## Contents



ISSN 2498-5392

AARMS Volume 16, Issue 2 (2017) 1–98

AARMS

Academic and Applied Research in Military and Public Management Science

Volume 16
Issue 2
2017

**Orsolya KEGYES-BRASSAI, Richard P. RAY, Rajmund KUTI: Seismic Risk and Disaster Management Perspectives in Hungary, Presented on a Case Study Performed in Győr**

**Lóránd UJHÁZI: Further Ethical Challenges in Military Science from the Perspective of the Catholic Church: Reflection on the Use of Drones**

**Mihály NYITRAI: Quo Vadis Sustainable Military Operations?**

SCIENTIFIC JOURNAL OF THE NATIONAL UNIVERSITY OF PUBLIC SERVICE, HUNGARY

AARMS is a peer-reviewed international scientific journal devoted to reporting original research articles and comprehensive reviews within its scope that encompasses the military, political, economic, environmental and social dimensions of security and public management.

AARMS is published in one volume of four issues per year by the National University of Public Service, Budapest, Hungary, under the auspices of the Rector of the University: Prof. Dr. PATYI András.



All correspondence should be addressed to
Prof. Dr. KOVÁCS László, Managing Editor
National University of Public Service
P. O. Box 15, H-1581 Budapest 146
Hungary

Phone: +36-1-432-9062
Fax: +36-1-432-9040
aarms@uni-nke.hu
aarms.uni-nke.hu

AARMS

Academic and Applied Research in Military and Public Management Science

Volume 16
Issue 2
2017

An International Journal of Security, Strategy, Defense Studies,
Military Technology and Public Management
Published by the National University of Public Service



Typeset and print by NORDEX Nonprofit Kft. – Dialóg Campus Kiadó

ISSN 2498-5392

Vákát oldal

# Contents

Vákát oldal

AARMS Vol. 16, No. 2 (2017) 5–16. **10.32565/aarms.2017.2.1**

# Seismic Risk and Disaster Management Perspectives in Hungary, Presented on a Case Study Performed in Győr

Orsolya KEGYES-BRASSAI,[1] Richard P. RAY,[2] Rajmund KUTI[3]

*Recent earthquakes with high number of casualties and enormous devastation have recently pushed engineers and designers to adopt preventive approaches to seismic safety. Vulnerability to earthquakes has increased due to extending urban areas. Seismicity in the Pannonian Basin is moderate compared to seismicity of surrounding areas, nonetheless, based on the recent high quality of earthquake observations, epicentre determinations have shown specific regions where earthquakes occur repeatedly. Moderate seismicity does not necessarily equate to moderate damage from earthquakes. Reports of major earthquakes often refer to heavy building damage and liquefaction (e.g. 1763 Komárom eq.). To reduce the potential damage, a comprehensive assessment of the seismic risk followed by a package of relevant remedial measures is needed. This paper presents the case study for the city of Győr, focusing on the local soil effects performing response analysis with more than 6,000 realizations and visual screening of more than 5,000 buildings to determine the vulnerability and the overall seismic risk. Based on the results engineers can plan improvements of the infrastructure easier, and authorities are able to make better plans for emergency activities in case of a seismic event.*
**Keywords:** *seismic risk, disaster management, local site effect, visual screening*

## Introduction

Preventive (pre-event) approaches have received greater attention recently since post-event evaluation methods are effective only in areas of regular seismic activity. Research in earthquake hazard mitigation has focused on evaluating possible damage scenarios for different magnitude events. [1] [2]

Hungary has experienced destructive earthquakes in the past; the most significant was the event of 1763 in Komárom with an estimated intensity of IX and an intensity of VII–VIII in Győr according to the European Macroseismic Scale. [3] Although such events are very rare, their intensity is comparable to the major earthquakes such as the Northridge earthquake (California 1994) with an MMI intensity of IX (equivalent to IX in EMS), being the second costliest disaster in US history after Hurricane Katrina. [4] [1]

[1] Associate professor, Széchenyi István University, Department of Structural and Geotechnical Engineering, e-mail: kegyesbo@sze.hu.
[2] Full professor, Széchenyi István University, Department of Structural and Geotechnical Engineering, e-mail: ray@sze.hu.
[3] Associate professor, Széchenyi István University, Department of Mechatronics and Machine Design, e-mail: kuti.rajmund@sze.hu.

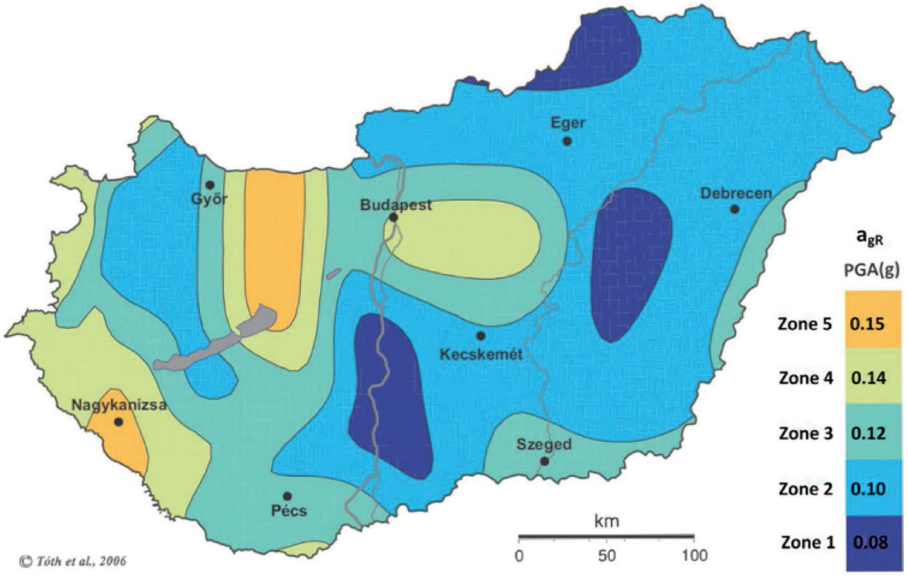


*Figure 1. Peak horizontal accelerations from a seismic event that would occur once in 475 years (or a 10% probability of occurring in 50 years).* [5]

The goals of the paper are: to present the process of seismic risk evaluation of a town; to integrate local site effects to previously determined seismic hazards (Figure 1) [5]; to examine the vulnerability of the built environment focusing on residential and public buildings; and finally, to combine the results and map risk scenarios to aid in the mitigation process.

The designated area to perform seismic risk assessment is Győr, being the sixth largest city of Hungary with an important regional economic and political role. Since no major damaging earthquake has occurred in Győr recently, vulnerability functions from observed damage patterns are not available. Therefore, a simple and fast evaluation method is proposed suitable for the assessment of local soil effects and evaluation of a large number of buildings.

## Seismicity of the Studied Area

The seismicity of the Pannonian region is moderate. Earthquakes causing light damage occur every year, while stronger, more damaging magnitude 5 quakes happen about every 20 years and the return period of magnitude 6 events is about 100 years. [6] The focal depth of earthquakes is between 6 and 15 km below ground level in the region. The distribution of earthquakes is diffuse; however, there are certain areas where the occurrence is more concentrated, e.g. at the surroundings of Komárom–Mór–Berhida, known as Móri-trench. The hazard map of Hungary (Figure 1) illustrates this region of higher seismicity that is just west of Győr, running north–south. Aerial distance between Győr and the Móri-trench is about 60 km. Historical data show that major earthquakes of this area had significant effects on buildings, causing damage not only in Komárom, but also in Győr.

The largest earthquake in Hungary occurred in the city of Komárom on June 28, 1763 with an estimated magnitude of 6.3, there were 63 casualties in Komárom and 4 in Győr.

Overall more than 100 victims were reported. The taller (2–3 story high) ecclesiastic and noble buildings with more complex structure, typical for that age, suffered serious damage, both in Komárom and Győr, while the buildings of common people with only a ground floor made of adobe and timber survived the quakes. [6] Remedial measures were applied after the earthquake: the construction of 2–3 story high buildings were forbidden. Based on the percentages: 24% of the buildings destroyed, 30% seriously damaged and 18% requiring reconstruction, the intensity can be assumed to be IX on the EMS (European Macroseismic Scale).

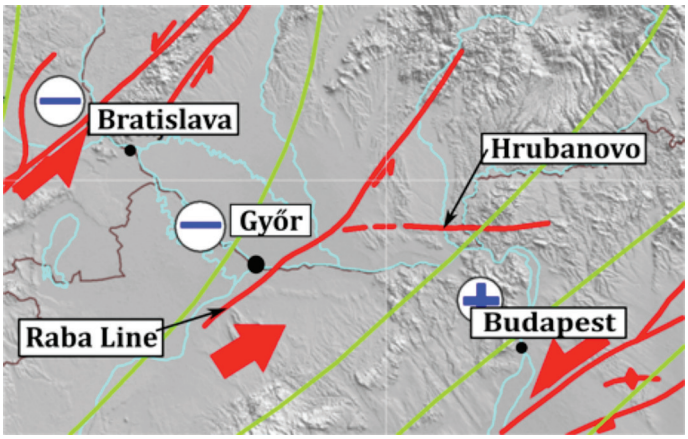


*Figure 2. Neotectonics of Pannonian Region.* [7]

Other significant faults contribute to the hazard concerning Győr. One of the lineaments lies beneath the Rába River, called Rába Line (Figure 2) and meets the Diósjenő–Őgyalla or Hrubanovo fault beneath the Danube River close to Győr. Recorded earthquakes with an epicentre at Győr mainly occur due to the above-mentioned faults.

## Microzonation of Győr

Microzonation is the identification of separate individual areas having different potentials for hazardous earthquake effects. Seismic microzoning applies the local ground response, becoming a useful tool for cost effective risk mitigation. Detailed geological, geotechnical and structural evaluations are required for a realistic microzonation assessment. [8]

The severity of local ground motion depends on the magnitude and nearness of the source event, the ability for local geological conditions to focus or disperse energy coming from the source toward the region of interest, topographic factors and dynamic properties of near-surface sediments. At the source the depth, the initial frequency content of the vibration and the directionality of the fault release will influence intensity. The magnitude of an earthquake determines the potential damage level if a populated area is involved. Seismic hazard obtained by probabilistic (Probabilistic Seismic Hazard Analysis – PSHA) or Deterministic Seismic Hazard Assessment (DSHA) uses ground motion parameters with a given exceedance probability referenced to rock. That layer of the strata is considered rock in which the shear wave velocity is more than 700 m/s. [9]

Seismic waves propagate through different geological formations affecting the characteristic of the waves, producing different effects on the ground motion at the ground surface, amplifying selectively different wave frequencies. It has been recognized that earthquake damage is generally larger over soft sediments than on firm bedrock outcrops. This is particularly important because most urban settlements have been built along river valleys over such soft surface deposits. The local topography can also modify the characteristics of waves, causing more damage to structures/buildings located at hilltops than those located in the valleys.

Soil effects and topographic effects are known as local site effects. Local site conditions describe the type of deposits that lie beneath the site. They are usually described in terms of shear wave velocity and sediment depth, representing physical quantities that can be related directly to the dynamic response of the underlying geological deposits.

One alternative to determine the effects of soil layers is to use the values of $v_{s30}$, the equivalent shear wave velocity that is the weighted average of shear wave velocities in the upper 30 meters. Soil profiles (SP) from the hydrogeological registers were used with the permission of the North Transdanubian Environmental Protection and Water Management Inspectorate. On the territory of the investigated area around 100 borings were available, from the 60 chosen hydrogeological registers originating from 1954 to 2008, with a depth varying between 25 and 2,155.7 m. The principle of selection was to cover adequately the study area with borings deeper than 30 m.

The next step was to identify the dynamic properties of the different soil types. During the research Multichannel Analysis of Surface Waves was performed at 11 places close to the original borings of the hydrogeological registers. Compared to conventional borehole sounding tests, it is less expensive and provides the subsurface shear wave velocity profile over a large area. At four locations raw data from Cone Penetration Tests were offered by geotechnical companies, which ensured verification of the results. Calculation of $v_{s,30}$ for each boring was performed based on three different methods. Based on shear wave profiles 15 zones (SP I to SP XV) were determined in Győr. (Figure 3)

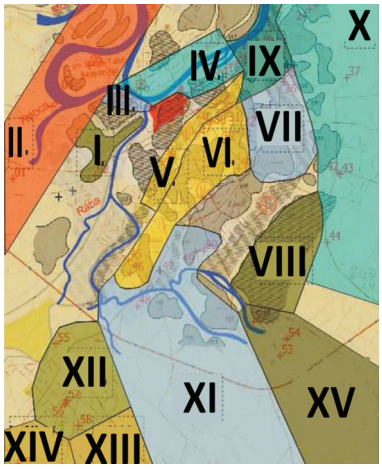


*Figure 3. Zones with different soil profiles in Győr.*
[Edited by the authors.]

Using the different soil profiles (SP), one-dimensional site response analyses (Strata) [4] were performed by applying a suite of 7-10 different earthquake records to the base of the profiles fitting the general requirements of this region. Additionally, nonlinear behaviour models were applied to the different soil layers, based on our dynamic laboratory test results and correlations to other models. The software allowed to consider reasonable variations in soil properties and thicknesses of layers. In all, 6,000 realizations were generated.

The effect of the different soil zones on surface response were evaluated and the results were compared to the more uniform approach described in Eurocode 8. [10] While there was very general agreement with EC–8, there was also a great deal of variation in the level of seismic action due to the different soil profiles. (Figure 4) The responses were different enough to divide the city into different zones. Based on the careful examinations of spectral accelerations, shear wave velocities, amplification factors and soil profiles eight zones (C1–C6 and B1–B2) were defined in Győr. [11] The zonation with respect to spectral accelerations was mapped. (Figure 5) Soft transition boundaries were used to show the variation of the mapped parameters. More defined clear boundaries are not recommended. This allows some flexibility to the urban planners and avoids misinterpretation of clear boundaries as precise estimations of the different zones.

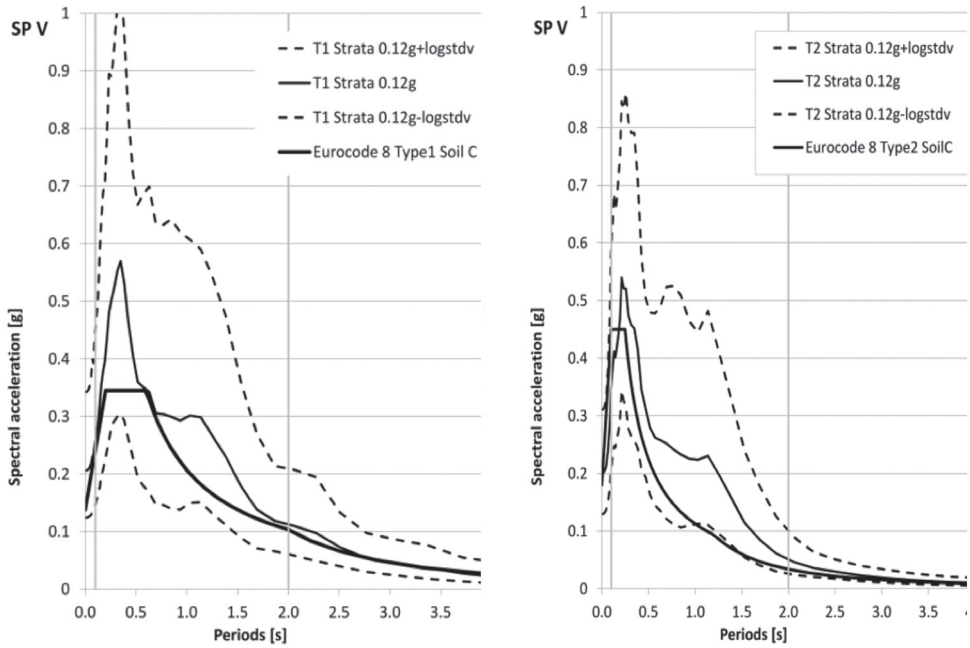


*Figure 4. Comparison of average, -1 log and +1 log standard deviation results with Eurocode 8 design spectra (Type 1 and 2), used as seismic inputs in STRATA for comparison.*
[Edited by the authors.]

