and established systems.

Keywords: fire protection, disaster management, technical equipment, possibilities, improvement

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Literature Review

In the past period, I reviewed the work of several Hungarian and then international authors in the field of the present paper, i.e. in the field of rescue fire protection or disaster management technical equipment and technical solutions.

From Hungarian literature

László Bérczi[1] analyzes the cooperation of fire departments operating in different organizational forms - as one of the bases for the introduction of this article - who reviews the changes that have taken place in recent years in fire departments with different legal statuses regarding the operational frameworks, especially in the areas of financing and therefore maintenance. This means the central (state) resources that ensure the provision of the undertaken firefighting activities, either the allocation of technical equipment in new or renovated form, or the contribution to ongoing maintenance and standby costs. As mentioned at the beginning of this paper, the author also examines the assistance provided to professional forces during general firefighting interventions, by local government, volunteer fire departments that supplement the basic activity.

István Németh[2] - especially with regard to the 150-year firefighting jubilee held in 2020 - presented the production of firefighting vehicles in Hungary covering a very wide period. As at the end of the overview we come to the production and assembly of firefighting vehicles in Hungary, it can be seen that nowadays a large part of the primarily used fire engines and water carriers are the result of Hungarian production and development. Zoltán Fülep examined[3] the challenges expected to affect the fire departments in the direction of the future, including in the field of technical, but also human resources, firefighters performing different positions. The author raises a number of issues, since considering the very long development and procurement times for technical devices, they must be kept ready for long, decades-long periods in such a way that it is difficult to precisely define the expectations of the fire departments of the future. On the human side, the other issue is the continuous readiness of firefighting personnel who are familiar with the technical equipment kept in the system,

[1] László Bérczi: A hivatásos és nem hivatásos tűzoltóságok szimbiózisa, a jelenkor mentő tűzvédelmében. Belügyi Szemle: 68: 8 pp. 93-104., 12 p. (2020)
[2] István Németh: Hazai gyártású, tűzoltásra használt oltójárművek fejlődése a 18. századtól napjainkig. Belügyi Szemle: 68: (2020)
[3] Zoltán Fülep: Elképzelés a jövő tűzoltóságáról a várható társadalmi és technikai változások szellemében. Belügyi Szemle: 68: (2020)

who can use them well, and who have the necessary qualifications, in such a way that during other demands (for example: vacations, illnesses, orders for further training) the readiness is not impaired. expected level of technique to be maintained.

Gergely Herczeg and Ágoston Restás published their research results[4], both regarding interventions at the scene of damage, and examining the traditional preventive fire protection area. Firefighting water sources and their availability, usability, finding and thus specifically their designation are the keys to the successful execution of more serious firefighting tasks. The authors analyze a wide range of examples and also illustrate negative examples with pictures and suggestions. They cover the various problematic water supply solutions, where although the method and design of marking fire water sources and the technical framework of the designs are mandatory, in reality it is possible to find locations where the original goal cannot or is difficult to achieve, so the earliest possible fire water supply in the event of damage is for firefighting vehicles. The issue of escape doors is typically preventive fire protection, since its purpose is to ensure and help the occupants leave the building as quickly and safely as possible in the event of a fire or other emergencies in buildings created for the residence of large crowds (either temporarily or on an occasional basis), improving the conditions of intervention.[5]

Staying on the ground of technical solutions in the area of fire protection, Gergő Érces and Gyula Vass[6] dealt with the fire protection issues of industrial plants that use and handle hazardous materials, which can achieve and enhance greater safety not only from fire damage, but also from other damaging effects occurring during damage cases, prevention of additional possible sources of danger. In a highly risky industrial location - for example, an area of industry that uses hazardous substances - a damage event can also have a domino effect as a starting, initializing effect.

Viktória Finta and Sándor Rácz raised the importance of the detection and detection of dangerous factors in their article regarding firefighting interventions in the presence of dangerous substances and radioactive substances.[7] They thoroughly examined the necessary elements and steps of the reconnaissance activity, the most important points of the command organization issues at the scene

[4] Gergely Heczeg – Ágoston Restás: Tűzoltó-vízforrások hozzáférhetőségének jelentősége. Védelem Tudomány: 5: 1 pp. 37-52., 16 p. (2020)
[5] Gergely Heczeg – Ágoston Restás Ágoston: *Menekülésre szolgáló ajtók zárva tartásának lehetséges feltételei,* Védelem Katasztrófavédelmi Szemle 27: 1 pp. 5-9., 5 p. (2020)
[6] Gergő Érces – Gyula Vass: Veszélyes ipari üzemek tűzvédelme ipari üzemek fenntartható tűzbiztonságának fejlesztési lehetőségei a komplex tűzvédelem tekintetében. Műszaki Katonai Közlöny XXVIII.: 4. pp. 2-22., 21 p. (2018)
[7] Viktória Tímea Finta – Sándor Rácz: *Tűzoltók sugárvédelme*. Hadmérnök XIII: 4 pp. 199-213., 15 p. (2018)

of the damage in order to protect the intervention personnel and to carry out the damage liquidation effectively.

In connection with this, László Bodnár and László Bérczi wrote about certain aspects of interventionist safety in the context of extinguishing protracted forest fires.[8] In relation to human limitations, in addition to the many sources of danger and exhaustion, the time of day itself, i.e. the limited vision that occurs from dusk onwards, significantly reduces the effectiveness of the intervention and worsens safety issues.

From the international literature

At the largest presentation of technical and technical developments in firefighting and disaster prevention in the international field, in June of 2020, the veil would have been lifted from the biggest fire protection technical researches of recent years in the framework of one or more world exhibitions. Due to the Covid-19 epidemic, this international exhibition was canceled and planned to be held next year, after that and finally in 2022. In practice, this pandemic situation and the postponement of global presentations and market entry means that those working in the profession and technical science cannot know, apply, or examine the most current developments. However, for the manufacturers and research groups involved, this current situation in a depressed economic environment may mean that significant sums earmarked for development will not be returned by entering the market at an inappropriate moment, so they should wait for the next situation when their research results will be used in the best possible sales situation, they are announced, since the lifetime of the individual developments is not expected to be more than ten years. A significant part of international research in the field of fire protection and disaster prevention is currently in this situation detailed above. The developments of the past years have been timed for 2020, and finally postponed to 2022.

Looking at the last few years - precisely for this reason - it is worth mentioning some of the writings and ideas published at the international level in the technical field in question.

Alexandr Smirnov, Alexej Smirnov and Andrea Majlingova examined the help to control forest fires from the fire prevention and rescue fire protection side.[9] In their article on the topic of early fire

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[8] László Bodnár – László Bérczi: Beavatkozói biztonság vizsgálata a nagy kiterjedésű erdőtüzek kapcsán. Műszaki Katonai Közlöny 28: 4 pp. 102-110., 9 p. (2018)

[9] Alexandr Smirnov - Alexej Smirnov - Andrea Majlingova: Early Fire Detection and Forest Fires Operational Fighting-Important Factors in Reducing Forest Fires in Russia and Slovakia. Delta Fire Protection & Safety Scientific Journal 12(2): 27–45, 2018 DOI: 10.17423/delta.2018.12.2.53

detection and forest firefighting, they mention visual remote monitoring by a human-assisted operator as a recent method of fire detection in some regions, which can now be further developed through an Internet, high-bandwidth connection, even supplementing the results and positive signals with geoinformation data.

If the performance of certain firefighting tasks is considered as work, the field of occupational safety also appears within the technical research area within the scope of this paper. The research carried out by Polish researchers in the field of occupational safety can shed light on an important premise about occupational safety and health culture in the workplace.[10] The firefighting forces involved in the incidents carry out orders, within a strongly regulated legal framework, and the professional forces are also under the scope of military legislation, in a strict order of dependence, but basically the firefighter is also a human being and an employee, so he can make mistakes and fail to comply with occupational health and safety regulations. The use and application of numerous personal protective equipment is the same duty of the firefighting forces as it is for civilian workers in a general workplace and they suffer the same – but rather higher – loss of comfort, since let's think of a firefighting task in an open space on a summer day. Nevertheless, their compliance with the rules and the organizational common thinking about occupational health and safety culture are the basis for avoiding service accidents and reducing their extent.

Expressed in this line of thought, I think it is worth drawing attention to and encouraging further research in the field (both technical and organizational) for the protection of those involved in the intervention, also in terms of the fact that the injury of one or more members of the forces intervening at the given damage site due to the limited dislocation of the standby forces in the short or medium term, it threatens the safety and effectiveness of the entire intervention. It is useless to have appropriate and suitable technical equipment on site, if the personal, intervening, and applying human resources are not available.

Tomasz Zwęgliński investigated the solution of aerial reconnaissance using drones to determine the extent of damage in disaster-stricken areas.[11] He explained that, in addition to the now traditional high-point observation and camera recordings, three-dimensional imaging can also help the work in

[10] Izabela Gabryelewicz – Patryk Krupa – Michal Sasiadek: Safety Culture: Influence of a Human Factor on the Process of Shaping Work Safety, Innovation Management and Education Excellence Through Vision 2020, VOLS I -XI, Page 4720-4727, Published 2018

[11] Tomasz Zwęgliński: The Use of Drones in Disaster Aerial Needs Reconnaissance and Damage Assessment— Three-Dimensional Modeling and Orthophoto Map Study. July 2020Sustainability 12(15)(6080), DOI: 10.3390/su12156080

the damage area and the reconnaissance of the affected geographical area. With appropriate IT elements, data collection and recording can be carried out in real time, and thus the work of the accident site commander and supervisor can be directly assisted.