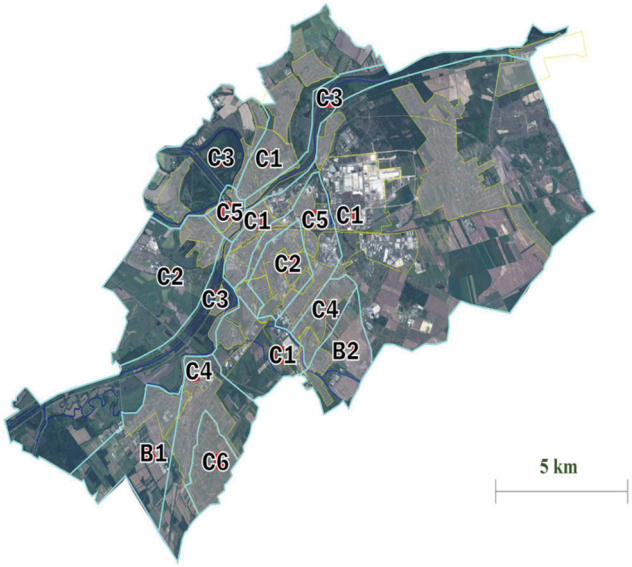


*Figure 5. Microzonation of Győr (C1–C6 and B1–B2).*
[Edited by the authors.]

## Vulnerability Assessment of Buildings

Vulnerability is the possibility of damage or loss of structures due to a seismic event; it is the characteristic of the structures and it can be expressed in probabilistic or statistical terms. Vulnerability assessment is the process of identifying, quantifying and prioritizing (or ranking) the vulnerabilities in a system, and can be performed according to the following steps:

- cataloguing assets and resources in a system;
- assigning quantifiable value and importance to those resources;
- identifying the vulnerabilities or potential threats.

Vulnerability as an input parameter to earthquake scenarios requires evaluation of a large building population in a rather short period of time using a simple method, which describes the seismic performance of the buildings adequately. Vulnerability can be determined with the help of different methods. [12] The selection of the methods depends on the objective of the study, the required results and the available data, and can be grouped according to the space scale considered for analysis: e.g. urban level or building level, etc. [13] Large-scale approaches are based on empirical methodologies and local scale assessments are performed using some detailed numerical analyses. As these methods are getting more complex, they become more accurate, but also more expensive, requiring higher computational and evaluation efforts. Vulnerability assessment can be performed after or before an earthquake with different aims: either to determine retrofitting measures or to estimate expected damage for prevention purposes respectively.

Score assignment procedures aim to identify seismically hazardous structures by identifying structural deficiencies. The vulnerability index and screening meth-

ods gather quantitative information by using vulnerability assessment forms, including parameters, such as quality of materials, type of foundations, number of stories, state of conservation, or stiffness of the structure. Depending on the parameter's value, a score is attributed to each feature to quantify the level of damage according to the severity of potential ground motion. [14] Potential structural deficiencies are identified from observed correlations between damage and structural characteristics. [15] [3] The objective of these procedures is to determine whether a particular building needs a more detailed investigation or not.

The rapid visual evaluation of buildings was performed on over 5,000 structures in Győr. (Figure 6) The evaluation method was developed from well-known approaches, [16] [2] [17] but modified to account for typical building designs found here. [11] The reliability of the visual evaluations performed by trained non-experts was verified by experts over a significant percentage of all buildings. Further evaluation of building vulnerability was performed by pushover analyses by simplified methods. The pushover analyses showed that the visual vulnerability assessments were consistent and reasonable.

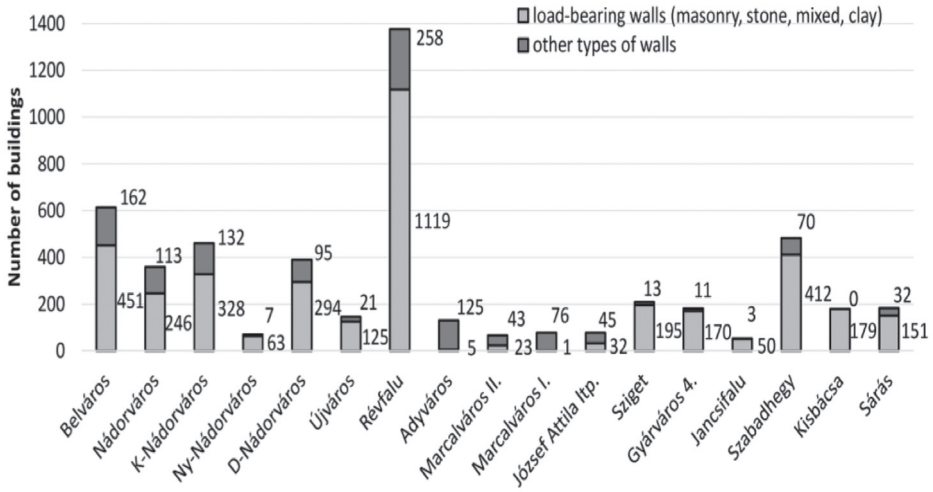


*Figure 6. Dominant building types in Győr. Note the very high number of load bearing masonry wall structures.*
[Edited by the authors.]

In order to determine the vulnerability throughout the city, city districts were divided into sections that each had a high percentage of one or two similar building types. This allowed for an accurate and rapid method to divide the risk assessment into manageable pieces. The evaluation process used about 25 sections within the city. Four districts were examined more closely. The zones differ from each other not only in location, but also in the types and the age of the buildings. For each building, a base score was determined due to structure based on FEMA 155. Score modifiers were taken into account, such as:

- vertical irregularity score modifier;
- construction code score modifier;

- score modifier concerning the height of the building;
- soil score modifier.

The construction time determined the level of seismic design used at the construction of each building. Based on the height of buildings two categories were taken into account: low-rise buildings with no modifier and mid-rise buildings. Vertical irregularity was based on the questionnaire.

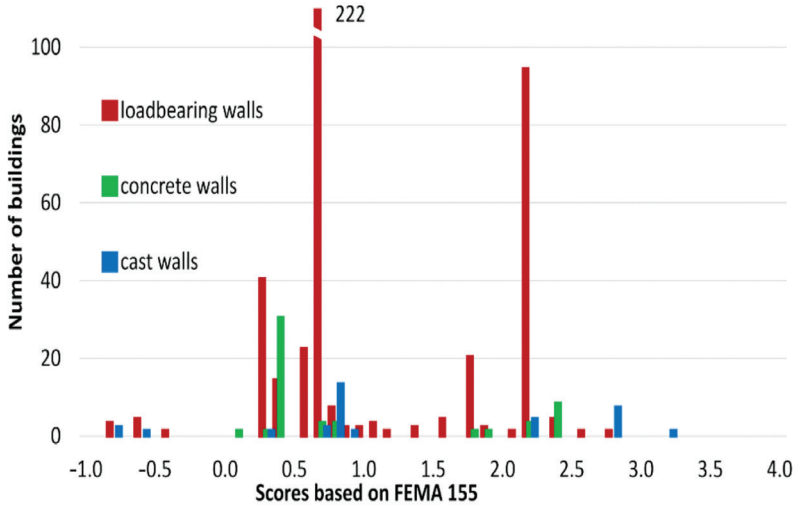


*Figure 7. Scores with soil modifier in Belváros.*
[Edited by the authors.]

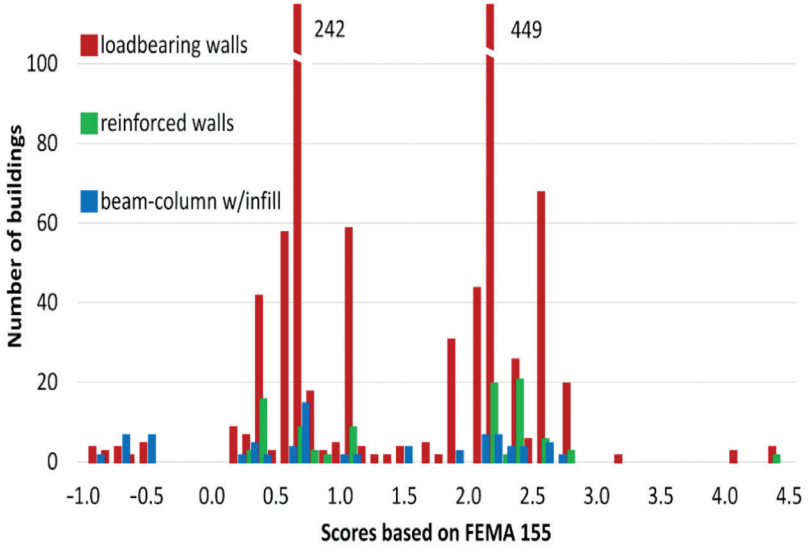


*Figure 8. Scores with soil modifier in Révfalu.*
[Edited by the authors.]

Two sets of histograms represent first the score of the buildings with code, height and irregularity modifier and with the soil modifier (Figure 7 and 8) differentiating the most dominant building types. Masonry buildings dominate the final scores of the districts with two peaks: the lower score for the irregular buildings and higher for regular buildings. Lower scores represent higher risks.

## Seismic Risk to the City

The city districts provide a good way to categorize building structures in general, since each district has a predominant building type and construction era. As shown earlier, there are over 5,000 buildings that have received scores. From an administrative view, mapping all would be problematic since evaluation, retrofit, repair and planning efforts would be applied by district or, perhaps, by sub-district.

Using a district approach is quite common in risk analysis; however, some decisions are necessary on how to assign a district score. One may pick a dominant structure type, either by building count or total resident occupancy. The average score for the dominant structure would then be applied to the district. Another approach is to use statistical methods to better describe the distribution of scores and the influence of different components of the hazard and vulnerability studies. For this study, both the dominant building approach and the average score approach produced essentially the same result. [11]

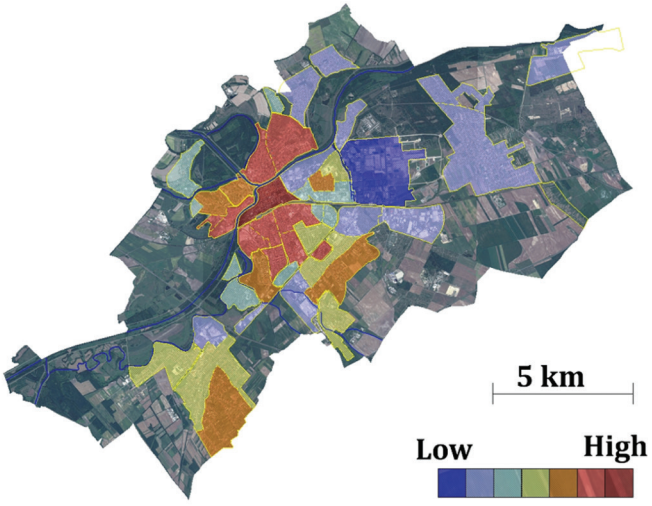


*Figure 9. Relative seismic risk zones in Győr. Red is highest risk, blue is the lowest.*
[Edited by the authors.]

As Figure 9 demonstrates, highest risk is centred in Belváros, the old city centre because the buildings are old and the relative hazard is high compared to the other areas. The risk gradually reduces as one moves outward. Newer districts with better construction and variations in soil conditions are responsible for the reduction and pattern of risk values shown. Lowest risk factors are in the Gyárváros district where there are substantial buildings constructed

according to newer codes and single free-standing homes having regular configurations. The risks shown are relative since the evaluation by rapid visual screening uses a score/demerit system. However, in order to "anchor" these numbers and give definite recommendations, further detailed analyses of selected building types would be necessary.

## Earthquake Risk Management Perspectives Integrated into the Risk Management Plan of Győr

The seismic hazard, vulnerability and earthquake risk is underestimated by both engineers and authorities or is not properly quantified as indicated in the next quotation, as stated on the homepage of Győr-Moson-Sopron County Emergency Management Directorate. "The county in terms of earthquake risk does not include itself among the hazardous counties. […] it is therefore concluded that the county is not seismically hazardous, but definitely has to be considered". [18]

Act No. CXXVIII of 2011, on disaster management and amending certain related acts declares that disaster management is a national matter and it is duty of the State and regulates the operation of the civil protection service and defence planning tasks of the cities. [19] Recently published National Emergency Risk Evaluation by National Directorate General for Disaster Management, Ministry of Interior based on the previously mentioned act adapts the results of the research about the seismic risk of Budapest. [20] Surprisingly it contradicts the former quoted statement of Győr-Moson-Sopron County Emergency Management Directorate, which definitely underestimates the seismic risk in Győr-Moson-Sopron County. [18] National Emergency Risk Evaluation suggests that microzonation of densely populated areas with higher values of assets should be performed, for example in case of county towns. This fact underlines the necessity of the hazard and vulnerability assessment of major cities (at least) and incorporation of the seismic risk assessment results in risk management plans of cities. Figure 10 presents the flowchart suggested to be incorporated into the Risk Management Plan (RMP) of City of Győr.

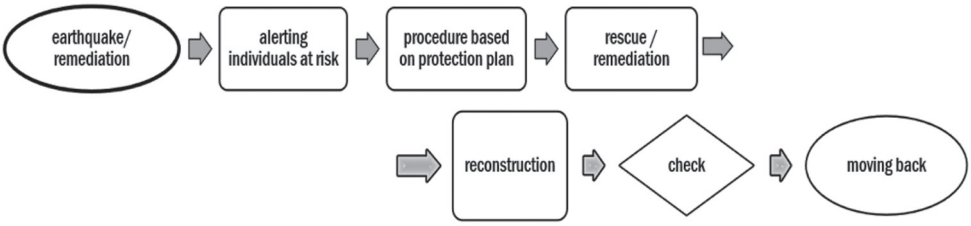


*Figure 10. Suggested flowchart of the earthquake remediation procedure for RMP of Győr.*
(Edited by the authors.)

The earthquake risk assessment results presented by this paper should be incorporated into the risk management plan of the city. Based on the seismic risk map of Győr, the exploration of endangered buildings would be easier and the population of identified higher-risk districts could be targeted with information more directly. The former evacuation and disaster plans should be modified concerning the rescue and remedial preparation setting priority of these

areas in order for rapid implementation of host sites and rescue vehicles to achieve a fast rescue of the population in the affected areas in case of a seismic event.

## Conclusion

This paper presents a comprehensive approach for assessing seismic risk in a small city. The area is considered a moderate earthquake risk with past events, estimated up to M = 6.5. It is a typical situation for many cities in Hungary and throughout Europe where the seismic hazard is not great, but cannot be ignored. In order to make the best use of limited resources, the methodology used existing soil data, rapid visual building assessment, a limited number of field tests and free, but sophisticated software.

Variation in seismic hazard was evaluated mainly as a function of soil type. Using one-dimensional site response software, the impact of the different soil zones was evaluated and compared to the more uniform approach by soil type profile from Eurocode 8. The rapid visual evaluation of buildings was performed in Győr. The evaluation method was developed from well-known approaches, but modified to account for typical building designs found here. Estimates of seismic risk were computed using seismic hazard results and building vulnerability functions. As one would expect, since the hazards and vulnerabilities were not uniformly distributed around Győr, there were zones of higher and lower risk.

Based on these results, engineers and planners can decide where to improve buildings, whether to permit further development. The results provided by a seismic risk analysis could be regarded as helpful guidelines in respect to all the phases of the risk management: during normal periods, during crisis periods, as well as in the recovery and post-emergency periods, and can be directly applied into development plans, emergency planning, insurance calculation, etc. The method developed for the Hungarian context can be directly used to evaluate the earthquake risk of other cities.

## References

[1] LUCO, N., ELLINGWOOD, B. R., HAMBURGER, R. O., HOOPER, J. D., KIMBALL, J. K., KIRCHER, CH. A.: *Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States.* Squaw Creek: SEAOC Convention, 2007.

[2] FEMA 155: *Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation.* 2nd ed. Washington, D.C.: FEMA, 2002.

[3] FUKUYAMA, H., TUMIALAN, G., MATSUZAKI, Y.: *Outline of the Japanese Guidelines for Seismic Retrofitting of RC Buildings Using FRP Materials.* Cambridge: Non-metallic Reinforcements for Concrete Structures. FRPRCS-5. 2001.

[4] KOTTKE, A., RATHJE, E. M.: *NEEShub – Resources: Strata.* 2013. https://nees.org/resources/strata (Downloaded: 12 05 2013).

[5] GeoRisk Earthquake Engineering Ltd.: *Seismic Hazard Map of Hungary.* 2006. http://georisk.hu/ (Downloaded: 01 20 2014).

[6] VARGA P.: Az 1763. évi komáromi földrengés [The Komárom Earthquake of 1763]. Természet Világa, 145 2 (2014), 69–72.

[7] BADA G.: *A Pannon-medence jelenkori geodinamikája: Vizsgálati módszerek és kutatási*

*eredmények (Contemporary Geodynamics of Pannonian Basin: Test Methods and Research Results).* Budapest: ELTE, 2005. http://geophysics.elte.hu/dolgozok/bada.htm#oktatas (Downloaded: 01 20 2014).

[8] ROCA, A., OLIVEIRA, C. S., ANSAL, A., FIGUERAS, S.: Local Site Effects and Microzonation. In. ROCA, A., OLIVEIRA, C. S., GOULA, X. (Eds.): *Assessing and Managing Earthquake Risk.* Dordrecht: Springer, 2006. 67–91.

[9] BISZTRICSÁNY E.: *Mérnökszeizmológia (Engineering Seismology).* Budapest: Akadémiai Kiadó, 1974.

[10] European Committee for Standardization: *Eurocode 8: Design of Structures for Earthquake Resistance. MSZ EN 1998–1: 2004/A1:2013.* Brussels, 2013.

[11] KEGYES-BRASSAI O.: *Earthquake Hazard Analysis and Building Vulnerability Assessment to Determine the Seismic Risk of Existing Buildings in an Urban Area.* Ph.D. dissertation, Győr: Széchenyi István University, 2015.

[12] CALVI, M. G.: A Displacement-Based Approach for Vulnerability Evaluation of Classes of Buildings. *Journal of Earthquake Engineering*, 3 3 (1999), 411–438.

[13] FOERSTER, E., KRIEN, Y., DANDOULAKI, M., PRIEST, S., TAPSELL, S., DELMONACO, G., MARGOTTINI, C., BBONADONNA, C.: Del. 1.1.1: Methodologies to Assess Vulnerability of Structural Systems. In. *ENSURE (Enhancing Resilience of Communities and Territories Facing Natural and Na-tech Hazards). Project WP1: State-of-the Art on Vulnerability Types. Eu. Com.* 7th FW Programme, 2009. 1–139.

[14] CALVI, G. M., PINHO, R., MAGENES, G., BOMMER, J. J., RESTREPO-VÉLEZ, L. F., CROWLEY, H.: Development of Seismic Vulnerability Assessment Methodologies over the past 30 Years. *ISET Journal of Earthquake Technology*, 43 3 (2006), 75–104.

[15] MOUROUX, P., BERTRAND, E., BOUR, M., LE BRUN, B., DEPINOIS, S., MASURE, Ph.: *The European Risk-UE Project:* An Advanced Approach to Earthquake Risk Scenarios. *13th World Conference on Earthquake Engineering*, Vancouver, B.C., 2004.

[16] FEMA 154: *Rapid Visual Screening of Buildings for Potential Seismic Hazard.* Washington, D.C.: FEMA, 1988.

[17] GRÜNTHAL, G. (Ed.): *European Macroseismic Scale 1998.* Luxembourg: European Seismological Commission, 1998.

[18] *A megye veszélyeztetettségének elemzése.* Győr-Moson-Sopron Katasztrófavédelmi Igazgatóság (Győr-Moson-Sopron County Emergency Directorate), 2014. http://gyor.katasztrofavedelem.hu/a-megye-veszelyeztetettsegenek-elemzese (Downloaded: 04 23 2014).

[19] KUTI R.: *Műszaki mentések I–II. (Technical rescue I–II.).* Study material, Budapest: ZMNE, 2007.

[20] GYENES Z.: *Nemzeti katasztrófakockázat-értékelés* (National Disaster Risk Assessment). Budapest: National Directorate General for Disaster Management, Ministry of Interior, 2011.

AARMS Vol. 16, No. 2 (2017) 17–32. **10.32565/aarms.2017.2.2**

# Further Ethical Challenges in Military Science from the Perspective of the Catholic Church: Reflection on the Use of Drones[1]

Lóránd UJHÁZI[2]

*The ethical assessment of the appropriate forms of offensive military action have been one of the most significant areas in this respect over the past few years. In the teachings of many religions military weapons and procedures are traditionally evaluated and the limits assessed as to what is appropriate in a war situation. In the Catholic Church quite an elaborate system has been evolved, beginning with the teaching on what constitutes a just war, followed by the medieval criminal law procedures as determined by the councils of the Church, and in the 20th century the various declarations on atomic weapons and weapons of mass-destruction. The Catholic Church still has no established and official position on offensive action in war in the light of the UAV systems. Different opinions and views have been expressed, but it is still far from being a definitive teaching. Research institutes in the Vatican, in the different Episcopal Conferences, and in Military Ordinariate are working on an overall assessment of the problem. However, a comprehensive and correct position has to take political considerations into account, as well as the advantages brought about by technical advances and an assessment of security factors. This way a position can evolve that is faithful to the Catholic Church's tradition, a doctrine what is acceptable to the political leadership, too.*

**Keywords:** *Military studies, Catholic Church, Just War, UAV systems*

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.[3]

The American science fiction writer, Isaac Asimov was playing around with the idea in the 1940s that there would come a society where robots and humans lived together. As every society, this one also required a rule of coexistence to be laid down. At that time Asimov's

[1] The work was created with the support of the Zrínyi Miklós habilitation excellence programme operated by the National University of Public Service in the *PACSDOP-2.1.2-CCHOP-15-2016-00001 "Public Service Development Establishing Good Governance" project.*

[2] Ph.D., Senior Research Fellow, National University of Public Service, Faculty of Military Science and Officer Training; email: ujhazi.lorand@uni-nke.hu.

[3] The rules of robotics known from science fiction literature were created by Isaac Asimov. The three rules mentioned were completed with a fourth, more specifically a zeroth one. According to the zeroth, a robot may not injure humanity, or, by inaction, allow humanity to come to harm. The robot is responsible for protecting the whole of humanity. So the robot can harm people if he can do so in service of humanity.

ethical questions and commentaries belonged to the world of science fiction. Today ethics, law, theology and philosophy all pose similar questions regarding "robots". Machines, especially their use in armed attacks have been a long-standing problem of religious systems. What weapons may be developed? Is their use ethical? Namely, starting and conducting a war, or the behaviour to be followed in a war do not have only technical and law-controlled frameworks. As religious communities form integral parts of a society, they have the right to establish ethical rules regarding starting a war, and the tools and actions to be applied in a war. In view of their tradition and teachings they evaluate ethical dilemmas which arise either from the side of new technical instruments, such as remote-controlled drones able to spy or strike without a crew, or from the side of new security phenomena, such as private military forces, asymmetric wars and terrorism. [1] The attitude of religions requires conscientious, ethical and rarely canonical liability from religious communities. The value of a religious community's reflection is not given by its power gained in secular law systems or the reaction of political leadership. Equipment and challenges are changing, but the principles and ethical norms of religious communities have actually remained the same. Regarding the question of "drones" the Catholic Church does not have any official teaching yet. There are opinions and initiatives, but they are far from being fully formed resolutions. At the same time, there should be official church guidelines as church institutions and Catholic forums have formulated different points of view on the matter recently.[4]

## Machines Used in Wars and the Resolutions of Religious Communities

It is not the first time that the ethical-moral question, whether the use of a certain weapon or process offends humanitarian conventions, has arisen in connection with drones during history. Beside considering their own ethical system, religious communities have been forced several times to make resolutions regarding weaponry and military processes. They have tried to formulate paradigms of ethical, moral behaviour for their own faithful. Not even one weapon can be considered "neutral" ethically. However, there are huge differences among different weapons and processes. It is shown by the fact that the use of certain weapons and techniques is prohibited by international law. So it is never pointless to carry out ethical investigation regarding new weapons. [3]

The effort to keep a clash of arms within certain limits appears in the teachings of several religions. [2] Hinduism condemns wars but the teaching has to be squared with the sad reality

[4] The journal *Ethik und Militär,* which belongs to the German Catholic Military Ordinate, 1 (2014) deals with the question of drones solely. Despite the fact that the succeeding studies have widely differing opinions, the issue regarding new weapon systems is manifoldly and scientifically elaborated, which is quite unfrequent. ARKIN, C. R.: Vollautonome letale Waffensysteme und Kollateralopfer. *Ethik und Militär*, 1 (2014), 3–12.; GOOSE, S.: Die Notwendigkeit eines präventiven Verbots vollautonomer Waffen. *Ethik und Militär,* 1 (2014), 13–22.; KOCH, B.: Von Menschen und Maschinen: Was bedeutet die Robotisierung des Militärs in ethischer Hinsicht? *Ethik und Militär,* 1 (2014), 23–26.; MÜLLNER, K.: Ferngesteuerte Luftfahrzeuge. Maßgeschneiderter und besserer Schutz für unseren Soldaten im Einsatz. *Ethik und Militär,* 1 (2014), 27–35.; OETER, S.: Rechtsfragen des Einsatzes bewaffneter Drohnen aus völkerrechtlicher Perspektive. *Ethik und Militär,* 1 (2014), 36–41.; RUDOLF, P.: Töten durch Drohnen. Zur problematischen Praxis des amerikanischen Drohnenkrieges. *Ethik und Militär,* 1 (2014), 41–45.; STATMAN, D.: Drohnen, Roboter und die Moral des Krieges. *Ethik und Militär,* 1 (2014), 46–51.; WELLBRINK, J.: Mein neuer Kamerad. Hauptgefreiter Roboter? *Ethik und Militär,* 1 (2014), 52–55.; MATTHEWS, M.: Special: Stress bei Drohnenpiloten posttraumatische Belastungsstörung, Existenzkrise oder moralische Verletzung? *Ethik und Militär,* 1 (2014), 59–65.

that there are wars and violence in human communities. The caste of warriors, whose task was specifically fighting, was framed to defuse the tension. On the other hand, provisions that should be followed in wars were introduced. Cavalry against cavalry and infantry against infantry were allowed to fight. Fleeing soldiers and the injured were not allowed to be killed, and those who were not involved in fights had to be respected. [2]

Buddhism elaborated a similar system. According to the original Buddhist teaching, the prohibition of killing is a supreme command. Killing a living creature deliberately was considered to be a sin. In the 7th century, the Mahayana sect declared killing acceptable if it was for protecting the purity of the Buddhist doctrine or to prevent more deaths. [2]

Rabbinical law differentiated two kinds of wars: optional warfare, where the aim was to prevent attacks, and compulsory warfare, which meant defence against attacks. Rabbinical tradition also tried to control the weapons used in compulsory, defensive wars. It was not allowed to destroy orchards, soil and family homes. Women and prisoners of war had to be respected. A besieged town could be surrounded on three sides only, so that a way of escape could be open for the besieged inhabitants. [2]

Jihad, the holy war, is interpreted in very different ways by some Islamic schools. The interpretation ranges from the war against our own addictions to the war where the aim was is to extend Islam to the whole world, even through violent means. The restriction of weapons and processes allowed to use in wars also appears in Islamic interpretations. Killing civilians in wars was banned. Prisoners of war had to be dealt with in a humane and dignified manner. Like the Jewish approach, Islam also banned destroying orchards, settlements, churches or temples and animals. [4] Nonetheless, in all of these situations the principle of "everything was allowed that was useful for the Islamic community" predominated, which quite relativized the above-mentioned limiting factors. [5: 33] [13]

## The Evaluation of Launching Drones According to the Classic Glossary of a Just War

In Catholic theology, a complex philosophical system has developed to assess wars. A few early Christian writers were even concerned about the participation in Christian wars.[5] Logically, these authors did not get to the theoretical depiction about limiting available weapons in wars. This changed in the period of Constantine. [6] In 314 the third canon of the Council of Arles decreed that "Concerning those who lay down their weapons in peacetime, be it resolved that they be excluded from fellowship." [7] According to the most common explanation of the canon, the council interpreted the military service of Christian soldiers as a compulsory civic duty. [8] There are multiple abstract interpretations of this canon as well, [9] [14] but it seems that following the literal meaning is the best. In the years of the persecutions, the military was called upon to carry out the imperial edicts. This created tensions amongst Christians in the military, so many Christian soldiers either deserted the army or they refused to obey orders. When Christianity was legalized, there was no justification for desertions. The synod underlined this fact. It reminded Christian soldiers that it was their duty to serve in the army.

[5] Saint Justin, Athenagoras, Tertullian, Cyprian, Origenes, Minucius and Arnobius.

When the "empire" became "Christian", and an existential threat to the empire was also an existential threat to Christianity, then the philosophical system of the Church had to reflect on wars and the use of war materials. At least this way the dilemmas that were looking for answers to the questions about wars and behaviour in wars was developed theoretically. The first great theorists of the doctrine of just wars were St. Ambrose and St. Augustine. St. Ambrose (337–397) developed certain principles regarding both starting a war and behaving in a war. He formulated that war could be launched after an appropriate announcement or notice. What makes it righteous to launch a war is the protection of a town or the innocent, or revenge on evil. In case of victory, mercy should be practised on victims. St. Augustine (354–430), the other great theorist of the era, did not write about war comprehensively. [10] He forms his main ideas in connection with persons and events. In his work, *City of God*, we can read about some forms of attitude that must be complied with. Accordingly, it is forbidden to kill the innocent, and not one of the prisoners of war can be tormented or executed.

The early decretalists like Dionysio-Hadriana, the Pseudo-Isidorian decretals of the Carolingian era, the collections of Burchard of Worms, Anselm of Lucca (eleventh century) and the Decretum and Panormia of Ivo of Chartres (in the early twelfth century) did not create a system about just war. [11: 55] They simply followed the concepts of scholars from the first Christian centuries especially the theory of Saint Augustine. The compilation of Gratian, the *Concordia Discordantium Canonum* had a huge influence on later canon law. His references to war and military service can be found in various passages of his work. He follows the general concept of other Christian theorists that war has to be either just or the final resort. The goal of every single war is to re-establish peace. Gratian also emphasizes the importance of the just behaviour of warriors. Moreover, according to him, pilgrims, clerics, monks, women and the unarmed poor cannot become targets in war on pain of excommunication and anathema. The compilation of Gratian became very influential, but it does not contain a single passage regulating the use of weapons. Supposedly, Gratian may have believed that if a war was necessary and just then the use of every weapon was permissible.

On the other hand, some ecclesiastical movements of the era tried to regulate the field of weapon usage when they prohibited some weapons which they classified as deadly. This can be traced back to the 29th canon of Second Lateran Council, where they declared: "We forbid under penalty of anathema that that deadly and God-detested art of stingers and archers be in the future exercised against Christians and Catholics." [11: 69–70] Interestingly Gratian omitted this passage from his compilation, but the later compilers have included this prohibition in their works. However, other decretalists, like the Compilatio Prima and the Gregorian decretals remained faithful to the concept of Gratian and did not write anything about limiting the use of certain weapons.

A more comprehensive elaboration of the just war's doctrine took place in Scholastic theology. Although several important contemporary philosopher-theologian authors reflected on the question, the elaboration of the doctrine is tied to St. Thomas Aquinas (1225–1274). In his scholastic school St. Thomas Aquinas improved the Augustinian doctrine of war or just war in three main directions:

- the right to launch a war: *jus ad bellum* (the rightful reason, the war is the last step, the rightful intention, the authority, the chance of a successful war and proportionality);[6] [12]

[6] The author emphasizes several times that the idea of the "just war" has remained theoretical and philosophical.

- the rules of warfare, namely what can and what cannot be done in a war: *jus in bello* (trying for the least possible victims, keeping proportionality, differentiating "legitimate" military and non-military targets);
- the rules of settling post-war status: *jus post bellum*.