From damage affecting a large geographical area to an intervention environment in a closed space, in a built environment, it is worth mentioning the work of Paul Grimwood, who investigated the protection of stairwells in tall buildings and the issues of intervention on them very thoroughly, both firefighting tactics and deployable firefighting equipment or other fire protection solutions by.[12] In another - very important - work of the author, he analyzes the most effective deployment of both the commander's activity and the intervention forces and equipment, the appropriate use of the available fire-fighting technical equipment, in great detail and in a rather large scope, using the example of real and prominent damage cases.[13]

Current technical situation of the fire protection and disaster prevention area, possibilities open for future developments

The basic activity of firefighting forces is typically based on the same foundations all over the world with one exception, which is the performance of medical emergency services or the solution by another organization. Preventive (for example, inspection and approval at the time of establishment) and rescue firefighting activities (for example, building or vegetation fire), technical rescue activities involving primary interventions (road accidents, building collapses) appear everywhere. In the emergency area, the supply of vehicles for different purposes, but which can be considered general (fire engines, water carriers, ladders), various small machines (hydraulic rescue tools), just as the issue of communication is also pivotal (radio systems), the provision of personal protective equipment for firefighting purposes next to. The individual differences can of course be found in accordance with the economic or professional policy differences of each country, but if I had to (and could) determine a percentage difference in ability and quality, then only within Europe considering the best-

[12] Paul Grimwood: Report from New York 2019 Fire Department of New York's High-rise Stair Search Strategy and other firefighting research topics, https://img1.wsimg.com/blobby/go/877d587b-6900-4f7f-b145-e75cc02aff97/downloads/Report%20from%20New%20York%202019.pdf?ver=1585146377236
[13] Paul Grimwood: Euro Firefighter 2 Firefighting Tactics and Fire Engineer's Handbook. D&M Heritage Press 2017, ISBN: 978-1-911148-12-8

equipped and least economic firefighting and disaster prevention national organizations, own based on my opinion, no more than about 30% difference is visible.

In the aforementioned categories, the generally necessary technical tools are typically available everywhere in Europe and globally - at a basic level.

The goal is, of course, everywhere to always have the most efficient, most suitable specialist equipment, firefighting vehicles, etc. within the given operational and budgetary frameworks. be regularized. It should not be forgotten that the technical equipment for defense purposes will be placed in individual vehicles, containers and barracks for storage and storage over a long period of time, even for the emergency service, and if the system-level application begins, it is expected that for many years, even a decade, the available technical solution will be the in different incidents.

With regard to firefighting vehicles in Hungary, with the establishment of the unified disaster management organization in 2012 and the integration of professional fire departments, the technical field received great opportunities, as well as responsibility. The uniform maintenance and vehicle maintenance issue, the possibility of supplying uniform technical and other equipment created a more favorable situation compared to the previous, heterogeneous solutions. During the large-scale development of the firefighting vehicle fleet that took place recently, the cavalry of the fire department, i.e. the first number of fire engines, were replaced by Hungarian superstructure and assembly with uniform designs and types, which are therefore easier to service, maintain, change and develop at the national level. This production does not have a long history however, the central production and development can be a very good opportunity for further improvement solutions or even new types to be born in the near future as Hungarian fire-fighting vehicle.

There has also been a significant change in the field of water carriers in Hungary, since in addition to the Hungarian-assembled versions (Heros Aquarius X) that have already been kept in readiness in a significant number, new solutions that can be called disruptive have also been created and found their way into various fire stations. These new firefighting vehicles (Heros Aquarex D7 and S10), which are able to transport large quantities of water and provide logistical solutions, already contain new technical solutions and calibrated devices that are new in the Hungarian firefighting field and require the harmonization of tactical issues, practical measurement and experience preparing training materials and publications based on results. Slovakian experience and solutions speak for the use of mobile firefighting water supply basins, especially in the case of large geographical differences above sea level, even during forest fires. The Hungarian Heros Aquarex water transport vehicles were equipped with mobile pools on the one hand, and on the other hand, technical solutions suitable for their rapid filling by the vehicle were developed. The use of hose packages, which can be found in cargo spaces, can also be a good solution for laying hoses over long distances quickly and requiring little firefighting manpower.[14]

1. *Figure: The new Heros Aquarex S10 water carrier in front of the and the placement of the hose packages attached to it in the right rear area. (Photo: Péter Pántya, 2019)*

In terms of Hungarian firefighting vehicles, on the one hand, the basic vehicle fleet has been renewed (fire engines and water carriers, possibly all-electric administrative passenger cars), but on the other hand, vehicles with very special capabilities have also appeared. On the one hand, these are the so-called marsh walkers, which can typically take care of getting personnel to the site, providing equipment and supplies, or delivering smaller fire extinguishers even in swampy and marshy terrain.

[14] Péter Tomka: A tömlőcsomagok magyarországi alkalmazásának lehetőségei zárt terű tűzoltás során. Védelem Tudomány, III. Évfolyam 3. szám - 2018. 9. hó

2. *Figure: The use of the marsh walker in the targeted natural environment (Source: TV Keszthely, 2019, edited by the author)*

On the other hand, the three double-cab, multi-purpose, forest fire and technical rescue superstructures developed and manufactured by the Hungarian Gamma Zrt. Komondor, RDO 4336 MPV firefighting vehicle provide completely new possibilities and capacity in the area of disaster management and fire intervention. Basically, traditional firefighting vehicles are expected to have good off-road ability, but these three new vehicles can perform above the usual ability in several aspects. The three-axle and all-wheel drive, high chassis design was specifically designed for the very difficult terrain. Thanks to the replacement superstructure system, the vehicle can deliver the most suitable, prepared mulch to the affected damage area. Among the replacement containers, you can also find the technical rescue, crane and fire-fighting versions, which can thus be used to transport fire-fighting water and to extinguish fires with water and foam, even with remote-controlled monitors (smaller water cannons) from the armored cab. It is also capable of self-defense with water mist and a water curtain, and it can be seen from the above that it was not developed for traditional, everyday firefighting interventions, but for firefighting in less frequent environments that pose a threat to the stock and the intervention and/or in areas that are particularly difficult to navigate and / or to perform technical rescue tasks. This is also evidenced by the additional capabilities of the thermal imaging camera system, which helps the driver of the vehicle in poor visibility conditions or at night.

3. *Figure: The Komondor, RDO 4336 MPV multi-purpose firefighting vehicle with technical rescue replacement superstructure (Source: Hungarian Disaster Management, 2020, edited by the author)*

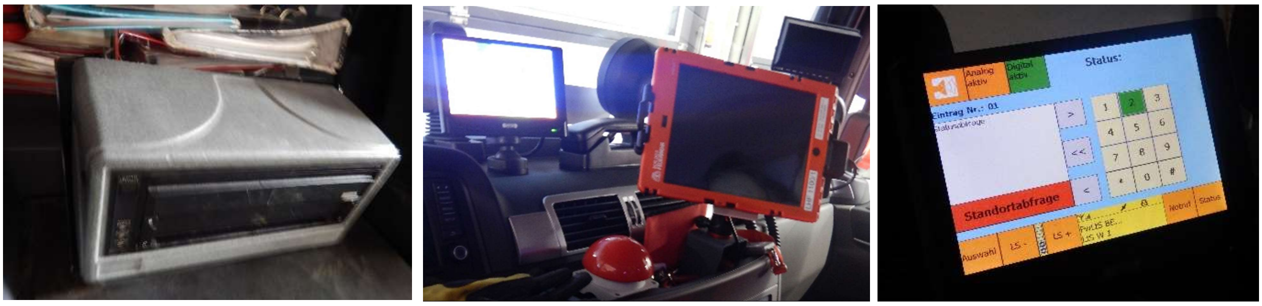
Looking at the small machines used in Hungary, but also by other fire departments around the world, there is a clear shift in the direction of battery-powered, electric solutions in the last few years. The traditional hydraulic rescue tools have been replaced in several places and, based on the experience so far, they perform their task just as well - if not better - than their hydraulic counterparts operating with an petrol-powered power supply unit. Today, there are also solutions that can reliably support technical rescue activities even underwater. The basic application of battery-powered, electric, LED operation is also clearly visible in our everyday life, and this has implications for firefighting and disaster management equipment as well. Other solutions that are more mobile, with less noise, and free of harmful emissions, i.e. can also be used in closed spaces, are disc-cutters and lighting devices at the scene of damage.

4. *Figure: Battery-operated electric tools (hydraulic rescue equipment, mobile damage site lighting and hand-held small machines) on a fire engine in England. (Photo: Péter Pántya, 2017)*

Naturally, IT also features prominently in the field of technical issues. In our case, both hardware and software issues are equally important. A few years ago, the concept of an on-board computer for

Hungarian firefighting vehicles began, the further development of which promises useful functions at the scene of incident. These can include navigation to the alerted location that works immediately after departure or reducing the amount and time of radio feedback by automating status signals (arrival, departure information, start of entrainment, etc.) at the push of a button. A good example here is the consideration of English solutions in the line of future further developments, where the work of the interveners and controllers can be supported with an on-board printer, location maps, fire hydrant network, the expected number of persons with limited mobility and even significant additional knowledge and skills.

IT support for everyday Hungarian service provision has changed significantly in recent years. In terms of the organization of services, the registration of vehicles, the alarm system, and various operational maps, more and more software and interfaces support the work of the standby area even in the fire stations, i.e. during the performance of internal activities. There is a need for tablet command support solutions that are already well used in other countries (e.g. Germany), which can similarly be installed on vehicles to help the fire engine driver while on the road and at the scene of incidents (in several roles).



5. *Figure: Fire engines with onboard and mobile IT tools, onboard printer in the UK and Germany. (Photo: Péter Pántya, 2016, 2019)*

In terms of personal protective equipment, presentated several innovative solutions and improved protective equipment, such can be the compressed air breathing apparatus presented by the manufacturer 3M (formerly Scott Safety) a few years ago. The significant function of which is the integration of a tactical thermal camera, ensuring that it operates continuously in the firefighter's line of sight and that both hands are free. We can expect that such complex solutions will appear in the offerings of several other manufacturers in the coming years, and in the coming years more fire department will have several thermal camera integrated to breathing apparatuses, in addition to the current few sets. Since at least 2 sets are continuously available for each service group, it is worthwhile to carry out investigations to find and share the best tactical principles and experiences in the field of these devices as well. Replacing the entire compressed air fleet in e.g. in Hungary with such integrated thermal camera systems would be very burdensome on an economic basis and at current prices and would not cause a significant difference in efficiency (think of a very rarely used fire extinguishing device), so in my opinion the complete transition - even the next taking into account price reductions over the years - not expected in the next years.

Staying in the field of personal protection and breathing protection, it is promising to consider the new type of compressed air bottles manufactured by Draeger. These new bottles follow in development after the heavy but very massive steel bottles, and then the significantly lighter, but more fragile and more demanding composite technical solutions. They now only contain a minimal amount of metal (at the neck, at the valve and at the sole), there is no internal metal body for the base of the carbon fibers, but there is only an internal frame the size of a plastic bottle, and the carbon and resin fibers are placed there. What can we achieve with them both at the scene of damage and in terms of continuous system maintenance and maintenance? We get the almost unlimited service life of steel bottles (after regular reviews) and a lighter weight on the firefighter's back than composite bottles.

6. *Figure: A mask equipped with a thermal camera and an internal monitor and a fully composite compressed-air bottle cut in half. (Photo: Péter Pántya, 2017, 2019)*

7.

Summary

In order to be able to move safely in the field of technical equipment and technical solutions affecting the field of disaster management and firefighting, we need to know their framework. The fire and disaster anegement organizational elements involved in the review and which can be omitted, as well as their systematized and prescribed provision of technical equipment, their ability to intervene, and their mandatory tasks can be reviewed.

As can be seen, both in Hungary and in the wider world, the epidemic situation caused new tasks and an economic downturn, which also led to the postponement and modification of certain purchases in the field of firefighting, as well as the publication and marketing of some relevant technical research and developments of the recent past. However, both in Hungary and internationally, there have been developments in the recent period that lead to increased efficiency and expansion of capabilities in the field of fire protection and rescue fire protection as well. These are also the areas of the described new types and designs of firefighting vehicles installed in the system, small machines used in incident areas and personal protective equipment.

References:

1. Alexandr Smirnov - Alexej Smirnov - Andrea Majlingova: Early Fire Detection and Forest Fires Operational Fighting - Important Factorsin Reducing Forest Fires in Russia and Slovakia. *Delta Fire Protection & Safety Scientific Journal* 12(2): 27–45, 2018 DOI: 10.17423/delta.2018.12.2.53

2. László Bérczi: A hivatásos és nem hivatásos tűzoltóságok szimbiózisa, a jelenkor mentő tűzvédelmében. *Belügyi Szemle*: a belügyminisztérium szakmai tudományos folyóirata 68: 8 pp. 93-104., 12 p. (2020)

3. László Bodnár – László Bérczi: Beavatkozói biztonság vizsgálata a nagy kiterjedésű erdőtüzek kapcsán. *Műszaki Katonai Közlöny* 28: 4 pp. 102-110., 9 p. (2018)

4. Gergő Érces – Gyula Vass: Veszélyes ipari üzemek tűzvédelme ipari üzemek fenntartható tűzbiztonságának fejlesztési lehetőségei a komplex tűzvédelem tekintetében. *Műszaki Katonai Közlöny* XXVIII.: 4. pp. 2-22., 21 p. (2018)

5. Zoltán Fülep: Elképzelés a jövő tűzoltóságáról a várható társadalmi és technikai változások szellemében. *Belügyi Szemle*: a belügyminisztérium szakmai tudományos folyóirata 68: (2020)

6. Izabela Gabryelewicz – Patryk Krupa – Michal Sasiadek: Safety Culture: Influence of a Human Factor on the Process of Shaping Work Safety. *Innovation Management and Education Excellence Through Vision* 2020, VOLS I -XI, Page 4720-4727, Published 2018

7. Gergely Heczeg – Ágoston Restás: Tűzoltó-vízforrások hozzáférhetőségének jelentősége. *Védelem Tudomány*: Katasztrófavédelmi online tudományos folyóirat 5: 1 pp. 37-52., 16 p. (2020)

8. Gergely Heczeg – Ágoston Restás: Menekülésre szolgáló ajtók zárva tartásának lehetséges feltételei. *Védelem Katasztrófavédelmi Szemle* 27: 1 pp. 5-9., 5 p. (2020)

9. István Németh: Hazai gyártású, tűzoltásra használt oltójárművek fejlődése a 18. századtól napjainkig. *Belügyi Szemle*: a belügyminisztérium szakmai tudományos folyóirata 68: (2020)

10. Paul Grimwood: Euro Firefighter 2 Firefighting Tactics and Fire Engineer's Handbook. D&M Heritage Press 2017, ISBN: 978-1-911148-12-8

11. Paul Grimwood: Report from New York 2019 Fire Department of New York's High-rise Stair Search Strategy and other firefighting research topics. link: https://img1.wsimg.com/blobby/go/877d587b-6900-4f7f-b145-e75cc02aff97/downloads/Report%20from%20New%20York%202019.pdf?ver=1593537861872

12. Viktória Tímea Finta – Sándor Rácz: Tűzoltók sugárvédelme. *Hadmérnök* XIII : 4 pp. 199-213., 15 p. (2018)

13. Péter Tomka: A tömlőcsomagok magyarországi alkalmazásának lehetőségei zárt terű tűzoltás során. *Védelem Tudomány*, III. évfolyam 3. szám - 2018. 9. hó, http://www.vedelemtudomany.hu/articles/05-tomka.pdf

14. Zwęgliński, Tomasz (2020): The Use of Drones in Disaster Aerial Needs Reconnaissance and Damage Assessment – Three-Dimensional Modeling and Orthophoto Map Study, *Sustainability* 12(15)(6080), p 20, DOI: 10.3390/su12156080

Network science in fire protection

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Abstract

Today, high-level, long-term sustainable fire protection has become a complex and complicated system, the design and operation of which continuously provides the required level of safety is a difficult task. From the passive, active, and reactive integrated technologies, through the human factors of the operation, to the intervention of the fire brigade, a range of problems that are comprehensive in space and time and branching out in terms of actors must be handled at the highest level from a life protection perspective.

Since the beginning of the 21st century, network science has provided modern methods based on an ever-increasing knowledge base for the analysis of complex systems made up of many factors and several variables, and for the holistic examination of the system as a whole. Network science methods provide an opportunity to analyze and evaluate fire protection from a new perspective.

The researcher's objective is to examine the application possibilities of network science methods in fire protection. According to his hypothesis, fire protection planning provides a new, more comprehensive level of safety than the current engineering methodology through the appropriate application of these methods. This method of complex fire prevention lays the foundation for the progressive achievement of the required safety level, i.e. computer-aided planning (building information modeling), the management of computer simulations in the system and the application of performance-based technical solutions.

Keywords: Fire protection, fire prevention, fire protection planning, network science

Introduction

"I think the next century will be the century of complexity." (Stephen Hawking.) Albert-László Barabási, one of the most prominent researchers in modern network science today, points out, as he writes in his textbook, that interconnectedness entails vulnerability. The proper functioning of complex systems at the system level depends on the interaction of the network elements that make up the system.

Today, high-level, long-term sustainable fire protection has become a complex and complicated system, the design and operation of which continuously provides the required level of safety is based on the above complexity. The mapping of the system, the examination of the system elements, that is, the quality of the degree and method of interconnection, decisively influences the level of security expected of the given fire protection system. The complex fire protection system forms a complex comprehensive system in terms of space and time, as well as the complexity of the actors and technical devices, which fundamentally affects the fire protection situation of the protection of a system. It is from this interconnectedness that such a network is vulnerable, as many errors can occur in space and time, either during the planning phase, the implementation phase, or the period of long-term use.