The question of instrument use belongs to the category *jus in bello.* Therefore, according to classic terminology, the ethical aspects of using new weaponry should be discussed in this category. [15] Special ethical research has been built recently on the applicability of UAV (Unmanned Aerial Vehicle), namely drones.[7] [16] The original application of UAVs, the intelligence, has brought up some ethical questions, as new instruments applied in the field of intelligence have always carried moral, even legal dilemmas. (Let us think of secret information gathering.) However, the real ethical challenges are those UAV instruments that provide attack capability. [17]

From the view of the Catholic Church, scholastic categories can be partly applied. [18] The question is—in the use of UAV instruments—to what extent it is possible to take into consideration the old aspect: the difference between fighting and non-fighting participants. Reports appear daily on those civilian victims who lost their lives in UAV attacks. The data mentioned in the reports are so different from one another that it is not worth getting involved in a "data war". US authorities are trying to lessen this number. On the other hand, data from "leaks" shows them to be not only excessive but also uncontrollable. [19] The White House used to publish an annual report on how many people died or were wounded in drone attacks. in 2013, the publication of the data of Afghan drone attacks stopped, and also the accessibility of previously published information was withdrawn. According to Pakistani sources, the number of victims is a bit higher. Human rights organizations are trying to find out rather than reveal the number of civilians who have died in UAV attacks. [20] There can be victims of inaccuracy and failure not only because of launching UAV instruments. The real question is, to what extent the aspect of classic differentiation is considered. According to certain analyses, UAV instruments are able to eliminate the target with extreme accuracy. On the other hand, it has to be taken into consideration that these actions take place in grounds where al-Qaida and other radical groups are strong, and tribe leaders, families give shelter to the members of terrorist groups. In these circumstances it is not easy but impossible to differentiate the target persons. Therefore, some analyses call the attention to the psychological effects that reach the population in an UAV raid. So, even though terrorists are the targets, the observation of terrorists and the presence of drones can terrorize families and children, even the population. [21]

However, confused situations and inaccurate data favour terrorists who exaggerate the number of victims to recruit new members easily. Lots of people are afraid that the use of drones does not only results in finishing war sooner in territories in crisis, but because of the propaganda many of the young take action against that "western" power which "uses killer robots unmercifully". [22]

The sortie of UAVs can be analysed from the side of proportion. According to the traditional aspect of a rightful war, violence in war can be used only to that extent that advances the successful finishing of a war. Some approaches state that the use of UAVs—due to the dis-

[7] Peter Lee (former chaplain) and Alex Leveringhaus have been studying the ethical attitude of applicability of drones for years.

tance between the machine and its operator—results in disproportion. The intense destruction and the above mentioned civil victims do not reflect the principle of proportionality either. Some people doubt whether this 'risk-free' warfare can be called warfare or rather maintaining safety and security, in which one party undertakes considerably less risk. [23: 47] When evaluating new technical instruments, it has to be considered that military leaders will, by definition, approve the use of such instruments that will lead to greater success and fewer human victims on their side. [3]

The war between the living and the non-living emerges as a new question. The machines used today are not independent from humans. They are better termed RPA (Remotely Piloted Aircraft). [17: 2] It is emphasized that they are not robots in the strict sense of the word, but ultimately human operated machines with robotic elements. [24] In an operation there are elements that are performed by these machines autonomously (landing, taking off, some flight operations) but there are humans behind the operation whose role and responsibility will remain. [25: 11] In theory, we can play with the idea whether there will be 'martial' robots operating without any human control that can destroy human life, but this is not the case here. Regarding this idea, some authors note that in this case the ultimate responsibility is of those who develop robot control softwares, and of those politicians who have to make legal and ethical rules which give a framework for the use of automated weapons. [26: 3–5] On the contrary, others say that fully automated martial weapons contravene fundamental ethical principles, so their mere development should be banned. [27] Aside from the authors' opinion, the fact is that the decision-making environment has changed compared to classic warfare, which has advantages and disadvantages. As physical presence promotes the perception of the significance and reality of the situation, remote controlling results in greater calmness and more sober decision-making. However, it is a common criticism that distance can generate the so-called video-play syndrome or brutality/apathy towards victims. Truth is, brutality towards victims can happen both using remote-controlled instruments or during the execution of a classic action.[8] [28] What is more, some analysts note that the stress surrounding a pilot or a soldier whilst using the UAVs do not result in thoughtless decision and it does not play any role. [29]

According to the classic view, war should be considered the last step. It is only acceptable to engage in warfare if no other sanction leads to results. The use of drones has developed the possibility for political leaders not to reckon with victims from their own side. Therefore, some critics say that it can easily happen that politics will use the war-level of violence soon. According to some Catholic explanations, covert operations and targeting strikes belong to the category of preventive sanctions, just like diplomatic tools, international and economic pressure, blockade, etc. [30] These tools serve the avoidance of using major military forces. So, it would be right to consider that the targeted use of UAVs with attack capability can fit the avoidance of using major military forces.

Furthermore, there is no crew that can be killed when using a UAV strike, however the number of casualties or injured can be much higher on the other side. [31: 130] Others say that as commanders are responsible for their own soldiers, it is not a possibility but an obligation for them to use instruments—such as drones—that provide greater security for soldiers.

[8] The author has indicated the extreme, human war-time reactions of which soldiers are not excluded either. The consequences are the indifference towards human suffering or the development of cruelty.

It is the moral obligation of political and military leaders to provide soldiers as secure situations as possible. UAVs are said to provide this security. [32]

Finally, it is also true that a serious industry that makes considerable profit has been established building drones, especially their armed versions. [29] So this segment must be considered as well when evaluating these weapons morally.

According to the Catechism of the Catholic Church (2316) "The production and the sale of arms affect the common good of nations and of the international community. Hence public authorities have the right and duty to regulate them. The short-term pursuit of private or collective interests cannot legitimate undertakings that promote violence and conflict among nations and compromise the international juridical order." [33] The ecclesiastical document forms general views regarding excessive weapon development and economy. This applies to the new UAV weapon system as well. It is a fact that UAVs are cheaper than conventional airplanes. New weapon systems always bring along a never-ending spiral: the technology that defends against these systems and later the development of instruments that exceed the technology of the defence system. [34] Naturally, it has a considerable economic aspect.

However, according to some analyses, the American drone monopoly may break on account of the profit priority of the sector. The fact that in some years substate organizations or terrorists will also possess attack capable UAV systems, cannot be excluded. [35] These threats must not be ignored,[9] which opens a new era regarding the "proliferation" of weapons of destruction.

## The Reflection of the Catholic Church on the Use of Remotely Controlled Weapons

The question on the use of remotely controlled weapons is not new in the reflection of the Catholic Church. In 1139, the Second Lateran Council dealt with the use of crossbows and catapults. The anxiety of the council fathers' was derived from the belief that new weapons would change knightly virtue, in which it was an important requirement of combatants to fight on foot. Therefore, the council came to the decision: "We forbid under penalty of anathema that that deadly and God-detested art of stingers and archers be in the future exercised against Christians and Catholics."[10] [37] Later a more dangerous weapon appeared: the longbow, which was capable of launching at least twelve arrows, contrary to the three arrows of the crossbow. Since the 11th century this weapon had wrought havoc on battlefields, the Church had to make a declaration on the question in official forums. It is also operative in conciliar provisions that the principle regarding criminal legislation must be closely interpreted. As the text uses the expressions "Christian" or "Catholic", the provision did not have to be extended to non-Christians, according to the general explanation. [38] Regardless of the conciliar measures, Christians deployed these weapons against each other. They did not want to give up the benefits of these effective weapons. The inefficiency of the provision was shown by the fact that in 1234, nearly a century later, Pope Gregory IX strengthened the enforcement. It was as inefficient as the conciliar provision.

---

9 Hezbollach, which operates in Lebanon, has drones as well. [36]

10 *"Artem illam mortiferam et odibilem ballistariorum et sagittariorum adversus Christianos et catholicos exerceri de caetero sub anathemate prohibemus."* [37]

However, the council and apostolic prohibition proposed a serious canonical explanation.[11] On the one hand, canonical schools studied whether the apostolic prohibition referred to the philosophical category of the "just war" only, or did it extend to all armed fights. That is, whether the use of these weapons is permissible from the party which conducts—according to the Christian teaching—a just war. Or rather, the question arose again in some cases: was the prohibition operative if the opposing party was non-Christian? Though the default values of the conciliar decision—that the above-mentioned weapons were prohibited only against Christians—lived on, sometimes new phrasing occurred, which was against the general understanding. Serious canonical explanations developed in reference to the punishment prospected by the synodical provision. Excommunication is "self-supervening", so the legal effect takes place without any other Church measure or the ecclesiastical authority has to declare it subsequently together with its direct legal sanctions. As the conciliar provision does not give an obvious guideline in this field, the canonical explanation played the major role. In comparison with UAVs, it is worth mentioning some early authors' opinion as to how they saw the reason for that rigorous regulation. The penitential manual *Quia non pigris*, which devotes a whole chapter to the question of catapult operators, sees the reason for the rigorous prohibition as "these weapons kill extremely quickly". [39: 40] Henricus de Segusio (Hostiensis) explains the prohibition: catapults and crossbows are prohibited because they have excessive toughness and unexpected lethal effects. He even adds that this is irrespective of the war they are used in. [39: 39] The medieval provisions and the explanations written in them are important with regard to the fact that they were studied from the scope of newer weapons, and some authors—as analogia legis—extended them to canons and other firearms. [39: 51]

The language of the 20th century ecclesiastical documents has changed a lot. The statement dealing with the moral-ethical assessment of modern weapons has more a teaching than criminal attitude. Regarding UAVs, ecclesiastical utterances concerning weapons of mass destruction (WMD) are significant. On one hand, we can see some gradual approach with which official ecclesiastical forums evaluate the ethical and moral dimensions of new weapon systems. On the other hand, UAVs raise similar ethical questions in many aspects: remote control, civilian victims, destructive power, etc. Therefore, by analogy some conclusions and principles can be referred to UAV systems, too. The appearance of WMDs made the Catholic Church adjust its reasoning on "just war" to the conditions created by new weapon systems. Today such a change of era is taking place, which makes it justified to think over old concepts.

By the '80s it had already become obvious that nuclear weapons could not create that degree of deterrence that had been hoped for. Disarmament programs and international debates inspired the Catholic Church to contemplate newer reflections. [40] Pope Saint John Paul II's speech, held in the UNO in 1982, about the existence and use of nuclear weapons determined the position of local episcopal conferences on this question. The Pope thinks that "In current conditions 'deterrence' based on balance, certainly not as an end in itself but as a step on the way toward a progressive disarmament, may still be judged morally acceptable. In his opinion, expressed to diplomats in 1982, he noted that the last goal, which cannot ever be lost sight of, is total nuclear weapon disarmament." [41] After

[11] Comprehensive review to some medieval authors' explanations: [39]

the Pope's and the Holy See's declaration, some episcopal conferences concerned also made declarations. Among the utterances of episcopal conferences, the circular of the American Episcopal Conference (published in 1983) is extremely significant. [42] Against extremely pacifist views, the document is a down-to-earth statement with realistic social approaches, which forms points of view that can be considered regarding the use UAVs. Not only does it confine to establish general principles, but it also conducts ethical assessment. [40] The document—in a separate subchapter and in the light of new instruments—studies the concept of *jus in bello*. According to the circular, internationally banned weapons cannot be used, the principle of proportionality and the saving of non-combatants must be respected. The document admits that it is not easy to determine military targets in a modern war, but the destruction of civil targets—such as children, schools, hospitals, the sick, the old, non-military workers or agricultural workers—cannot be allowed. Actions cannot be taken against non-combatants, not even if the action has any retaliatory measures. On this question it formulates, also on the level of the individual's conscience, that a command that is against the most fundamental ethical and moral norms cannot be executed by a Christian. Regarding new weapon systems, it also has a significant wording, as it declares that the questions of nuclear weapons are not only political and military ones, but they have primal ethical significance, too. It is also true regarding UAV systems.

The 1994 Catechism of the Catholic Church (CCC) formulates significant principles on the level of the universal church. The document (2309) deals with the question of launching a war. As a matter of fact, it summarizes the traditional teachings on the discipline of the rightful war.[12] CCC (2312, 2313, 2314) studies the compulsory behaviour in a war. CCC (2312) also repeats the principles of the Second Vatican Council: the Church and the human reasons propagate the unchanged validity of the moral law during armed conflicts. "Nor, by the same token, does the mere fact that war has unhappily begun mean that all is fair between the warring parties." [44: 79] It is not allowed to torture, kidnap or force anybody. CCC (2313) specifically protects non-combatants. "Non-combatants, wounded soldiers, and prisoners must be respected and treated humanely." [43: (2313)] CCC (2314) is similar, and repeats the teaching of the Second Vatican Council. [44: 80] These "general" ecclesiastical utterances are significant regarding the use of UAVs. While it is true that when these documents came into existence, the question of using UAVs did not come up, but by analogy both synodical documents and the utterances of CCC are relevant regarding new weapon systems, too. The destruction of the population of cities or greater territories without any distinction is prohibited and considered to be a serious sin by the ecclesiastical documents. Regarding nuclear, biological or chemical weapons, the documents mention

[12] "The strict conditions for legitimate defence by military force require rigorous consideration. The gravity of such a decision makes it subject to rigorous conditions of moral legitimacy. At one and the same time:
– the damage inflicted by the aggressor on the nation or community of nations must be lasting, grave, and certain;
– all other means of putting an end to it must have been shown to be impractical or ineffective;
– there must be serious prospects of success;
– the use of arms must not produce evils and disorders graver than the evil to be eliminated.
The power of modern means of destruction weighs very heavily in evaluating this condition." [43: (2309)]

that there is a much greater opportunity for the use of these weapons in modern wars. So today the list of the weapons of these documents should contain UAV systems as well.[13]

John Paul II gave a complex statement about the nature of armed conflicts on the World Day of Peace in 2000. [45] Here the pope classified small-calibre weapons and so-called "light" arms as the most dangerous weapons on Earth partly because these armaments are responsible for the most casualties in conflicts and partly since it is almost impossible to block their smuggling into crisis zones. The pope added that the civilian population suffers the most tragically from measures intended to disarm an aggressor.

## Ecclesiastical Utterances Regarding UAV Weapons

As regards to UAV weapons no official opinion has been declared by the Holy See, but some Catholic moral theologians and Catholic research institutions have dealt with the question.

Archbishop Silvano M. Tomasi, UN delegate of the Holy See, summarized his opinion in a letter. It says:

1. The technology may lower the threshold of conflict, making it seem more attractive to enter into war.
2. Large populations live in constant fear of the strikes where these strikes are systematic. These people think that their own lives and property can be victims of mistaken strikes in the future.
3. It is difficult "to assess the precise impact on civilians of the use of weaponized drones".
4. When data related to the use of weaponized drones is withheld, compliance with international law, international humanitarian law and ethical standards cannot be verified.
5. Today we can speak about the proliferation of drones. There are not always ethical restrictions to use them, but non-restricted cases must be clearly set. The restriction is needed to limit the accelerating spread—"proliferation"—of drones. [46]

Archbishop Tomasi in an interview given to Radio Vatican stated that however complex machines were, they would never be able make a real ethical judgement. In the interview he said that the excessive spread of UAVs was of concern as it could spoil international relations between different countries. Bishop Tomasi's letter or the interview is confined to the most relevant points. It is obvious that the background research, which the Holy See owns in other fields, is still missing. In certain Western-European countries, where there is a culture of researching the ethical, religious, military science questions together, the ethical evaluation of UAVs is already well advanced. The utterances of the German Catholic Church, given in different forums, are notable. [47] Bishop Franz-Josef Overbeck, military ordinary has often spoke concerning the question. Since the German governmental intention was revealed—according to which Bundeswehr would be armed with attack capable UAV planes—he has set out his position in several forums. Institut für Theologie und Frieden, which works closely with German Military Ordinate, has made

[13] "Every act of war directed to the indiscriminate destruction of whole cities or vast areas with their inhabitants is a crime against God and man, which merits firm and unequivocal condemnation. A danger of modern warfare is that it provides the opportunity to those who possess modern scientific weapons—especially atomic, biological, or chemical weapons—to commit such crimes. [43: (2314)]

several analyses and background materials for the ordinary. In 2012, the ordinary already noted that the problem had to be studied from every side critically. [48] Actually, he expects the German political leadership to clarify the legal and ethical frameworks of attack capable UAV weapons. According to the ordinary, the large distance between the weapon and the operator is problematic, and he considers it to be ethically questionable to endanger non-combatants and civilians so that soldiers can be safe.

On the conference about remote controlled airplanes that was organized by Bishop Stephan Ackermann, the chairman of Justitia et Pax, and the military ordinary had the same final conclusion. At the end of the conference it was formulated again that professionally correct answers were expected from the political leadership. In a joint declaration they summarized their concerns regarding remote controlled attack capable airplanes. In their opinion, political authority—for the sake of soldiers—must clarify this question. Although the two German, Catholic philosophers, theologians are not always of the same mind, they agreed on key questions, respectively that the debate should be submitted to a broader social discussion, and the political and military leadership should give professionally correct answers. For that reason, a set of questions that should be submitted to public discussion was compiled.

Both Catholic theologians agreed that weapon systems providing safety to soldiers, such as remote controlled armed planes, can and have to be developed. However, when evaluating these weapons, we cannot be confined to stereotypes. There is truth in critical statements, of which much is true to combat aircraft, helicopters or sharpshooters as well. [49]

According to the bishop's declaration, the most important ethical question is how new weapon systems affect the ethical principle and goal of using the least possible violence. The possibility offered by drones can easily create "asymmetry" between conflicting parties, so the stronger party will sooner make use of violence. UAVs create the necessary circumstances for soldiers involved to be in greater safety, but the other party's soldiers and civil inhabitants are in greater danger due to the use of these machines. Especially, if the intelligence information which the mission is based on is not accurate enough.

Likewise, what criteria exist as the basis for the decision: when to give a lethal strike on hostile powers? Is it not an unlawful massacre, or is it the use of capital punishment without a trial?

Other German bishops occasionally made declarations regarding UAVs. Archbishop Ludwig Schick of Bamberg says that the use of armed drones can intensify violence. [50] In March, 2013, in Königsbronn—in the Reserve Army of Germany (Deutschen Reservistenverbandes)—Archbishop Robert Zollitsch stated that he was missing those clear criteria which would unambiguously define the conditions of using drones.

German bishops are of the same opinion: there should be a social discussion in this matter, and while the political leadership form their point of view regarding the obvious legal and ethical frameworks of using drones, they should take notice of the classic principle of using wartime violence as the last step. The opinion *(Arbeitspapier)* of the Community of Catholic Soldiers (Gemeinschaft Katholischer Soldaten) differs from that of the Pope's. According to their view, the Bundeswehr should have strike capable UAV systems but, on one hand, they cannot be used for targeted destruction practiced by the USA, on the other hand, German soldiers should get clear and unambiguous training about the ethical and legal frameworks of UAV deployments. Furthermore, the document itself notes that violence can only be the last step, and the number of civil victims should be minimized. [47: 11]

American Catholic Church leaders especially feel involved in the matter because of the international involvement of the United States. In this case both Catholic theologians and official church forums answer the ethical dilemma of the application of UAV systems. [51] Their doubts are similar to the already introduced critical views—namely the threat of civil inhabitants—[52] hence there is no possibility of selecting targets.[14] They note that the drone program, launched under the Bush presidency, has increased significantly under the Obama administration. [53] Furthermore, the deployment of drones did not even shorten military missions. Terrorist cells regenerate quickly, they are able to recruit new members and replace leaders with new ones. [54]

The *Iustitia et Pax* (IUPAX) commission of the United States Conference of Catholic Bishops (USCCB) wrote letters to several United States congressional committees. In the letter IUPAX summarized the doubts that can occur regarding armed UAVs. They emphasize that everybody has the right to protect themselves in self-defence, but this principle does not give the opportunity to use any means of weapons without limitation. On the other hand, the letter lays down an important statement. The principles of a just war cannot be applied to the fights against terrorists outside the "battlefield." The elements of the just war was worked out to be used in a war, not outside the battlefield in anti-terrorist actions. If we used the same categories for terrorists (as substate participants), philosophically we would raise them to the level of state participants'. Therefore, philosophically, anti-terrorist movements cannot be called at war. However, there are questions on using certain weapon systems, as follows using UAV systems. The American IUPAX finds it offensive that UAV systems do not make any difference but they consider each armed man over a certain age to be an enemy. The letter quotes the *Compendium of the Social Doctrine of the Church*: "a preventive war without clear proof that an attack is imminent cannot fail to raise serious moral and juridical questions." By analogy, the letter states that a lethal strike without obvious evidence to the fact that the people attacked are really terror threats raises moral dilemmas.

## Conclusions

Throughout history the development of military appliances has always involved ethical and moral questions. Religious communities, as integral parts of the society, felt impelled to speak. The Catholic Church needed time to evaluate each weapon system. However, it is obvious that there are periods in history when the church, both universal and particular, has to make a declaration on using certain weapons regarding ethical and moral perspectives. It is true that the evaluation should take into consideration the eternal moral verities, but on the other hand, it can not ignore neither military, nor political arguments. Regarding the use UAV weapons, their military and political benefits cannot be ignored either. (Little fuel consumption, cheaper maintenance, strategic benefits, greater safety of soldiers, etc.) [55] The moral and ethical questions which these technologies bring forward have to be exposed beside these benefits. (Mental problems, fear, greater threat to civil inhabitants, asymmetry, fight between human and machine, video game effect because of the distance, etc.)

[14] The study mentions Osama bin Laden's elimination: it was executed by special forces and not with remote controlled planes. [51] This opinion is only partly true, as it was important to make sure personally of the success of eliminating the terrorist leader.

The Catholic Church does not possess a universal resolution on the question. On the highest level Archbishop Tomasi—UN delegate of the Holy See—has spoken about the use of drones so far, in a rather critical tone. The utterances of the German Church are notable locally as they model the dialogue that the Church should hold with each segment of society based on the principles of the Second Vatican Council. The utterances of the American Catholics, which try to square international tendencies with the tradition of the Catholic Church, are also notable. Due to the American involvement, it is the most affected community.

The Catholic Church has already established severe official resolutions regarding nuclear and biological weapons. Hopefully, a resolution which is coherent with ecclesiastical traditions but also takes political tendencies and military technologies into consideration will be formed in this field in time.

## References


[1] RESPERGER I., TÚRI V.: A terrorizmus és az aszimmetrikus hadviselés pszichológiai aspektusai. *Repüléstudományi Közlemények*, 2 (2010), 1–16.

[2] SOMFAI B.: *Háború és béke a Katolikus Egyház tanításának fényében.* Szeged, 1992. http://web.295.ca/gondolkodo/talalkozo/irasok/Somfai1HU04.html (Downloaded: 10 04 2017).

[3] *Bundeswehr und Kampfdrohnen. Deutschlands volle Drohnung.* www.taz.de/!126091/ (Downloaded: 26 05 2014).

[4] *Dzsihád = Szent háború?* Iszlam.com. http://iszlam.com/iszlam-az-elet-vallasa/iszlam-alapismeretek/item/54-dzsihad-szent-haboru (Downloaded: 03 06 2014)

[5] FODOR P.: A dzsihád íze: A szent háború az iszlámban és a 14–17. századi Oszmán Birodalomban. *Historia*, 30 (2008).

[6] SMITHER, L. E.: *Rethinking Constantine History, Theology, and Legacy.* Eugene, OR: Pickwick, 2014.

[7] *The Canons to Sylvester from the Council of Arles* (A.D. 314). www.fourthcentury.com/arles-314-canons-to-sylvester/ (Downloaded: 09 05 2017).

[8] HARNACK, A.: *Militia Christi: Die christliche Religion und der Soldatenstand in den ersten drei Jahrhunderten.* Tübingen: J.C.B. Mohr (Paul Siebeck), 1905.

[9] LECLERCQ, H., HEFELE, K., MICHEL, A.: *Histoire des conciles d'après les documents originaux*. Paris: Librairie Letouzey et Ané, 1952.

[10] MARCUS, A. M.: Saint Augustine's Views on the "Just War". In. SHEILS, W. J. (Ed.): *The Church and War.* Hoboken: Blackwell, 1983.

[11] FRUSSEL, F.: *The Just War in the Middle Ages.* Cambridge: Cambridge University Press, 1975.

[12] SZIGETI P.: *A nemzetközi jog és az igazságos háború eszméjének fejlődése.* www.ajk.elte.hu/file/SzigetiPeter-NemzetkoziJog.pdf (Downloaded: 26 05 2014).

[13] MÜHL, B.: Faszination Dschihad von Sinnleere und Todesliebe: Von Sinnleere und Todesliebe. *Communio*, 46 (2017), 142–146.

[14] MARROU, H.: *Christiana tempora: Mélanges d'histoire, d'archéologie, d'épigraphie et de patristique.* Collection de l'École française de Rome, 35. Roma: École française de Rome, 1978.

[15] The German Bishops*: Soldiers as Servants of Peace: Statement on the Status and Tasks*

*of Soldiers in the Federal Armed Forces.* Bonn: Secretariat of the German Bishops' Conference, 2006, 6.

[16] The Bureau of Investigative Journalism, 14. 04. 2014. *Drones Podcast: An Ethics Special.* www.thebureauinvestigates.com/stories/2014-04-14/drones-podcast-an-ethics-special (Downloaded: 09 05 2017).

[17] DUDÁS Z., RESTÁS Á.: Nemzetközi példák az UAV repülés emberi tényezőit érintő jogi szabályozásra az RPAS 2012 konferencia tapasztalatai alapján: Kockázatkezelési elvek megvalósulása a szabályozásban. *Repüléstudományi közlemények,* 24 3 (2012), 7–10. www.repulestudomany.hu/folyoirat/2012_3/2012-3-01-Dudas_Z-Restas_A.pdf (Downloaded: 20 05 2014).

[18] WILLS, G.: What is a Just War? Arguing About War by Michael Walzer. *New York Review of Books*, 51 18 (2004). www.nybooks.com/issues/2004/11/18/ (Downloaded: 20 05 2014).

[19] ROMÁSZ A.: WikiLeaks: Több mint százezer civil áldozat. *Kitekinto.hu,* 26. 10. 2010. http://kitekinto.hu/archivum.php?kulcsszo=Rom%C3%A1sz%20Andrea&szerzo=1#.U5ldLXY7jXQ (Downloaded 12 06 2014).

[20] Hány civil áldozata van a drónoknak? *Kitekinto.hu*, 31. 10. 2013. http://kitekinto.hu/europa/2013/10/31/hany_civil_aldozata_van_a_dronoknak/ (Downloaded 02 06 2014).

[21] SHIMA, T., RASMUSSEN, S.: *UAV Cooperative Decision and Control.* Philadelphia: Society for Industrial and Applied Mathematics, 2009.

[22] World Churches Condemn Use of Drones. *Independent Catholic News*, 13. 02. 2014. www.indcatholicnews.com/news.php?viewStory=24156 (Downloaded: 10 06 2014).

[23] VARGA A. F.: A drónok mint a kockázatmentes hadviselés eszközei. *Hadtudományi Szemle*, 6 2 (2013), 44–58.

[24] LEVERINGHAUS, A.: *What's so Bad About the Killer Robots?* www.surrey.ac.uk/politics/files/cii/Leveringhaus_Surrey%20presentation.pdf (Downloaded: 15 05 2014).

[25] BASTIAN, B.: Roboter am Abzug: Sind Soldaten ersetzbar? *Auftrag – Gemeinschaft Katholischer Soldaten*, 53 (2013).

[26] ARKIN, C. R.: Vollautonome letale Waffensysteme und Kollateralopfer. *Ethik und Militär*, 1 (2014), 3–12.

[27] GOOSE, S.: Die Notwendigkeit eines präventiven Verbots vollautonomer Waffen. *Ethik und Militär,* 1 (2014), 13–22.

[28] HARAI, D.: *Érték, teljesítmény, siker: Tanulmányok, esszék a katonapedagógia, a katonai antropológia köréből.* Budapest: Zrínyi Kiadó, 2013.

[29] FIEDERSDORF, C.: Distant Death: The Case for a Moratorium on Drone Strikes. *The Atlantic*, 14. 11. 2013. www.theatlantic.com/politics/archive/2013/11/distant-death-the-case-for-a-moratorium-on-drone-strikes/281471/ (Downloaded: 15 05 2014).

[30] *Just War Doctrine.* www.catholicleague.org/just-war-doctrine/ (Downloaded: 10 06 2014).

[31] CSENGERI J.: A dél-szláv légi háború: A NATO légi háborúja a dél-szláv válság megoldása érdekében 2. *Repüléstudományi Közlemények,* 25 1 (2013), 126–133.

[32] STRAWSER, B. J.: Moral Predators: The Duty to Employ Uninhabited Aerial Vehicles. *Journal of Military Ethics*, 9 (2010) 343–344. DOI: https://doi.org/10.1080/15027570.2010.536403

[33] *Catechism of the Catholic Church.*

[34] VÁNYA L.: Hogyan védekezzünk a drónok ellen? *Repüléstudományi Közlemények*, 25 2 (2013), 255–261.

[35] Terjednek a drónok: Visszaüthet a megelőző csapás gyakorlata. *Háború Művészete*, 07. 11. 2011. www.haborumuveszete.hu/rovatok/fegyverek/repulok/terjednek_a_dronok_visszauthet_a_megelozo_csapas_gyakorlata/ (Downloaded: 17 05 2014).
[36] SINGER, P. W.: *Wired For War: The Robotics Revolution and Conflict in the 21st Century.* London: Penguin Press, 2009.
[37] *II. Lateran Council.*
[38] Ördögi szerszám Isten szolgálatában. *Tudtad.com*, 25. 04. 2014. www.tudtad.com/2014/04/ordogi-szerszam-isten-szolgalataban.html (Downloaded: 28 05 2014).
[39] ERDŐ P.: Az íjászok és hajítógép-kezelők büntetése: Adalékok a kánonjogi esetmegoldás módszeréhez a kései középkorban. *Magyar Sion*, 2 (2008) 23–58.
[40] SOMFAI B.: *Az Amerikai Püspöki Konferencia pásztorlevele a békéről.* http://tarsadalomformalas.kife.hu/az-amerikai-puspoki-kar-pasztorleve-a-bekerol/ (Downloaded: 12 06 2015).
[41] Pope JOHN PAUL II.: Messagio ai diplomati. *L'Osservatore Romano.* 05. 01. 1988.
[42] National Conference of Catholic Bishops: *The Challenge of Peace: God's Promise and Our Response, a Pastoral Letter on War and Peace*. Washington. NCCB, 1983. www.usccb.org/issues-and-action/human-life-and-dignity/war-and-peace/nuclear-weapons/upload/statement-the-challenge-of-peace-1983-05-03.pdf (Downloaded: 12 06 2014).
[43] *Catechism of the Catholic Church.*
[44] Pope PAUL VI: *Pastoral Constitution on the Church in the Modern World. Gaudium et spes.* Vatican: Second Vatican Council, 1965. www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651207_gaudium-et-spes_en.html (Downloaded: 12 06 2014).
[45] Pope JOHN PAUL II: *Message of His Holiness Pope John Paul II for the Celebration of The World Day of Peace.* 01. 01. 2000. http://w2.vatican.va/content/john-paul-ii/en/messages/peace/documents/hf_jp-ii_mes_08121999_xxxiii-world-day-for-peace.html http://tarsadalomformalas.kife.hu/az-amerikai-puspoki-kar-pasztorleve-a-bekerol/ (Downloaded: 12 06 2017).
[46] FIEDERSDORF, C.: The Holy See: Lethal Drones Pose Urgent Ethical Issues. *The Atlantic*, 25. 11. 2013. www.theatlantic.com/international/archive/2013/11/the-holy-see-lethal-drones-pose-urgent-ethical-issues/281794/ (Downloaded: 15 05 2014).
[47] GERHARD, A. von: Streit um Kampfdrohnen: Die positionen der beiden grossen Kirchen. *Auftrag – Gemeinschaft Katholischer Soldaten*, 53 (2013), 9–10.
[48] HEVERKAMP, C.: Militärbischof: Verteidignugsminister sollte Einsatz von Drohnen „hochkritisch prüfen". *Neue Osnabrücker Zeitung*, 2012. 08. 31.
[49] WIEGOLD, T.: *Katholische Bischöfe fordern ethische Diskussion über bewaffnete Drohnen.* 05. 02. 2013. http://augengeradeaus.net/2013/02/katholische-bischofe-fordern-ethische-diskussion-uber-bewaffnete-drohnen/ (Downloaded: 24 05 2014).
[50] BUCHSTEINER, R.: Umstrittene Aufrüstung, Bundeswehr will Kapfdrohnen anschaffen: Kritik von Opposition und Kirchen. *Ruhr Nachritten*, 2013. 01. 26.
[51] DARLING, A.: *Catholics See Moral Complications in Drone Usage.* www.catholicnewsagency.com/news/catholics-see-moral-complications-in-drone-usage/ (Downloaded: 05 26 2014).

[52] STAFFORD, S. C.: I Met a 16-Year-Old Kid. 3 Days Later Obama Killed Him. *The Guardian*, 06. 14. 2012. www.alternet.org/story/155723/i_met_a_16-year-old_kid._3_days_later_obama_killed_him?page=entire (Downloaded: 26 05 2014).

[53] Department of Justice, Peace and Human Development, Office of International Justice and Peace: *Background on Armed Drones.* January 2014. www.usccb.org/issues-and-action/human-life-and-dignity/war-and-peace/upload/background-on-armed-drones-2014-01.pdf (Downloaded: 28 05 2016).

[54] ODDIE, W.: *A Moral Theologian Defends the 'Surgical' Use of Drones to Assassinate Terrorist Leaders: But is Their Use Really Intended to Minimise Civilian Deaths?* www.catholicherald.co.uk/commentandblogs/2012/11/20/a-moral-theologian-defends-the-surgical-use-of-drones-to-assassinate-terrorist-leaders-but-is-their-use-really-intended-to-minimise-civilian-deaths/ (Downloaded: 28 05 2016).