Network science methods provide an opportunity to analyze and evaluate fire protection from a new perspective. The researcher's objective is to examine the application possibilities of network science methods in fire protection. According to his assumption, fire protection planning provides a new, more comprehensive level of security than the current engineering methodology with the appropriate application of methods based on network science. This method of complex fire prevention lays the foundation for the progressive achievement of the required safety level, i.e. computer-aided planning (building information modeling), the management of computer simulations in the system and the application of performance-based technical solutions.

In order to verify the hypothesis, the researcher collected, organized and evaluated the analysis methods of network science. In order to apply the results achieved in the field of network science in the field of fire protection, the researcher created a model of the network structure of contemporary fire protection. During the analysis of the fire protection network, he applied the relevant methods of network science, based on which he drew conclusions about the properties of the fire protection network, which affects the fire protection situation of a given complex system. In this publication, the researcher summarizes and describes the results achieved so far.

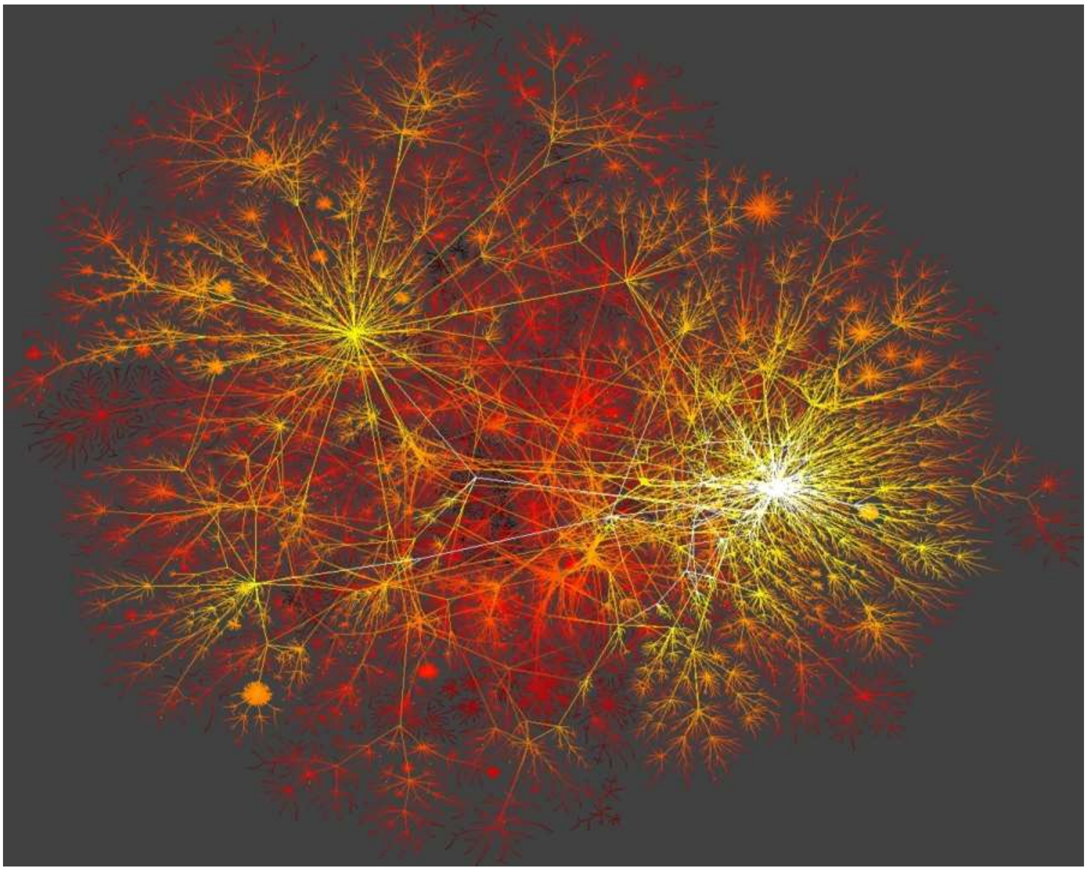

Figure 1: Network, https://mta.hu/tudomany_hirei/megerteni-a-minket-korulvevo-nagy-halozatok-matematikajat-interju-lovasz-laszloval-109089

Network science

The subject and methodology of network research are also unique. Network research is fundamentally an interdisciplinary science. This property also enables its use in the field of fire protection research. The important concepts and definitions of network research originate from graph theory, a special field of mathematics. However, what distinguishes network science from graph theory is that it is based on experience and focuses on the usability of data and results. It not only contains the description and derivation of properties in a mathematical sense, but also tries to evaluate each device based on real data and the results achieved.

Network research drew its toolkit for handling graphs from graph theory, and methods describing the general organizing principles of random processes from statistical physics. The random processes taking place in fire protection systems can therefore be easily visualized with the above method, and the combination of data-oriented and empirical methods is also a well-applied method in this field. In the last decade, network research has been expanded with a new set of theoretical tools. It adopted the tools of control and information theory from engineering sciences. This made it possible to understand the guiding principles. It also adopted a method from statistics, which makes it possible to extract information from incomplete and noisy databases.

Thanks to the development of network analysis software, network research tools are now widely accessible even to those who are less familiar with the theoretical foundations of the discipline and their full mathematical depth. This therefore offers a huge opportunity for wide application through interdisciplinarity. Network research often draws on the ideas of algorithms and data management, in which computational problems can now be solved with a variety of software.

Based on the above, it can be seen that complex solutions to complex problems require the application of a complex methodology, which requires a wide-ranging and multi-level knowledge of the above tools and methods and proficiency in this holistic field. [1]

Graphs and networks

The origins of not many research areas are known, typically we do not know where and when the various theories were born. However, the circumstances of the birth of the graph theory, which provides the mathematical basis and framework of network science, are well known, almost everyone has heard its story: It was created in the prosperous 18th century East Prussian trading city, Königsberg (now Kaliningrad). The city, which grew rich from trade, had seven bridges built over the Pregel River, five of which connected the island shared by two branches of the river with the rest of the city. This special arrangement gave rise to the legendary mathematical riddle, is it possible to walk along the seven bridges without crossing each one only once? The solution to the mathematical puzzle was confirmed in 1735 by the Swiss Leonhard Euler, who proved that the above route does not exist. For the solution, he drew a graph, the vertices of which were the different city districts, while the edges were the bridges. In his proof, he revealed that if there were a route that passes through each bridge only once, then the vertices matching an odd number of edges in this graph can only be starting vertices or endpoints. So, in a graph where more than two vertices fit an odd number of edges, there is no such path. Euler was the first to solve a mathematical problem with the help of graphs, thereby opening up new dimensions. . [2] [3]

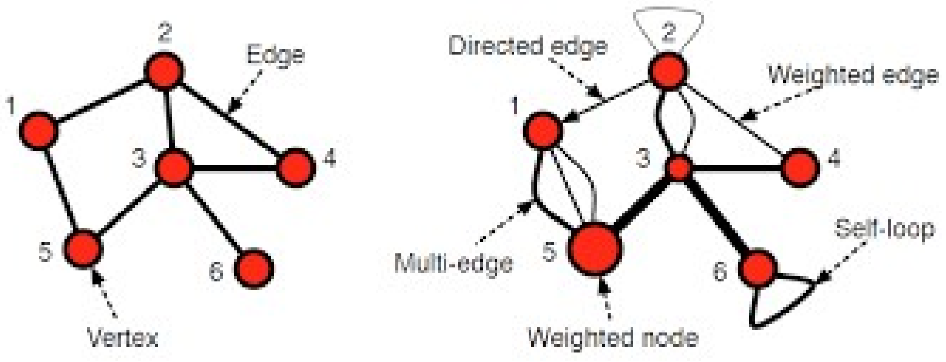

Figure 2: Graphs, basic concepts, http://www.inf.u-szeged.hu/~london/Halozatok/halozat1.pdf

If we want to understand a complex system, we need to know its components and the connections between them, i.e. the connection map of our network. The network encompasses the components of a system, which the discipline calls points and vertices, while the connections between them are called edges (links). This common mathematical language provides the opportunity to learn about and analyze systems with a very different nature, appearance, or applicability. The number of nodes determines the size of a network, the edges providing connections between them can be directed or undirected. The most important property of a point in a network is its degree, which shows the number of connections between the point and other vertices in the network. In the case of evacuation planning, the number of emergency exits and the distribution of the degree determine the fire safety basis of the system.

If we want to fully describe a network, we need to know the connections in the network. From a mathematical point of view, networks are often so-called is described by an adjacency matrix: the adjacency matrix of a directed network consisting of N points has N rows and N columns. In the adjacency matrix of the undirected network, each edge appears twice and represents the same undirected connection. In a real network, the number of nodes and connections can fall within very wide limits. Most real networks are proven to be sparse. The weights of nodes in a network are not necessarily the same. From a fire protection point of view, an emergency exit door considered for mass occupancy does not have the same weight as a door built into an evacuation route, so the quality of the connections must be weighted. In a weighted network, the elements of the adjacency matrix give the weight of the connections. The weight of edges, i.e. relationships, cannot always be measured well. [4]

According to Metcalfe's law (circa 1980), the value of a network is proportional to the square of the number of points in the network. This theory can also be perfectly applied to the characterization of the fire protection network, since the more fire protection technical parameters (nodes) I place in the network, it obviously increases the value of the given fire protection network, the extent of which can be determined by the square of the points based on the above law.