[55] Gutes töten? *Katolisch.de*, 01. 23. 2013. www.katholisch.de/de/katholisch/themen/politik/130122_drohnen_bundeswehr_krieg.php (Downloaded: 28 05 2014).

AARMS Vol. 16, No. 2 (2017) 33–39. **10.32565/aarms.2017.2.3**

# Managerial Responsibility and Efficiency in Public Service (Competency-Based Solutions)

Szilvia SZABÓ[1]

*"The key of being an effective leader is*
*to be ableto influence people without exercising power."*
(Thomas Gordon)

*This study aims to deal with a current and undoubtedly unique theme by examining the scope of leader responsibilities and effectiveness in a unique labour market environment following a concept which is still new in our country. The basic thesis of this study is that the responsibility of leaders is highly significant in achieving organizational efficiency even in public administration institutions, and additionally the terms of natural and developer leaders will be explained from this aspect as well. Furthermore, this study wants to define the importance of emotional intelligence and emotional competence in managerial work, particularly with regard to the practice of public administration. In relation to this topic the study also aims to formulate proposals for the behaviour of leaders with "creative vision", and it summarizes those competency-based methods and good practices that can support leader activities efficiently, effectively and with resource saving.*
**Keywords:** *leadership management, civil service, public administration, emotional intelligence and competence, leader with vision, best practices, flow, balance between life and work, coaching*

## Leader Responsibility and Effectiveness

Leadership is first of all an effect. It is an effect on the environment and an effect on those employees and managers with whom the appointed leader works with directly or indirectly. Therefore, his or her behaviour affects all, those who share his or her goals and mission both at organizational and individual levels as well. Therefore, it is the responsibility of the leader to create a vision and be able to find the best ways to motivate others for effective actions. [1: 37] In case someone becomes a leader, it is of primary importance to be accepted and trusted by others, since he/she will be able to speak about goals, daily tasks and common vision as a leader based on this aforementioned acceptance. Sufficient experience, preparedness and skills are necessary for executive leadership, because the task is not only to fill in a particular position, but also to lead a team's life with full responsibility. [2]

"The Myth Nr. 1 of leadership is that it exists." [3: 782] Accordingly, the presence of a responsible and effective leadership has a very positive and progressive impact on any organizational culture. It can be particularly important during times when there is a crisis or a change in the life of the organization. It is felt exponentially in the life of public adminis-

[1] Ph.D., associate professor, National University of Public Service, Faculty of Science of Public Governance and Administration; e-mail: szabo.szilvia@uni-nke.hu.

tration, since due to the nature of the organizational culture it means a different motivational media for its employees. [4] The mission consciousness of leaders extends beyond carrying out all tasks effectively and well, since they have special responsibility in the organization's human resource management during the process of achieving the objectives. [5]

In the organizations of public administration, the base of success and effectiveness lies—in addition to professional knowledge—in leader behaviour and competencies. These are being the following:

1. One of the pillars of leadership is a process by which a leader influences the behaviour of the members of the organization with his/her own behaviour in order to achieve a goal and taking into account several aspects. Therefore, psychological and professional maturity are key elements for success, while leader motivations [6: 183] [6: 222] [7: 11] [7: 19] that stimulate leaders to fill certain roles [5: 178] are also very important.
2. The other pillar of effective and efficient leadership is the existence of those leader competencies, which support such leadership practices that are able to create visions and manage human resources effectively. [5: 179]

## The Competency Model of the "Natural" Leader in Public Administration

Leaders have a special position in the social structure. Nobody was born for any positions, but certain genetic and biological conditions are needed to develop leader behaviour with fairly complex qualities and skills. Becoming a leader is a result of a long learning-developmental process. Leadership has some so-called general laws (leadership and organization science, management methodology), which should prevail at all management positions. It has long been proven that there are no "born leaders", but "being a leader" has some genetic and biological basis, on which the characteristics of "the leader's personality" will be simply based during personal development. Therefore, the leader characteristics of the individual function as a specific and complex system that is called leadership competencies. [8: 17] [8: 20]

The term natural leader is still quite unknown in the practice of public administration, although its efficiency is proven by market practices. The internationally acknowledged book, *Natural Leader* by Daniel Goleman, Richard Boyatzis and Annie McKee [9] was published and translated into Hungarian more than ten years ago. According to the authors "the previous leader ideal was functional minded and did not care much about personal and emotional aspects and looked at people only as replaceable elements." [10: 44] The main principle of natural leadership is therefore formulated saying that the emotional effect exerted by leaders should appear in the relationship of the leader and "the follower." [10: 44]

Awareness of the above-mentioned, it has also become commonplace in practice that professional life explains the terms of success and efficiency with a new joint competency. It is called emotional competency (EC), of which joint competency is a learned skill based on emotional intelligence (EQ), resulting in especially outstanding work performance. [11: 41] Of course, the high EQ itself does not guarantee that the individual actually learns the important emotional competencies necessary for practicing leadership, but he/she has excellent chances to do so. Therefore, the new joint competency has a significant role during the managerial work already in the process of becoming a leader, since the competency model

of the natural leader can be described by the joint leadership competency characteristic of the emotionally intelligent leader.

Goleman coined the "framework," in which he identified a total of 25 "emotional competencies" along five dimensions. He determined two basic categories, such as, "personal competency" and "social competency." [12: 58] [12: 61] This is of great importance in leadership, because the leader as a human (human capital) and as a separate subject takes part in the interpersonal (social) relationships.

*Table 1. Goleman: Emotional Competency Model. [12: 58] [12: 61]*

| **Personal competencies** | **Social competencies** |
|---|---|
| **Self-awareness** | **Empathy** |
| – emotional awareness | – understanding others |
| – accurate self-assessment | – development of others |
| – self-confidence | – client-centred |
| **Self-regulation** | – evaluation of diversity |
| – self-control | – political awareness |
| – reliability | **Social Skills** |
| – conscientiousness | – influence |
| – adaptation | – communication |
| – innovation | – conflict resolution |
| **Motivation** | – management |
| – achievement motivation | – catalyst for change |
| – commitment | – networking |
| | – cooperation |
| | – team spirit |

Based on these facts the EC is closer to practical life than the EQ, because it is primarily such a personality trait that leads to outstanding work. The EQ is the general characteristics of individuals, while the EC is more than that, because it is the ensemble of the job-specific skills. Both develop with age, knowledge and experience, so they are less dependent on genetic conditions or childhood experiences, than the traditionally used intelligence quotient. According to all these information, medium and high labour force—including the leader—differs from each other in their emotional competence levels.

In case of responsible and efficient leadership roles beyond professional and methodological competencies, the existence of personal and social competencies is of great importance as well. Using these competencies would have particular significance in the closed, hierarchical, bureaucratic and often inflexible organizational culture and practice of public administration. Those leaders can best adapt to the constantly changing world of work, which are emotionally competent and able to convey this toward their subordinates. This means that they can easily develop themselves, and quickly adapt to organizational and cultural changes resulting from innovations, which is also a benchmark for subordinates. These leaders have an open and people-centred attitude toward workers, and they do their tasks by providing support and caring leadership behaviour. All of these means for the organization measured results in efficiency and performance.

## Leader with Vision

We can see that the issue of leadership effectiveness and responsible behaviour is much more complex and goes beyond whether a person is professionally competent to fill the position. Considering not only the present behaviour and roles, but also the importance of the new leadership competencies of a leader, we can say that leaders being responsible for the organization have to be "leaders with vision." [3: 782] To meet this expectation a leadership attitude is needed that we can characterize with five basic joint competencies, based on the Goleman-model. [5]

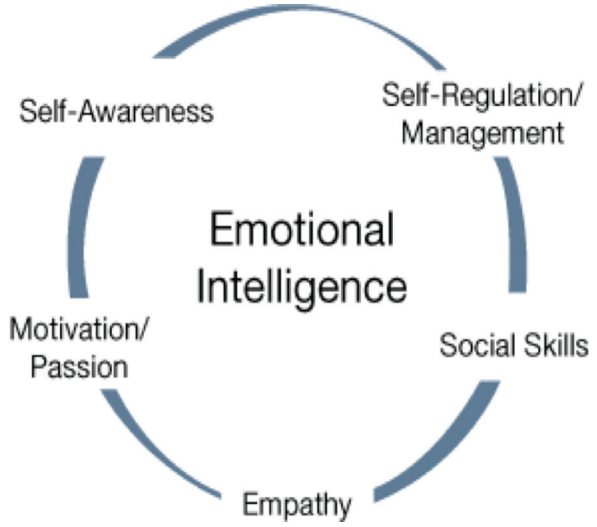


*Figure 1. Joint competencies of the leader with vision.* [5] [3: 782]

1. Empathy: these leaders are able to provide long-term motivation for people working in the organization, they understand emotions and feelings and take into account the point of view of others.
2. Motivation/Passion: leaders who are in possession of this competency are able to convey important organizational goals as values to be followed for the subordinates by using this motivation.
3. Self-Awareness: these leaders will be only successful and efficient, if they are able to define their own leader behaviour and goals. Namely they are familiar with the leadership tools and techniques available and able to use them, according to the needs of their subordinates.
4. Self-Regulation/Management: exercising power does not mean self-serving and unlimited managerial work, but a well-controlled leadership process.
5. Social Skills – Openness: these leaders can be only creditable, if they also believe in organizational ideas. In case their commitment and sense of purpose are not deep enough or only a pretence, others will quickly notice and this leads to distrust among subordinates. The key to effectiveness is the free and credible flow of knowledge and information, but this can be only realized in a trusting, honest and open atmosphere.

in such atmosphere the employees feel needed and motivated, and that is why they are able to work the most efficiently. A lot of leaders still believe that keeping information and knowledge for themselves increases their power. Responsible leaders understand that sharing knowledge makes them truly successful.

## Good Practices–Competency Based Solutions

The new leader attitude needs to find new solutions as well (besides the well-known and functioning HR tools) in order to increase efficiency and effectiveness. The realization lies in such innovative competency solutions which have to be added to the leadership methodology and thus to the human organizational strategy. Such solutions could be considered as priorities as inter alia life–work balance, creating conscious experience flow or coaching-oriented leadership and organization design. [13] It is indubitable that the listed solutions are obviously based on the "philosophy of a liveable workplace."

The life–work balance is of major importance in terms of the caring organizational culture as well. Its knowledge and conscious use are essential for today's leaders working in public administration, [5: 141] since employees spend most of their time at their workplaces. Creating balance is the individual's responsibility, but leaders in charge also have a key role in creating sustainable balance between workload and private life, because it provides increased capacity and efficiency if individuals as private persons and as employees experience flow within the organizational culture, since they are able to enjoy their jobs and workplaces as they are in accordance with their abilities and qualifications. Activities implemented under favourable circumstances provide protection for balanced and healthy employees. Mutual respect and respect for each other's personality are keeping forces, which develop the organization and the work itself as well. Confrontations, intrigues, fighting for positions, unresolved conflicts only make life difficult and lead sooner or later to stress, loss of efficiency and mental and physical health deterioration. [5: 144] [13: 195]

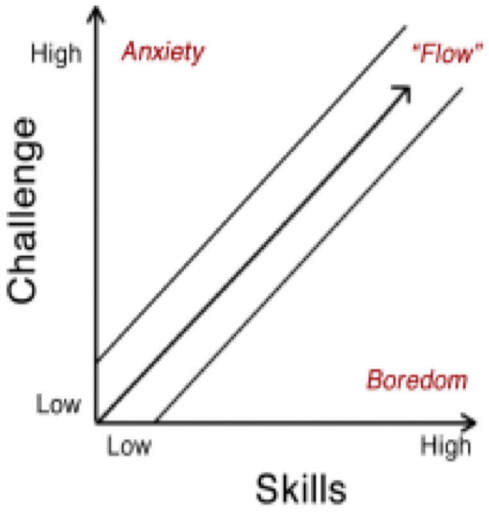


*Figure 2. Flow.* [14]

The Flow experience is a feature of the advanced labour market situation of the 21st century, but unfortunately it is rarely known in Hungary. [14: 19] [14: 24] It refers to a conscious state, where the individual is able to focus maximally in order to achieve increased performance. The earmark of work flow is if employees can fulfill their duties in a motivating and trusting atmosphere without stress and excessive effort. Therefore, developing and maintaining such a working atmosphere should be the primary role of leaders.

The coaching-oriented organizational climate and/or coaching-oriented leadership behaviour ensure a supportive atmosphere for work–life balance and flow. It is characteristic for this approach that work performance takes place in an atmosphere of trust that is based on clear rules and processes with the support of a natural or developer leader. For this not only the existence of personal and social joint competency of leaders is necessary, but they also have to strengthen the empathetic, supportive, helping and encouraging behaviour from among the roles of leaders with vision. In such organizational atmosphere both the employer's and the employee's roles change as well, since the employees become interested, therefore they are able to fulfill their tasks with long-term effectiveness in a highly motivating atmosphere.

## Conclusions

It has become commonplace to say that members—especially leaders—of public administration organizations face new challenges because of accelerated social changes and transformation processes of values. It is a fact that the issue of leadership efficiency and effectiveness requires a new approach in the practice of organizations. The way of thinking and practice being introduced in this study show new perspectives for leaders working in public administration, but a new opened and recipient attitude is necessary for acquiring this approach. Based on studies of recent years, [4] [5] there are some forward-looking initiatives in public administration, but there is still a long way to go to achieve a complete paradigm shift.

## References

[1] ENDREI J.: *Kemény üzenetek.* Győr: Endrei könyvek Kiadó, 2011.
[2] SZABÓ Sz.: Vezetői felelősség és eredményesség a közszolgálat emberierőforrás-gazdálkodásában. *HR & Munkajog*, 6 11–12 (2015), 39–43.
[3] KLEIN, S., KLEIN, B.: *A szervezet lelke.* Budapest: Edge 2000 Kiadó, 2006.
[4] SZAKÁCS G.: *A közszolgálati szervezetek jellemzői és az emberierőforrás-gazdálkodás.* (ÁROP – 2.2.17. Új közszolgálati életpálya, Emberierőforrás-gazdálkodás és közszolgálati életpálya-kutatás, „Közszolgálati humán tükör 2013" kutatás.) Budapest: Nemzeti Közszolgálati Egyetem, 2014.
[5] SZABÓ Sz., SZAKÁCS G. (szerk.): *Közszolgálati HR-menedzsment.* Budapest: Nemzeti Közszolgálati Egyetem, 2015.
[6] BAKACSI Gy.: *Szervezeti magatartás és vezetés.* Budapest: KJK-Kerszöv Kiadó, 2001.
[7] DOBÁK M.: *Szervezeti formák és vezetés.* Budapest: KJK-Kerszöv Kiadó, 2001.
[8] SZABÓ Sz.: *A vezetői kompetenciafejlesztés tapasztalatai és lehetőségei egyes rendvédelmi szervek hivatásos állománya körében.* PhD-tézisek. Budapest: Zrínyi Miklós Nemzetvédelmi Egyetem, 2008.

[9] GOLEMAN, D., BOYATZIS, R., McKEE, A.: *Primal Leadership.* Boston: Harvard Business School Press, 1992.
[10] GOLEMAN, D., BOYATZIS, R., McKEE, A.: *A természetes vezető: Az érzelmi intelligencia hatalma.* (BALLÉR P. ford.). Budapest: Vince Kiadó, 2003.
[11] SZABÓ Sz.: *Kompetenciaalapú emberierőforrás-gazdálkodás.* (ÁROP – 2.2.21: Tudásalapú közszolgálati előmenetel.) Budapest: Nemzeti Közszolgálati Egyetem, 2014.
[12] GOLEMAN, D.: *Érzelmi intelligencia a munkahelyen.* Budapest: Edge 2000 Kiadó, 2004.
[13] SZABÓ Sz.: Life–work balance az érzelmi kompetencia mentén: Egyéni és szervezeti aspektusok. *Tudásmenedzsment,* 14 1 (2013) (special issue), 189–196.
[14] CSÍKSZENTMIHÁLYI M.: *Flow: Az áramlat (a tökéletes élmény pszichológiája).* Budapest: Akadémiai Kiadó, 2001.