The connectivity of a network can be an important issue. A network is connected if there is a path consisting of the edges of the network between any two points. In contrast, a network is not connected if it has at least two points with no path between them. In addition to connectivity, the clustering property of a network, i.e. its clustering coefficient, shows how densely the neighbors of all points in the network are connected to each other. So the clustering coefficient measures the local connection density of a network. The clustering of the entire network, on the other hand, can be measured by the average clustering coefficient. This gives, for example, the connection density of fire detectors and manual call points, which affects the quality of early detection and alarm. [5]

In summary, it can be seen that a graph theoretical and network research methodology based on very mature mathematical foundations is available in the complex field of network science, which is suitable for adaptation in scientific language to other disciplines, so it can be called interdisciplinary in a proven way. Based on the above, the network structure of fire protection and the investigation of the fire protection network using network research methods may become possible. In the next chapter, the researcher examined the possibilities of adapting the method and searched for relevant and standard research areas in fire protection, primarily in the field of fire prevention.

Network science in fire protection

One of the problems with fire protection systems is that they must provide adequate protection solutions at a very strict security level. The definition of the protection level is typically proportional to the level of given or assumed risks. Identifying the various risks is an exact task: we can know how much and what quality of combustible material we have, how much smoke can be expected in a room, how many people are in a building, how many exits are available for escape, etc. Of course, these parameters appear nuanced in the case of real systems: it is not certain that we know where and how the combustible material is located at a given moment, where the smoke flows under given flow conditions, whether people are all following the evacuation protocol, whether an emergency exit is closed for some reason, or whether the escapees take advantage of the opportunities provided by the emergency exits. In order to be more certain, I therefore have to examine the risks and the rational possibilities for solving the problems in a complex manner.

The rationalization of solutions is an economic issue, on the one hand, and the basis of long-term sustainability on the other. Looking at two extreme values, it can be seen that it is necessary to rationally optimize the solutions, i.e. to design the fire protection system for the optimum. If we strive for the minimum protection, we will be exposed to the protection provided by the given solution in an extreme way. In the event of this failure, the complete failure of the system may also occur, so we create an unstable fire protection situation. If we move in the direction of the other extreme value and want to use all possible protection tools and solutions in one system, we will also create an unstable situation by the fact that the protection systems will weaken each other's effect and thus work counter productively. [6]

So we have to find the optimum. To find this, we first need to map the orderliness of the fire protection system. We must be able to identify problems, sources of danger, and their possible outcomes. A suitable solution for this, e.g. fault tree analysis and various risk assessments. By itself, however, this way we can only analyze the course of a series of events, but we do not necessarily see the behavior of the entire system. In order to holistically examine the behavior of the entire system, the spatial and temporal identification of the system elements is the task, within which the degree of orderliness of the given system can be measured, i.e. the entropy of the system. The higher the degree of orderliness, i.e. the lower the entropy of the system, the more stable a fire protection situation can be created.

To model this and examine the models, we apply network research methods, which can be used to create a fire protection network, in which the weight of the centers can be identified, the degree correlation, degree distribution can be calculated, the clustering coefficient can be determined, the correlation of the nodes can be measured, etc., which in the system the expected processes and the optimal responses to them can be prognosticated. The protection solutions can be dedicated to the given nodes, but by analyzing the edges connecting the points, the effects on each other can also be identified, thus determining the central protection elements that can have a predominantly negative effect on the entire network, thus in the case of providing these centers with a predominantly positive protection structure we can create a long-term sustainable, stable fire protection equilibrium situation to an optimal extent. [7]

Centers

Fire protection networks are finite networks, all their points and the connections between the points can be mapped. However, the degree of the nodes does not show the quality of the connection between the neighbors. We can show you the fire detectors and manual call points, etc. connections, we can determine the degree of the fire alarm center, i.e. its quantitative indicators, but to examine their qualitative connection system, knowledge of the clustering coefficient is also necessary. Network science has proven that real networks are not random. Fire protection networks are not built as a random network either, expanding or shrinking, but behave in a planned manner. The so-called a small-world phenomenon, which means that short distances can be identified between two randomly selected nodes in the network, i.e., if not directly, they influence each other. Although a fire door and a point-type smoke detector are not directly connected at the system level, they are connected through specific nodes, and a process can be started at the end of which, or as an intermediate step, the physical fire door closes, fulfilling its role in preventing the spread of fire. So we can consciously and plannedly create small worlds in the fire protection network.

Since real networks have a finite property, the fire protection network is also a finite network. When nodes with a high number of degrees compared to the average degree distribution are formed in a network, centers are formed in that network. These centers are able to decisively influence the properties of the network. Such central points in the fire protection network mainly determine the quality of the protection level, so during the exploration and evaluation of risks, the planning of these central points is necessary in proportion to the risk. A well-weighted, well-planned, i.e. node with a high degree and a suitable clustering coefficient can decisively determine the degree of fire safety and the creation of a stable fire protection situation. Economist Vilfredo federico Damaso Pareto observed in the 19th century that in Italy 80% of wealth is concentrated in just 20% of the population. Based on his research, the 80/20 rule he established proved to be basically true and seems relevant even today. For example, 80% of web links point to 15% of web pages, or 80% of scientific links are received by 38% of the world's scientists, or during the 2009 global financial crisis, economic analysts showed that the population of the United States of America 1% own 15% of all revenue. [8] It can therefore be concluded that the interpretation of the rule may be relevant in the fire protection network as well. The extinguishing water intensity of a building made up of many fire sections is sufficient if it is sufficient for the benchmark, i.e. the fire section with the highest demand for extinguishing water, since even though it is a spatial network, the fire sections form independent small worlds with their own special properties, between which the spread of fire can be prevented, so only the benchmark, i.e. the property of the center decides the issue of the intensity of the extinguishing water. It is also true that although the traffic system of a building forms a complex network, from which highlighted and designated routes can be enforced as escape routes. Not because their spatial connectivity is adequate, but because their clustering coefficient is also adequate, so they are included as a center point in the traffic system, such as a smoke-free stairwell. We do not smoke-free the entire traffic system of the building, only the nodes with the appropriate weight, i.e. the center points. The evacuation and escape system is not homogeneous in a building. It depends on the number of people inside, their wakefulness, ability to escape, what floor they are on, etc. By taking these parameters into account, small worlds can be created in the escape system network, which can be optimized in terms of the fire protection situation, thereby differentiating the level of fire safety of these small worlds. It is not as risky to escape on the ground floor located on the same level as the connecting field level, even if we also have to count on people with limited mobility, as the escape of people located on the thirtieth level to the safe open space through twenty-nine floors. By establishing the appropriate small worlds, the evacuation strategy can be differentiated depending on the risks, the engineering solutions of which are most optimal when the escape is based on the central nodes between the small worlds, such as the formation of a temporary protected space system, or the establishment of pressurized, smoke-free stairwells or free stairs.

Based on the above, the central points determine the stability of a fire protection system, which is why we must ensure that the attack tolerance of these central points is high, since the loss of these high-degree nodes from the protection system makes fire safety unstable. In optimized fire protection planning, it is therefore necessary to ensure an adequate level of protection of the central points in order to create a stable fire protection situation, in the case of nodes with a low number of degrees, a weaker one, e.g. even one factor protection may be sufficient from the point of view of the holistic examination of a complex stable equilibrium situation, or sizing for an unstable equilibrium situation is also sufficient, since their role is peripheral. However, the protection of centers, especially in the case of multi-center fire protection networks, is crucial to avoid a possible domino effect that can lead to fatal and total failure. Since the behavior of the nodes of a network depends on the behavior of neighboring nodes, they can lead to a chain reaction in the event of negative impact mechanisms, especially with regard to node densities that have a decisive influence on the system. In order to avoid the above, a given minimum level of protection proportional to the level of risks is required at all nodes of the fire protection network, but the safety of the system, i.e. the fire safety of the fire protection network, is determined by the centers protected to the appropriate extent and manner. [9]

Removing a single node has little effect on a large network, but changing, removing, etc. several nodes. already has a noticeable effect. That is, a fire protection network can change dynamically during its life cycle, which is affected by its use, obsolescence, the dangerousness of specific activities, the quantity and quality of stored combustible materials, etc. In order to be able to continuously maintain the required security level, we must identify these network points and continuously monitor their situation. We have to carry out life cycle analyzes of the entire network so that the initial optimums are sustainable in the long term.