AARMS Vol. 16, No. 2 (2017) 41–65. **10.32565/aarms.2017.2.4**

# The Relationship Between the Tasks Aimed at the Prevention of Extraordinary Incidents, the Preparation for the Mitigation of their Consequences and the System of Protection[1]

Júlia HORNYACSEK[2]

*Extraordinary incidents, including disasters, usually cause significant damage to nature, the built environment and human lives. An approach, accepted by experts, is gaining more and more ground in the field of protection and research: it is not enough to respond to incidents following their occurrence, but great attention should be paid to prevent them, and authorities should be fully prepared to mitigate their consequences in due time. What does the preparation for extraordinary incidents mean, where is the place of these tasks in the system of protection, what are the tasks of the prevention phase, and how can the preparation activity be more efficient? In the article the author analyses the complex system of protection/defence, its subsystems, and then she demonstrates the place of disaster management and its subsystems in this environment. She examines the tasks of preventative protection against threat factors, with special regards to the tasks of the prevention/preparation phase. In the light of Hungarian and international prevention practice, she shows the up-to-date methods and tools with the help of several examples.*

**Keywords:** *complex system of protection, disaster management, hazards, prevention, preparation, protection, rehabilitation, flood, wild fires*

## Introduction

The pursuit of security, the protection of human life and essential material goods has been a part of community life ever since the beginning of humanity. The subject not only enjoys the priority of professionals, but also of scientists, so the various aspects of protection have been focused on by researchers, and also the possibilities of increasing the efficiency of implementation. A series of papers examines this special field dealing with the "natural study" of situations resulting from the emergence of extraordinary incidents, the types and features of damage, but also the implementation of the protection of the population and the establishment and operation of organizations responsible for the implementation as well. These writings approach the question differently depending on what purpose they were made for. In them, however, there is a perceptible similarity in that individual sectors draw their

[1] The work was created in commission of the National University of Public Service under the priority project PACSDOP-2.1.2-CCHOP-15-2016-00001 titled "Public Service Development Establishing Good Governance" in the Miklós Zrínyi Habilitation Program.

[2] Ph.D., associate professor, National University of Public Service, Faculty of Military Sciences and Officer Training; e-mail: hornyacsek.julia@uni-nke.hu; ORCID code: 8695713152-13391.

conclusions and make their upgrading proposals mostly based on their own professional filters, their own terminology and profession-specific interpretation.

The various hazard factors—including natural and man-made disasters—are inherent in our times. According to UN data, between 2005 and 2015, more than 700,000 people were killed, the number of injured was over 1.4 million and about 23 million became homeless as a result of disasters. Over the past period, in overall, more than 1.5 billion people were affected by disasters. The total economic loss exceeded 1.3 trillion USD in this period. Between 2008 and 2012, 144 million people were forced to leave their homes as a result of disasters.[3] [1: 10]

Nowadays, with the widening range of hazard factors, with the change in the nature and devastating effects of disasters, it is necessary to analyse all forms of prevention, meaning activities aimed at avoidance and preventing escalation. This research has not only aimed at identifying prevention tasks, finding results serving empirics, but also the theoretical investigation of the place of the prevention/preparation group of tasks in the protection system and the correlation of its system elements. Planning my research, I assumed that disaster management is an integral part of today's complex system of protection; its structure, subsystems show similarity therewith; there are identical phenomena in multiple places. I have also assumed that the fundamental areas of hazard factors and the prevention of disasters also show significant correlation, and their implementation at national, county and local levels are mutually interrelated.

During my research, I studied Hungarian and international literature with the method of document analysis, compared the subsystems of protection/defence system and their elements with the components of the system of disaster management. I have analysed the guidelines of international organizations regarding protection, the internal regulators of entities involved in disaster management and other protection organizations, as well as relevant legislation, furthermore, the disaster management activities of settlements. I conducted interviews with Hungarian defence and protection specialists; analysed some of the foreign examples of prevention and preparation; looked for analogies, I used the experience of my colleagues and my own professional practice gained in the protection/defence sector.

In order to identify and analyse the major cornerstones of the prevention of extraordinary incidents, we must look at factors influencing our security from this aspect and the protection system set up for security, define its subsystems and find a place for the tasks of prevention and preparation in them.

## Hazard Factors and the Responses to Them

The design of effective protection against hazards is based on Hungary's vulnerability assessment. It determines the risk of occurrence and executes it along a planned, comprehensive strategy, and the toolbox for its implementation is the security policy used as the starting point.

The aim of security policy is to identify the fundamental values and interests in a given country. All of them in Hungary were laid down in the National Security Strategies. [2] [3] The definition of activities aimed at preventing extraordinary incidents affecting the safety

[3] The United Nations has already devoted considerable resources to the fight against disasters and several actions and forums have addressed effective protection, such as the Framework for Action 2005–2015, the International Decade for Natural Disaster Reduction of 1989, the Yokohama Strategy for a Safer World, etc.

of the country and the population is only possible on the basis of identifying the hazard factors. This can be done from multiple sources, so based on legislation, Hungarian hazard analyses, publications made from research in the field of protection/defence, as well as the analysis of basic security policy papers, etc.[4] The identification is best done based on the National Security Strategy that identifies hazards. (Figure 1, Column 1) These factors have a different risk of occurrence, endangering our environment in a variety of ways. The protection against them has a wide range of activities, efficiency and effectiveness, which, as a result of the Hungarian protection system, also contributes to our participation in international organizations, collective protection/defence co-operation. The current National Security Strategy (NSS)—besides the list of hazard factors—mentions protection/defence activities as means of preventing them. (Table 1, Column 2) [3: Items 24–38]

*Table 1. Hazard factors and the preventive protection activities against them according to NSS. (3: Items 24–38)*

| **1. Hazard factors** | **2. Preventive protection/defence actions against them** |
|---|---|
| Regional conflicts, extremism | Strengthen security policy relations based on mutual interests; action to prevent crises, help stabilization. |
| Terrorism | Participate in international actions against terrorism; develop an international counterterrorist organization system; prepare for the emergency. |
| Proliferation of weapons of mass destruction and their means of delivery | Further strengthen the international demobilization process; assist in armaments control, multilateral diplomacy. |
| Security of financial systems and processes | No solution is proposed because it interprets public debt as vulnerability. |
| Vulnerability of information technology systems | Risk assessment, proper operation of information and communication systems, government backbone networks. |
| Vulnerability of energy systems and supply | Protection of the operation of the national critical infrastructure. |
| Global climate and environment change | Build an integrated regional and European internal energy market; find new purchasing and transit opportunities; promote renewable energies. |
| The effects of the weather becoming increasingly more extreme | Increase flood and inland water protection safety, eliminate health risks and epidemics. |
| Exhaustion of raw materials and natural resources | Preserve natural resources and values. |
| Problems of getting healthy drinking water | Eliminate health risks, epidemics; maintain food and water security; reduce pollution in the waters, accumulated in the soil and subsurface. |

[4] In a previous study I examined their content, relationships and the anomalies in the grouping of hazard factors, so I will not elaborate it in detail. [4]

| 1. Hazard factors | 2. Preventive protection/defence actions against them |
|---|---|
| Food problems | Eliminate health risks, epidemics; maintain food and water security; reduce pollution in the waters, accumulated in the soil and subsurface. |
| Natural and industrial disasters | Increase nuclear safety and protection in Hungary; bilateral exchange of information and cooperation with neighbouring countries; extend the licensing and control activities; adequately prepare/train professional disaster management entities, as well as other bodies involved in disaster management. |
| Arms, drugs and human trafficking | Close cooperation of criminal and law enforcement agencies, justice and national security services, cooperation with EU bodies; increase the efficiency of law enforcement; improve the technical level and qualification of the personnel of the relevant entities. |
| Organized crime | Reconnoitre the property background of groups; prevent the legalization of their funds; develop criminal and prosecutorial legislation; develop legal regulation preventing the influence of organized criminal groups. |
| Migration | Effective implementation of the enhanced protection of external borders; improve the cooperation of contributors in the implementation of the Hungarian law enforcement and migration tasks. |
| Appearance of extreme groups | Consolidate the use of force monopoly of the state; more effective management of social and societal problems. |

The preventive measures listed in the table are the first steps of prevention and preparation. The National Security Strategy—completed as a result of the security policy activity (Figure 1)—has provided the foundation for the creation of new protection/defence organizations and the adaption of the existing ones to the new security environments; they are the basics of safeguarding our security and achieving adequate protection/defence.[5] The protection strategy is the protection system, established in a way fixed in legislation, adapting to the stipulations described here, and the triple unity of organizations and assets operated to guarantee our protection.

[5] I interpret security here not as the absence of hazards, but as an adequate protection against them.

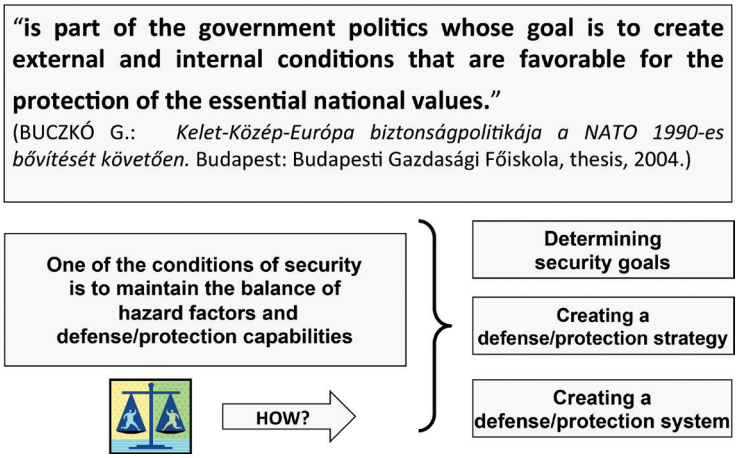


*Figure 1. Goals and tasks of security policy.* [5: 8]

There are some new hazard factors in addition to the earlier threats, but we also encounter specific variants of the traditional types as well. They have a wide range of effects, therefore, the protection/defence activity—such as the *prevention* and *preparation* task group, studied in this research—cannot be linked to a particular field of expertise, not even to the functioning of the complex system of protection/defence, because it goes far beyond: it is an all-societal task.

Effective protection presupposes the coordination of different systems performing activities in interaction with each other: in legislation and law enforcement, in the development of a protection/defence system and within the preparation; in the operation of different levels of protection/defence organizations and protection administration, as well as in the preparation of citizens and NGOs alike. I will outline its details later, under the heading *Preventive Protection*.

## Components and Special Features of the Protection System

It can be seen in Table 1 that from the tasks to be carried out in the interest of security, the examination of the definition of security objectives or goals is not relevant to the present study or the formation of the protection strategy, but the analysis of the Hungarian protection system and its features are important. I will analyse the relevant legislation and security policy documents based on this.

### *Components of the Protection/System*

The system of protection was developed in Hungary based on the principles of complexity and the comprehensive approach. [4: 107–109] In this context, the system of protection consists of distinguishable independent *elements* and *fields.* Beyond this, it has a peculiar *function.* (Figure 2)

The *elements* of the protection system is society itself, accepting and requiring the protection demands, public administration prepared for protection (in given case: protection administration), entities and institutions of the defence economy, civil protection, armed forces, law enforcement entities, other entities participating in defence and the contributing population. However, after the period following the appearance of the interpretation of sectoral security, the creators of the system have striven for complexity not only considering the structure, but also its intended function.

The basic *function* of the system is to be able to manage extraordinary incidents, may they be of any nature, and even in such cases to be able to ensure the functioning of the state and local government administration and vital systems, to create protection-targeted reserves, the country's and population's security is at stake, to prepare the population for the hazards and the protection against them, and to ensure the conditions for life.

Another responsibility is that the protection of the population and essential material assets be viable (civil protection task), the armed forces, law enforcement agencies (including the professional branch of disaster management) and other entities involved in defence be available. They should be well-prepared and deployable.

The *main fields* of the protection/defence system are the system tasks of armed defence and civil protection. The tasks of armed defence are implemented in case the need arises to defend the country through armed defence and in case of the development of crises of military character. The tasks of civil protection are implemented in case of disasters or if non-military type of crises appear.

**The complex system of protection/defense of Hungary**

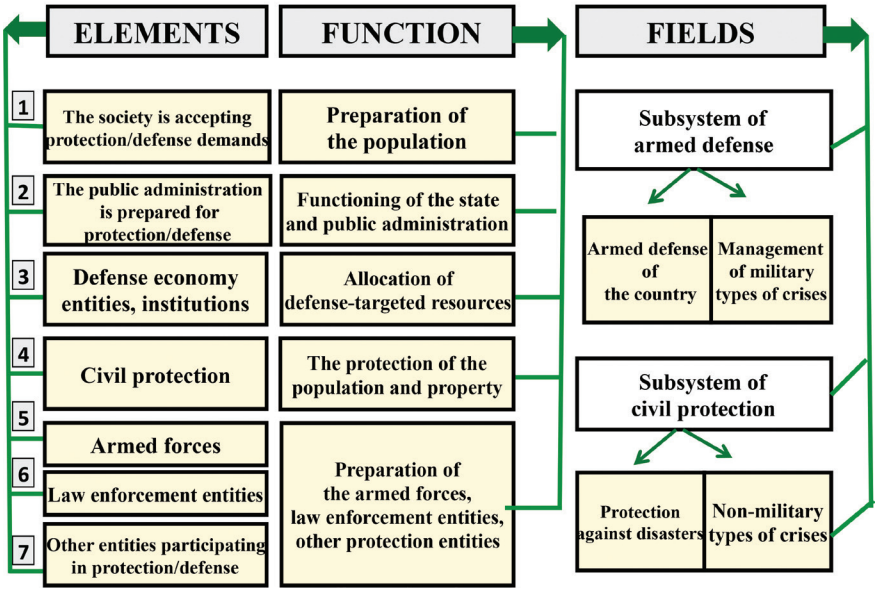


*Figure 2. Elements of the complex system of protection/defence of Hungary, its function and fields nowadays.*
(Created by the author.)

There is a question as to how these elements and the protection tasks are linked to each other, what the complexity of the system is, and what basic features it has.

## *The Systems Nature and the Subsystems of the Protection System*

The countries of Europe—with the disappearance of the bipolar world order—redrafted the security interests, objectives. Then security policy analysts and specialists in the protection sector took a "snapshot" of the hazard factors which are constantly monitored; these together formulated the possible trends.

Accordingly, the formulation of the expectations concerning the protection, the creation of the legal background and the change of existing system elements (subsystems), furthermore the establishment of new protection/defence organizations sector has taken place in Hungary.

## *Subsystems of the Complex System of Protection*

Analysing the structure of the system, it can be ascertained that it has subsystems that may be grouped, according to different aspects. By the nature of hazard factors and from the aspects of responses to them, we distinguish subsystems: the already mentioned *armed defence* and *civil protection.* However, analysing it from the angle of implementation, we can speak of *subsystems of tasks*, *organizations/institutions*, and *resources*. The subsystems of the protection system, their main elements are summarized in Figure 3. Let's examine them!

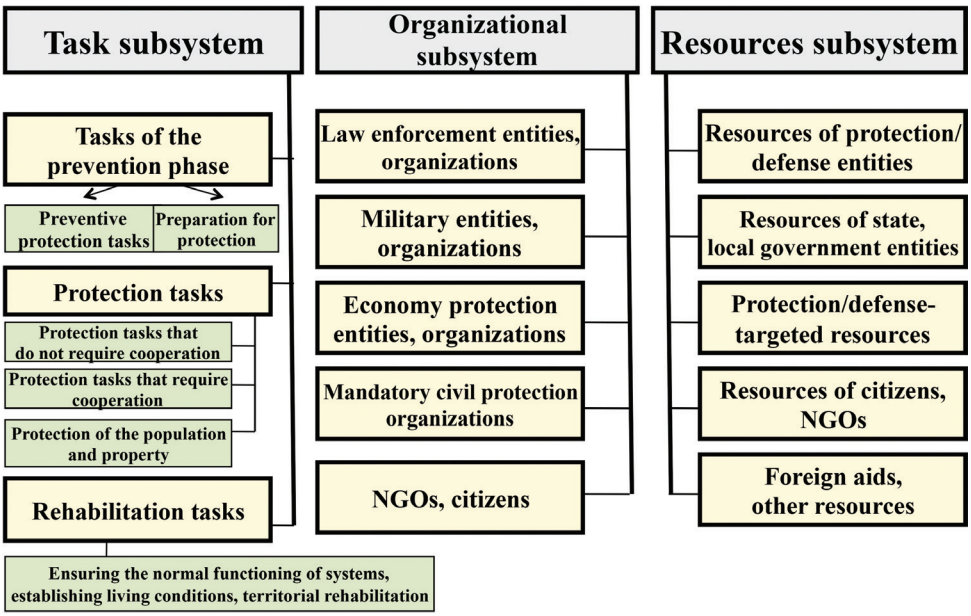


*Figure 3. Subsystems of the complex system of protection/defenceand their elements.*
(Created by the author.)