The robustness of the networks naturally makes it difficult to solve the above problem, but we can find relief in the so-called in percolation theory. This theory is a subfield of statistical physics and mathematics. An illustrative example of the theory is that if we place pebbles in the nodes of a square grid with probability p and consider neighboring pebbles as connected, they form clusters of two or more elements. Since the location of each pebble is random, there is the question of what is the expected size of the largest cluster, and what is the average cluster size. The percolation theory points out that the cluster size does not change uniformly with probability p, i.e. the change cannot be clearly predicted. This is typically true of a fire. Take, for example, a forest fire and examine its spread. Let's say that the above pebbles are replaced by the trees of the forest, and the lattice network is the forest. If a tree catches fire, the fire spreads to its neighbors, which indicates the interconnectedness of nodes, i.e. trees, so a chain reaction starts and the fire spreads from neighboring tree to neighboring tree. The question is, when will it stop, when can the spread of the fire be stopped? The spread of the fire can be stopped when no burning tree has any neighbors or non-burning neighbors. Thus, the fundamental question arises: if a tree catches fire in the forest, how much of the forest will burn? The answer depends on the density of the trees. If the density of nodes is low, the fire will go out relatively quickly, but if the density of trees is high, then by definition we should expect a fast and widespread fire spread, since the trees form parts of a large cluster. Based on the simulations carried out by the researchers, there is a critical density value at which a long burn-up time should be expected. The example above illustrates well the importance of the degree of clustering and its prominent role in protection against the spread of fire. [10]

From the point of view of fire protection, two network science concepts are relevant in the field of fire safety design:

1. Robustness, which shows whether a fire protection system maintains its basic functions even in the event of internal and external faults. So, by robustness we mean the ability of the fire protection system to perform its basic tasks even if some of its nodes are missing. This is one of the most important principles that we need to achieve in terms of the stability of a fire protection network. This principle is basically applicable in the field of passive fire protection.

2. Resilience, which shows whether a fire protection system, in case of external and internal faults, is able to adapt by changing its operation in such a way as to maintain its functionality. This capability is therefore a dynamic feature that basically plays an important and indispensable role in the field of active fire protection.

In order to maintain the required level of security and a stable fire protection balance, the knowledge and application of a third very important concept is also necessary, especially in the case of large and complex systems. This is redundancy, which means that protection components and safety functions are present in parallel with each other, which can replace a missing component or function if necessary. For example, in the case of tall buildings, the duplicate fire water line. [10]

Results

The author systematized network research methods and modeled their application possibilities in the field of fire protection. In his research, he proved that fire protection planning provides a new, more comprehensive level of security than the current engineering methodology through the appropriate application of methods based on network science. This method of complex fire prevention lays the foundation for the progressive achievement of the expected safety level, i.e. computer-aided planning (building information modeling), the management of computer simulations in the system and the application of performance-based technical solutions, which serve as the basis for optimum planning.

Conclusion

In his research, the author proved that the systems affecting the fire protection situation can be analyzed and evaluated in a complex way by using network science and network research methods, therefore with this methodology a new fire prevention methodology with a more comprehensive, holistic approach than the current one can be founded.

References

1. Barabási, A.-L.: A hálózatok tudománya, Libri, 2016, pp.: 39-55. ISBN: 978-963-310-787-4
2. Euler, L.: Solution Problematis ad Geometriam Situs Pertinentis Commentarii Academiae Scientiarum Imperialis Petropolitanae 8:128-140, 1741.
3. Alexanderson, G.: Euler and Königsberg's bridges: a historical view, *Bulletin of the American Mathemetical Society,* 43:567, 2006
4. Barabási, A.-L., Albert, R.: Emergence of scaling in random networks, *Science*, 286:509-512, 1999.
5. Albert, R., Barabási A.-L.: Statistical mechanics of complex networks, Reviews of Modern Physics, 74:47-97, 2002.
6. Barabási, A.-L.: A hálózatok tudománya, Libri, 2016, pp.: 133-163. ISBN: 978-963-310-787-4
7. Albert, R., Jeong, H., Barabási A.-L.: Attack and error tolerance of complex networks, *Nature*, 406:378, 2000.
8. Cohen, R., Havlin, S.: Complex Networks: Structure, Robustness and Function, Cambridge University Press, UK, 2010.
9. Barrat, A., Barthélemy, M., Vespignani, A.: Dynamical Processes on Complex Networks, Cambridge University Press, UK, 2012.
10. Barabási, A.-L.: A hálózatok tudománya, Libri, 2016, pp.: 297-321. ISBN: 978-963-310-787-4

Providing spiritual aid after disasters

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Abstract

Disasters are sudden, unexpected natural calamities or damage caused by civilization that can claim people's lives, harm their health, and endanger their property. They can affect smaller communities - for example, in traffic accidents - and they can affect the lives of hundreds or even thousands of people - for example, after earthquakes, floods, destructive storms, rains. These effects have serious psychological consequences.

Individual reactions and forms of community coping can be diverse. In this study, we examine the importance of faith in making it easier for individuals and communities to find effective coping strategies after disasters.

Disaster management is a national matter. The common interest of all of us is the physical protection and spiritual assistance of citizens.

Keywords: spiritual aid, disasters, Hungary

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The disasters

The concept of disaster is defined in Act CXXVIII of 2012. Act § 3. 5, it is defined as follows: "a condition suitable for the declaration of a state of emergency, or a situation that does not reach the level of declaration of this situation, which endangers people's lives, health, material assets, the basic care of the population, the natural environment, natural values in such a way or endangers or damages to such an extent that the prevention, removal or liquidation of the consequences exceeds the defense possibilities of the organizations assigned to this purpose in the prescribed cooperation order, and the introduction of special measures, as well as the continuous and strictly coordinated cooperation of local governments and state bodies, as well as the use of international assistance requires."[1]

In a kind of grouping of disasters, according to their origin, we distinguish natural and civilized disasters. Disasters of natural origin can be further divided into damage events of meteorological,

[1] https://net.jogtar.hu/jogszabaly?docid=a1100128.tv date of download : 2021. március 13.

hydrological, geological and biological origin. Disasters of civilized origin include nuclear accidents, accidents involving dangerous substances, fires (except fires caused by lightning strikes, because they are of natural origin), and traffic accidents.

The tasks related to the disaster prevention system can basically be divided into three periods:

- before the disaster: for the period of prevention or preparation,
- for the period immediately following the occurrence of the disaster: protection or intervention and
- after the devastating effect of the disaster has passed: for the period of liquidation of the consequences.

"Referring to UN Office for Disaster Risk Reduction (UNISDR) data, between 2005 and 2014, more than 1.7 billion people died as a result of disasters and the estimated material damage reached 1.4 trillion USD."[2]

The most serious disasters in Hungary since 2010 – intense risks

Borsod flood in 2010

From May 15, 2010, almost the entire country was hit by heavy downpours. Due to the sudden heavy rainfall, streams (Boldva, Szinva) and rivers (Ipoly, Hernád, Sajó, Bodrog, Zagyva) overflowed in countless places, which caused enormous damage to municipal buildings and residential buildings. The Government has declared a state of emergency for the entire administrative area of Borsod-Abaúj-Zemplén County. Later, the special legal order period was also announced for the affected settlements of other counties.[3] Defense was necessary in a total of 842 of our settlements.[4] On June 8, 2010, the number of people displaced nationally from the area affected by the damaging effects of the disaster was 5,259.[5]

[2] Kopcsó István, Balázs Róbert: Konszenzuskeresés a katasztrófák tudományos kutatásának egységesítésében az Utstein irányelvek alapján, Honvédorvos, 2016. (68) 3-4. szám, DOI: 10.29068/HO.2016.3-4.5-12

[3] For 2 settlements of Nógrád county (Pásztó, Hasznos), for 3 settlements of Győr-Moson-Sopron county (Bőny, Mezőőrs, Rétalap), for the first time for 7 settlements of Jász-Nagykun-Szolnok county (Jászdózsa, Jánoshida, Jászalsószentgyörgy, Alattyán, Jásztelek, Jászjákóhalma, Jászberény) , then to the entire administrative area of the county, and further to the entire administrative area of Békés, Bács-Kiskun, Csongrád, Fejér, Heves, Pest and Szabolcs-Szatmár-Bereg counties.

[4] https://www.katasztrofavedelem.hu/285/arviz-2010 date of download: 2021. március 13.

[5] https://www.katasztrofavedelem.hu/285/arviz-2010 date of download: 2021. március 13.

2010 red mud disaster

On October 4, 2010, after 12:00 p.m., one of the sludge storage tanks belonging to Magyar Alumínium Zrt.'s Ajka alumina plant ruptured, as a result of which approximately one million cubic meters of red mud and alkaline water spilled out and flooded the deeper parts of Kolontár, Devecser and Somlóvásárhely. A few other settlements along the Torna stream were also contaminated.
390 people had to be immediately evacuated from the affected areas, and another 110 people had to be relocated. 10 people lost their lives in the disaster and 120 were hospitalized.[6]
The number of victims exceeded 900 people, hundreds of people lost their homes and livelihoods.[7]

2013. extraordinary snowfall

In mid-March in 2013, the country was hit by extraordinary snowfall, sudden cooling and stormy winds. In some parts of the country - in the central part of Transdanubia and in the northeastern part of the country - roads became impassable and settlements became inaccessible. The situation affected 65,000 people, 146 settlements were closed off from the outside world by the fallen snow and extreme weather.[8]
23,887 people and 8,313 vehicles were rescued during road and railway jams. [9]16,000 people had to be placed in warming centers across the country.[10] The power outage caused by the storms affected a total of 318,432 consumers in 135 settlements in 13 counties, and the duration of the outage lasted up to 78 hours in some places.[11]

2013. Danube flood

Between May 30 and June 3, 2013, a large amount of precipitation fell in the Danube's watersheds, as a result of which the upper reaches of the Danube started flooding to such an extent that it resulted in record water levels in most of the Hungarian section. At Budapest, it peaked at 891 cm, this water height was 31 cm higher than the highest water level so far, which was measured

[6] https://muzeum.katasztrofavedelem.hu/35837/10-eve-tortent-a-vorosiszap-katasztrofa date of download: 2021. március 13.
[7] https://muzeum.katasztrofavedelem.hu/35837/10-eve-tortent-a-vorosiszap-katasztrofa date of download: 2021. március 13.
[8] Jackovics Péter- Herbák Dóra: A katasztrófavédelmi művelet- elemzés, mint a lakosságvédelem eszköze, Hadmérnök, XIII. évfolyam 1. szám 2018. http://real.mtak.hu/78959/1/181_15_jackovics.pdf letöltés ideje: 2021. március 13.
[9] http://real.mtak.hu/78959/1/181_15_jackovics.pdf date of download: 2021. március 13.
[10] http://real.mtak.hu/78959/1/181_15_jackovics.pdf date of download: 2021. március 13.
[11] http://real.mtak.hu/78959/1/181_15_jackovics.pdf date of download: 2021. március 13.

during the spring tide of 2006.[12] Water levels exceeding the previous highest values were formed all the way to Baja.

The flood wave entered our country on June 7, 2013, and intensive flood protection was carried out for six days over a length of 807.4 km.

The flooding directly endangered 206,000 people, requiring the evacuation of 1,570 people.[13]

2019 ship disaster on the Danube

On May 29, 2019, a Hungarian spa passenger ship (event ship) collided with a Swiss hotel ship. As a result of the collision, the event ship, with 35 people on board, sank in a few seconds. The number of fatalities was 28 people, the youngest of whom - a child - was 6 years old. The disaster shook and shocked the entire country, because until then everyone felt that navigation on the Danube was harmless and safe.

2019-2020-2021 Pandemic

In December 2019, a disease caused by a new type of coronavirus appeared in the Chinese city of Wuhan and caused an epidemic.

The epidemic quickly spread to China and then to the rest of the world. The World Health Organization (WHO) officially named the new coronavirus as SARS-CoV-2, and the disease it causes as COVID-19.

On March 13, 2021, a total of 119,165,535 people worldwide were infected with the virus, of which 2,641,567 people died.[14] The death toll from the epidemic in Hungary is 16,790.[15]

Smaller scale disasters – extensive risks

The UN Secretariat for International Disaster Reduction (UNISDR) drew attention with its studies to the fact that, in addition to major disasters, "smaller-scale disasters" (extensive risks) are becoming more common on a global level. It was emphasized that these events also need to be taken

[12] https://www.katasztrofavedelem.hu/417/arviz-2013/2269/az-arviz-szamokban date of download: 2021. március 13.
[13] https://www.katasztrofavedelem.hu/417/arviz-2013/2269/az-arviz-szamokban date of download: 2021. március 13.
[14] https://koronavirus.gov.hu/ date of download: 2021. március 13.
[15] https://koronavirus.gov.hu/ date of download: 2021. március 13.

seriously, because - on a global level - they have a greater impact on the lives of millions of people and cause greater economic damage than the rarely occurring large-scale disasters (intensive risks).[16] Strengthening the resilience to these extensive risks is extremely important at the level of the affected communities, as well as paying adequate attention to the local impact of these types of disasters.

In our opinion, such typical extensive risks, e.g. damage events related to sudden, heavy rainfall, which can even occur in the form of flash floods or flooding of settlements. These events cause significant damage in different areas and settlements of our country and occur relatively often. Most typically in the May-June period.

In addition, natural disasters, such as extreme storms and droughts, and civilized disasters, such as road traffic accidents and accidents involving dangerous substances, represent an extensive risk.

In its 2014 opinion, the European Economic and Social Committee (EESC) stated that many disasters are not caused by a single factor, but by many risks that add up to each other, that disasters and their effects must be examined from a systemic perspective - even damage events related to the activities of the defense forces must be considered will.[17] It was highlighted that, in addition to "natural" and "unintentionally man-made" threats (natural disasters, civilizational accidents), risks that are created intentionally by humans and are related to human behavior (conscious behavior) must also be taken into account. . It was highlighted that, in light of this, more attention should be paid to the threats arising from technological development, for example.

Possible psychological consequences of disasters, individual coping strategies

Disasters trigger a collective stress situation, since during their occurrence a large part of the members of the given community are in danger and/or suffer losses.[18] In many cases, natural or civilizational disasters have a negative psychological effect on people even if the disaster does not happen in their immediate environment, but they learn about it, for example, from the news.

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[16] Opinion of the European Economic and Social Committee - The post-2015 Hyogo framework for action: risk management for building resilience
https://eur-lex.europa.eu/legal-content/HU/TXT/?uri=uriserv%3AOJ.C_.2014.451.01.0152.01.HUN download time: September 10, 2020

[17] Padányi, József ; Földi, László: Environmental responsibilities of the military soldiers have to be "Greener Berets" ECONOMICS AND MANAGEMENT 2014 : 2 pp. 48-55. , 8 p. (2014)

[18] Kiss Alida: A természeti katasztrófákat követő helyreállítás-értékelő rendszer fejlesztési lehetőségeinek vizsgálata. PhD-disszertáció. Debrecen, 2020.
https://dea.lib.unideb.hu/dea/bitstream/handle/2437/293815/Kiss_Alida_Doktori_ertekezes_titkositott.pdf?sequence=1&isAllowed=y date of download: 2021. március 14.

Symptoms of action paralysis, panic reaction or disaster syndrome can be typical during and after disasters. Psychotrauma occurs in cases where a person is faced with a threat of death, serious injury, loss of physical and psychological integrity, and reacts with intense fear, anxiety, and helplessness.[19]
The Lazarus model describes two types of coping strategies – problem-focused and emotion-focused – and states that people use these basic strategies in all stressful situations – such as during and after disasters.[20]

During problem-focused coping, they focus on changing the situation through their actions and avoiding it in the future. This action can be aimed at changing both external circumstances and their own behavior.

During emotion-focused coping, in contrast to the above strategy, you do not try to solve the problem, but try to alleviate your negative emotions, your own emotional reactions to the given stressful situation.

We can distinguish four areas of emergency responses: physiological, cognitive (mental, intellectual), emotional, and behavioral reactions.[21]

The emotional reactions that appear in an emergency situation[22]:

- grief and related guilt, self-blame,
- feelings of anxiety, anger, helplessness, rage,
- anxiety, fear, paralysis,
- a feeling of exclusion, displacement.

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[19] Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

[20] Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

[21] Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

[22] Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

Typical behavioral reactions in emergency situations[23]:

- complete inactivity,
- withdrawal from the social space,
- emotional outbursts,
- unreasonable intolerance, aggression,
- noticeable talkativeness or silence,
- hyperactive behavior.

Psychological resilience related to disasters (disaster resilience)

Psychological resilience linked to disasters means the flexible resistance of individuals or communities, i.e. their reactive ability to adapt to a strong, repeated or even one-time, shock-like external impact (disaster).[24] It is therefore a dynamic process during which the individual copes with the trauma that has happened to him in a positive way and is able to adapt to it.[25]

The basis of community resilience is individual resilience, and the key to individual resilience is psychosocial well-being, which the community is often able to create, so the individual and the community interact back and forth.[26] The role of religious communities is crucial for the development of an individual's psychosocial resilience, and resilient individuals form religious communities based on solid foundations and mutual support.

Currently, research is being conducted on the extent to which resilience can be inherited, learned or developed. However, there are characteristics in people who are outstanding in terms of resilience, which can be observed already in childhood. Among these, we highlight the most relevant from the

[23] Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

[24] Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

[25] Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

[26] Sáfár Brigitta: A humanitárius segítségnyújtás elméleti és gyakorlati kérdései a Vöröskereszt nemzetközi tevékenységének tükrében – doktori értekezés, p. 108. Nemzeti Közszolgálati Egyetem, Budapest, 2018.

point of view of the later chapter of the study, which is the ability (and strong faith) to have a positive outlook on life and to develop a positive vision of the future.[27]

The role of churches in providing spiritual assistance after disasters

Disaster prevention, law enforcement, military[28] and healthcare professionals are the first point of contact for those involved after a disaster or terrorist attack, when people are still in danger. Their primary task is to rescue, care for and protect the wounded - according to their needs - as well as assess the damage and mobilize the appropriate resources. Various church and charitable organizations play a welcoming role for people affected by disasters, they provide help with practical arrangements, and they satisfy social and legal needs. They listen and provide psychosocial counseling and, if necessary, refer those involved to a mental health or psychological specialist. Mental health professionals, family and social networks, and representatives of church and religious organizations help provide people with a protected spiritual community after the trauma they have experienced. They provide spiritual assistance, try to encourage those affected to act again, and in the case of psychopathological reactions, psychiatrists and psychotherapists deal with those in need. The task of professionals providing mental assistance is to coordinate the volunteers of church and charitable organizations providing psycho-social assistance, as well as to provide spiritual support to the helpers.[29]

"The state and religious communities with legal personality can cooperate in promoting the public good. The state can enter into agreements with religious communities with legal personality for the provision of educational, higher education, health, charitable, social, family, child and youth protection, cultural or sports activities, as well as other public activities that preserve historical and cultural values, their historical and social role, their social acceptance, their embeddedness, their organization, their experience gained during the public activities they traditionally carry out and - adjusted to the specificities of the public activities involved in the cooperation - taking into account the existence of the conditions necessary for their performance."[30]

[27] Sáfár Brigitta: A humanitárius segítségnyújtás elméleti és gyakorlati kérdései a Vöröskereszt nemzetközi tevékenységének tükrében – doktori értekezés, p. 108. Nemzeti Közszolgálati Egyetem, Budapest, 2018.
[28] Padányi, József ; Földi, László:Tasks and Experiences of the Hungarian Defence Forces in Crisis Management.BILTEN SLOVENSKE VOJSKE 17 : 1 pp. 29-46. , 18 p. (2015)
[29] Sáfár Brigitta – Hornyacsk Júlia: A Vöröskereszt és Vörösfélhold Társaságok Nemzetközi szövetségének pszicho-szociális támogató programja. Műszaki Katonai Közlöny, 2011. Különszám pp. 35-50. 16 p. 2011.
[30] 2018. évi CXXXII. törvény a lelkiismereti és vallásszabadság jogáról, valamint az egyházak, vallásfelekezetek és vallási közösségek jogállásáról szóló 2011. évi CCVI. törvény módosításáról 9.§ (1)

Helping our fellow human beings is one of the most important basic ideas of church life. The cornerstone of church activities is the constructive power of the community, personal relationships, social care, and support for the elderly, the downtrodden, and those in need of help. After the occurrence of disasters - based on the experience of the past decades - church charitable organizations are indispensable in the assistance tasks that appear during the elimination of the consequences. The more people who find their spiritual place in a denomination, the greater the chance that a member of society can count on the support of a community in emergency situations, since church organizations have significant mobilizing power.[31]

Education for social sensitivity should be an extremely important part of church education in order that as many of the rising generations as possible choose helping professions and that career choice is not primarily determined by the expected salary, but by social usefulness.

Strong faith gives strength after the occurrence of disasters both on an individual and community level, even when everything seems hopeless and meaningless. It strengthens people's psychological resilience to disasters in helping them to develop a positive vision of the future.

Disaster management is a national matter. Thus, every citizen has the right and duty to prevent disasters, protect against disasters and participate in eliminating the consequences. Given that this task is often mentally taxing - since the devastating effects of the disaster and human tragedies can be felt up close - promoting and enhancing resilience is necessary.

In addition to the victims of disasters, spiritual assistance is also important for those involved in defense and rescue.

Psychologists at the professional disaster prevention agencies help the staff process their traumas. However, they are the primary law enforcement psychologists who are entitled to a first-degree psychological fitness test[32], so in principle it may happen that someone does not turn to them for psychological help because they are afraid that their psychological fitness would be called into question.

The voluntary activity of churches after disasters is based on the solidarity felt towards our fellow human beings.

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[31] Petró Tibor – Dr. Hornyacsek Júlia: Az egyházak, mint társadalmi szervezetek lehetséges helye és szerepe az árvízi védekezésben, Műszaki Katonai Közlöny, XXII. évfolyam 2. szám 2012. file:///C:/Users/OKF%20NKE/Desktop/Tudományos%20Tevékenység/2021/Egyház%20és%20katonai%20erők/anyagok/2012_2_09%20Egyhazak%20szerepe%20a%20katasztrofa%20felsz-ban%20-%20Petró-Hornyacsek.pdf date of download: 2021. március 14.

[32] 45/2020. (XII. 16.) BM rendelet a belügyminiszter irányítása alatt álló egyes rendvédelmi feladatokat ellátó szerveknél foglalkoztatott hivatásos állomány és rendvédelmi igazgatási alkalmazotti állomány alkalmasságvizsgálatáról

In the case of the biggest damage events of the past decades, this voluntary activity manifested itself in the following activities:

- in the restoration of damaged buildings,
- in the accommodation and care of the displaced population,
- starting support programs (e.g. "Support a flood-damaged family" program),
- supporting those in trouble with movable goods, collecting money, food and clothing donations,
- in support with medicine,
- in the creation of a medical group,
- operating a telephone counseling service,
- in the pastoral care of families.

Summary

The role of churches and faith in eradicating the consequences of disasters through spiritual assistance and spiritual care can significantly contribute to individuals and communities being able to face the hopeless situation after disasters with the help of an appropriate coping strategy.

One of the bases for increasing and strengthening the psychological resilience associated with disasters is faith, which helps those in trouble through even the most hopeless situations.

Bibliography

1. Kopcsó István, Balázs Róbert: Konszenzuskeresés a katasztrófák tudományos kutatásának egységesítésében az Utstein irányelvek alapján, Honvédorvos, 2016. (68) 3-4. szám, DOI: 10.29068/HO.2016.3-4.5-12
2. https://www.katasztrofavedelem.hu/285/arviz- 2010 date of download: 2021. március 13.
3. https://muzeum.katasztrofavedelem.hu/35837/10-eve-tortent-a-vorosiszap-katasztrofa date of download: 2021. március 13.
4. Jackovics Péter- Herbák Dóra: A katasztrófavédelmi művelet- elemzés, mint a lakosságvédelem eszköze, Hadmérnök, XIII. évfolyam 1. szám 2018.
5. https://www.katasztrofavedelem.hu/417/arviz-2013/2269/az-arviz-szamokban date of download: 2021. március 13.
6. https://koronavirus.gov.hu/ date of download: 2021. március 13.

7. Az Európai Gazdasági és Szociális Bizottság véleménye – A 2015 utáni hyogoi cselekvési keret: kockázatkezelés az ellenálló képesség kiépítéséért https://eur-lex.europa.eu/legal-content/HU/TXT/?uri=uriserv%3AOJ.C_.2014.451.01.0152.01.HUN date of download: 2020. szeptember 10.

8. Kiss Alida: A természeti katasztrófákat követő helyreállítás-értékelő rendszer fejlesztési lehetőségeinek vizsgálata. PhD-disszertáció. Debrecen, 2020. https://dea.lib.unideb.hu/dea/bitstream/handle/2437/293815/Kiss_Alida_Doktori_ertekezes_titkositott.pdf?sequence=1&isAllowed=y date of download: 2021. március 14.

9. Bolgár Judit: Veszélyhelyzetek kezelésének és feldolgozásának kognitív és affektív aspektusai, Szemelvények a katonai műszaki tudományok eredményeiből I. Oktatói kötet, Ludovika Egyetemi Kiadó, Budapest, 2021. https://nkerepo.uni-nke.hu/xmlui/bitstream/handle/123456789/16207/905_KMDI_I_oktatoi_tanulmanykotet.pdf#page=30 date of download: 2021. március 14.

10. Padányi, József ; Földi, László: Tasks and Experiences of the Hungarian Defence Forces in Crisis Management.BILTEN SLOVENSKE VOJSKE 17 : 1 pp. 29-46. , 18 p. (2015)

11. Padányi, József ; Földi, László Environmental responsibilities of the military soldiers have to be "Greener Berets".ECONOMICS AND MANAGEMENT 2014 : 2 pp. 48-55. , 8 p. (2014)

12. Sáfár Brigitta – Hornyacsk Júlia: A Vöröskereszt és Vörösfélhold Társaságok Nemzetközi szövetségének pszicho-szociális támogató programja. Műszaki Katonai Közlöny, 2011. Különszám pp. 35-50. 16 p. 2011. https://mkk.uni-nke.hu/document/mkk-uni-nke-hu/2011_k_03%20Voroskereszt%20vorosfelhold_k.pdf date of download: 2021. március 16.

13. 2018. évi CXXXII. törvény a lelkiismereti és vallásszabadság jogáról, valamint az egyházak, vallásfelekezetek és vallási közösségek jogállásáról szóló 2011. évi CCVI. törvény módosításáról 9.§ (1)

14. Petró Tibor – Dr. Hornyacsek Júlia: Az egyházak, mint társadalmi szervezetek lehetséges helye és szerepe az árvízi védekezésben, Műszaki Katonai Közlöny, XXII. évfolyam 2. szám 2012. file:///C:/Users/OKF%20NKE/Desktop/Tudományos%20Tevékenység/2021/Egyház%20és%20katonai%20erők/anyagok/2012_2_09%20Egyhazak%20szerepe%20a%20katasztrofa%20felsz-ban%20-%20Petró-Hornyacsek.pdf date of download: 2021. március 14.

15. 45/2020. (XII. 16.) BM rendelet a belügyminiszter irányítása alatt álló egyes rendvédelmi feladatokat ellátó szerveknél foglalkoztatott hivatásos állomány és rendvédelmi igazgatási alkalmazotti állomány alkalmasság vizsgálatáról

16. 2011. évi CXXVIII. törvény a katasztrófavédelmeről és a hozzá kapcsolódó egyes törvények módosításáról https://net.jogtar.hu/jogszabaly?docid=a1100128.tv date of download: 2021. március 13.

17. Sáfár Brigitta: A humanitárius segítségnyújtás elméleti és gyakorlati kérdései a Vöröskereszt nemzetközi tevékenységének tükrében – doktori értekezés, p. 108. Nemzeti Közszolgálati Egyetem, Budapest, 2018.

18. Sáfár Brigitta – Hornyacsk Júlia: A Vöröskereszt és Vörösfélhold Társaságok Nemzetközi szövetségének pszicho-szociális támogató programja. Műszaki Katonai Közlöny, 2011. Különszám pp. 35-50. 16 p. 2011.

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