Analysing the *task subsystem* of the protection/defence system, it can be stated that it has several elements, such as prevention and preparation tasks, protection/damage mitigation tasks of an incident (independently from their nature), and after responding to an incident, the tasks aiming at ensuring rehabilitation and flawless operation. They basically depend on the sectors providing the environment of the protection/defence system, the geopolitical situation, the expectations necessary for performing alliance obligations, the hazard factors and their effects. The tasks are implemented in three phases: the phases of prevention, protection/response and rehabilitation.

- *Prevention phase:* the main group of tasks, which are implanted in order to be able to avoid a hazard, or to prevent its consequence(s) (prevention, avoidance tasks).
- *Protection/response phase:* the tasks are to be performed if (despite prevention) the effects of the hazard factors develop. We distinguish three main groups:
  1. The first group is made up of tasks that must be performed if the incident, due to its character, is such that it can be managed by the responsible protection/defence organization on its own, without the need for cooperation.
  2. The second group is characterized by the fact that they can only be resolved through the cooperation of organizations and responsible entities.
  3. The third group is made up of tasks aiming at the protection of the population and the essential material goods.
- The group *rehabilitation tasks* constitutes the third element of the task subsystem. It can be divided into three further categories: the tasks aiming at the normal functioning of the systems, sustaining the conditions for life and territorial rehabilitation.

Examining the *institutional/organizational subsystem* of the protection system, we may say that it has been designed in accordance with the security environment and is basically made up of home defence/military, law enforcement, civil protection, and economy protection entities, organizations. They carry out their duties in a tight context with the system of protection administration (e.g. disaster management, home defence administration).[6] The establishment of the protection system is a state responsibility; the organizational subsystem mainly consists of state entities and organizations. However, because the implementation of tasks is all-societal, NGOs, humanitarian organizations and citizens are involved in it as well.[7] Each element of the organizational subsystem, due to its purpose, has basic tasks, fixed in legislation, but additionally they contribute to the provision of the core tasks of other institutional elements and in the resolution of extraordinary incidents, too.[8]

Due to the systems approach, any changes in an element will have an effect on the other one.

---

[6] *Home defence administration:* "System of tasks and organizations forming a part of defence administration, within which entities established for the protection of the country, as well as public administration entities assigned to this task, as well as other entities, contributing to national defence perform the tasks stipulated in paragraph (3) of Section 1 of the Act on Home Defence on the training and preparation of entities defined for home defence, by the defence of the country and fulfilment of home defence obligations." [6: para 1 (b)]

[7] The participation of citizens may be voluntary, but may also be based on citizen's obligation, such as compulsory military service or civil protection obligation. [7: para 1 (3)]

[8] The basic function of the Hungarian Defence Forces is e.g. "the military defence of Hungary's independence, integrity and borders, the fulfilment of joint defence and peace-keeping tasks, originating in international treaties, and in harmony with the rules of international law, the performance of humanitarian activity." [8: Article 45 (1)] Beyond this, it participates as a cooperating entity, e.g. in fulfilling disaster management tasks as well. In detail see: [42] [43].

Examining the third component of the protection system, the *resources subsystem* can be ascertained that it is also composed of several sources, which are the following:

- own resources of entities, organizations participating in protection, including state, municipal entities,
- protection-targeted reserves, including citizens, NGOs,
- foreign aid and other resources.

Their application, the coordination of deployment and the allocation are coordinated by the Government and the protection committees, depending on the nature of the task and the activities necessary to restore normal life.

## *Features of the Protection System*

I will outline the general characteristics related to all elements of the protection system. Examining the protection documents and legislation related to this, the features may be summarized as below:

- Hungary is a member of the United Nations, NATO and EU and other international organizations and it assumes the values thereof. It adheres to and enforces the principles of the United Nations Charter, takes an active role in crisis management operations of international organizations, so the defence/protection system should also be able to contribute to these tasks.
- When the protection/defence system currently in place was designed, the hazard factors, the features of the existing entities and organizations, the operational and procedural rules emerging in the past, the financial resources of the country and the expectations of international alliances had to be considered.
- Main considerations of the formation of protection/defence as central procedural, control and system requirements should prevail.
- The legislation accurately stipulates the obligations, tasks, entities, organizations, powers and jurisdictions; the order of control, enforcement and cooperation, and the bearing of defence costs in the protection system.
- The subsystems of the system are self-contained, they themselves constitute a complex entirety, but integrate organically, each of which represents added value.
- The system is hierarchically structured, consisting of several subsystems that are subdivided into elements. They can be subdivided into additional "element-specific" groups.
- Some of the tasks in the system can be performed in the normal legal order, but there are cases that necessitate the activation of the defence administration system and the introduction of a state of special legal order.
- The implementation of protection tasks take place under the principle of subsidiarity and if that is inadequate, the principle of assistance and other elements of the system are activated. There is a fundamental expectation of concentrating and planning the use of resources.
- Depending on the nature of tasks, cooperation not only within organizations, but between each other. It has paramount importance that they know each other's work, organization, the order of operation, and their coordination.

– By today, sustainability and cost-effectiveness are gaining a momentum both in the formation, operation of the organizations and in the implementation of tasks, so prevention plays a prominent role in the system.

Their analysis by a scientific method, the investigation of the hazard factors and their polarization is timely due to the change in the recent period of public administration and the protection system. The extent of this article does not allow me to look at the activities that aim at avoiding all the above-mentioned factors, so I will emphasize the prevention of disasters and the preparation for their effects. (Table 1, Item 12: Natural and industrial disasters)

## Disaster Management Subsystems and Their Place and Role in the Complex System of Protection

Analysing the protection system demonstrated above, I have ascertained that the subsystems can be defined in several ways. Examining the nature of the tasks to be performed, the protection system can be divided into the subsystem of *armed defence* and *civil protection*.[9] (Figure 2) One of the areas of the subsystem of civil protection is the protection against disasters.

The prevention of disasters and the protection against their effects is an all-societal issue, stipulated by law, the implementation of which is done in a unified system of disaster management.[10] The questions arise: where is the disaster management in the complex system of protection? How is it built up? How are the disaster management tasks implemented?

### *The System and Subsystems of Disaster Management*

The tasks of the protection against disasters are implemented in the framework of disaster management,[11] which belongs to the civil protection subsystem. (Figure 4)

---

[9] In addition, there is an important task of *civil emergency planning.* Its aim is to decide how the armed forces should participate in solving the issue during civil emergencies or in case of war, and how civil forces should be involved in the protection of the population and property.

[10] The uniform system of disaster management is not identical with the professional disaster management entity, whose development became finalized and uniform by becoming state-owned and controlled, by concentrating the forces, assets and capacities, by making the fulfilment of tasks more efficient, because other elements and entities are also part thereof.

[11] Let us disregard the dispute going on for a long time in professional circles (in Hungarian literally "it is not possible to *protect a disaster*"—a dilemma in the Hungarian terminology) relating to the semantical and syntactical correctness of the word, because nowadays, this concept has become accepted; during its scientific interpretation, we may abstract from the "mixed metaphor" derived from the peculiarity of the Hungarian language.

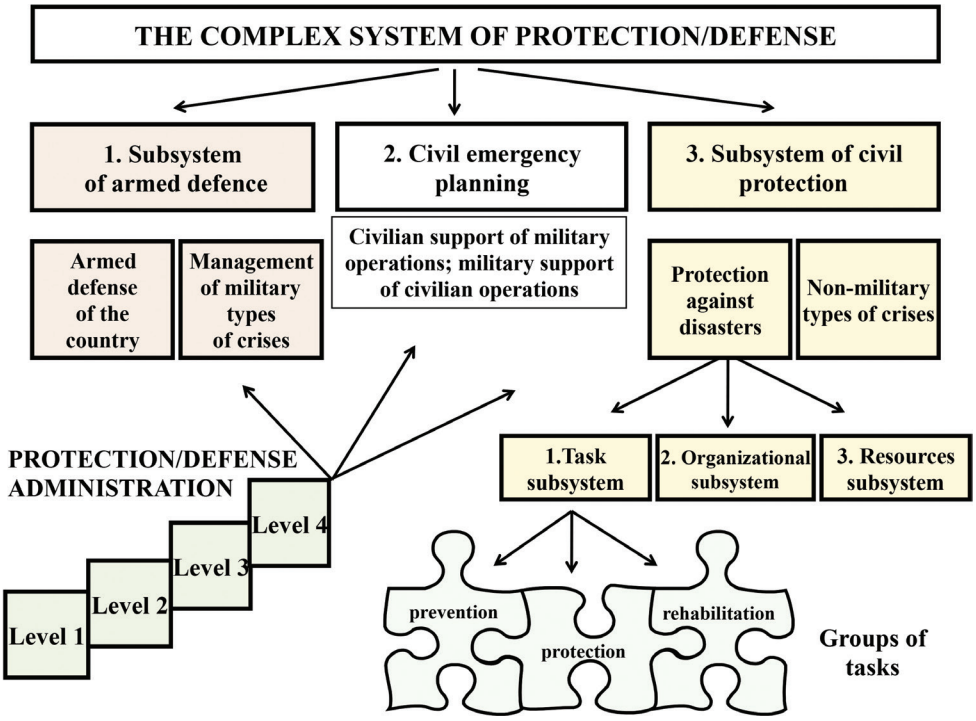


*Figure 4. The place of the protection against disasters in the complex system of protection/defence.* (Created by the author.)

It can be seen from Figure 4 that the structure of the system of disaster management and its hierarchy is similar to the one of the complex system of protection. The protection against disasters itself is an independent unit[12] and can be divided into subsystems. These are the following:

- hazard factors and the implementable *disaster management task subsystem*,
- *organizational* and *institutional subsystem* consisting of implementers,
- *resources subsystem* necessary for implementation.

The first subsystem of the protection against disasters is made up of *groups of tasks* which must be carried out in the phases of prevention, preparation, protection/response and rehabilitation.[13]

Although the tasks of a given phase are named after the given phase, however, it is important to note that the tasks of prevention and preparation are not exclusively performed in the prevention phase. In the phase of protection, it may be necessary to fulfil the tasks that serve rehabilitation, that is, the tasks that are not only linked to their own phase. The goals and the implementation methods of the groups of tasks are shown in Figure 5.

[12] Under disaster management in this context, one should understand a system and not an organization.

[13] Regarding their nature, according to the classic categorization, these tasks may be civil protection, fire safety and industrial safety.

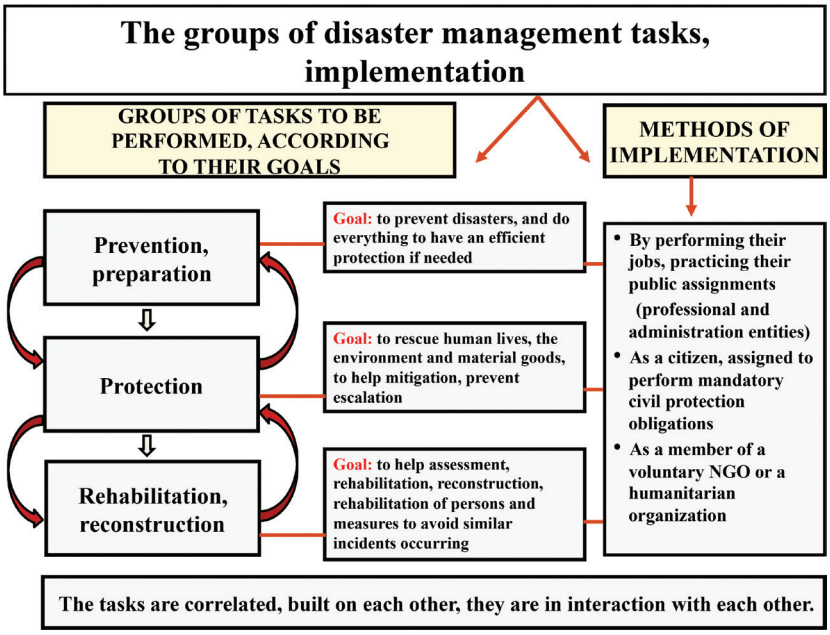


*Figure 5. Groups of disaster management tasks and the methods of their implementation.*
(Created by the authors.)

In the system of disaster management, given the *organizations* and *institutions*, the scope of contributors is wide. Entities created for protection and for eliminating the consequences of disasters are the professional disaster management entity[14] and the mandatory civil protection organizations.[15] However, according to the law, additional elements also participate in the implementation of tasks as contributors. [9: Section 2 (1)]

The resources to perform disaster management tasks are included in the *resources subsystem*. They originate from several areas. The resources provided by them and the ones created from the reserves of contributors, and on the other hand, state, local government protection reserves and the resources of citizens, NGOs and humanitarian organizations belong to this group. Protection and rehabilitation and the measures to ensure life subsistence are also supported by Hungarian and international assistance and aids.

As a summary, it can be stated that disaster management is an integral part of the complex system of protection/defence and is included in the group of civil protection tasks. Its structure shows a match with the complex system of protection, its system characteristics are

[14] National Directorate General for Disaster Management, Ministry of the Interior, and its county and settlement-level entities.

[15] Civil protection obligation is a citizen's obligation, which includes data provision, reporting, appearance and civil protection service. Under this obligation, citizens may be assigned to civil protection organizations. For the sake of an intervention necessary for disaster prevention, and in an emergency, a person assigned to a civil protection organization may be ordered to fulfil temporary civil protection service. These organizations may be central, territorial, settlement-level and workplace civil protection organizations. [9: Chapter VI]

detectable, and there is the division of tasks, organizations and resources. They show interaction with each other and with other elements of the protection system. The formation of its legal background fits it into the legal environment of the protection/defence system. Among these tasks, prevention and preparation play a prominent role.

## Goals, Basic Fields and Main Group of Tasks of the Prevention of Extraordinary Incidents

The experience of the past decades shows that eliminating the effects of extraordinary incidents, the protection against them can only be effectively performed in the phase (prevention) before it occurs, minimizing the chances of its development, and in parallel, we prepare to perform all the tasks that are needed to be done in a possible protection operation.

*The goal of the prevention phase* is to implement all legal, technical, investment, training, preparation, resource allocation etc. tasks, activities, with which the occurrence of extraordinary incidents can be prevented or their adverse effects can be reduced, and which, if necessary, increase the effectiveness of protection tasks and minimize escalation.

### *The Basic Fields and Main Groups of Tasks of the Prevention of Extraordinary Incidents*

The types of extraordinary incidents and their effects are complex, the principles and methods of protection against them are diverse, however, there are general prevention considerations, requirements and tasks that are applicable and can be extended to any hazard. I summarize them below.

#### *Definition of International and Hungarian Protection-Targeted Guidelines Objectives*

The framework directives of international organizations (UN, EU, NATO, OSCE,[16] etc.), such as the UN INSARAG[17] Guidelines or the NATO doctrines belong here. The protection/defence objectives are defined in the National Security Strategy of Hungary, the Military Security Strategy and the various sectoral guidelines.

#### *The inclusion of protection/defence-targeted requirements, obligations and tasks in legislation*

Legislation, provisions, measures aimed at the prevention and elimination of extraordinary incidents belong here, but those acts may also be included here that define the establishment of organizations necessary for protection and the management of protection clarify the powers and competences, regulate the conditions of implementation and name the required forces and assets.

[16] Organization for Security and Cooperation in Europe
[17] International Search and Rescue Advisory Group

### *Planning and implementing preventive protection investments, territorial arrangements*

Definition of settlement development plans, protection-targeted requirements of investments, planning the location of hazardous industrial plants, reducing transportation vulnerability, raising its resilience, planning the dimensions of roads and bridges aligned with protect goals, building utilities, power supply with multi-directional feed, etc. are included here.

Definition of the protection-targeted requirements of different sectors (energy systems, industrial and agricultural activities, etc.), the establishment of legal requirements for the implementation and the coordination of implementation are also part of this area.

### *Protection planning*

Amongst others, the drafting of preventive protection plans for the protection against extraordinary incidents can be listed here. Their goal is to determine all the tasks, criteria, assets and manpower needs which may ensure the efficient implementation of prevention and the tasks of protection. The protection plans primarily contain the strategic and tactical tasks of national or regional levels and their criteria which appear on a local level in the emergency management plans of settlements.[18] The basis of protection plans are vulnerability assessment, risk identification and the determination of the necessary protection level.

### *Establishing the organizational, human resources, material and technical resource needs of protection*

Among others, the acquisition and existence of human and material resources, the technical equipment necessary for the establishment of entities, organizations involved in protection and their maintenance for protection activities can be listed here. Central and local protection kits, materials, tools, instruments, resources, indispensable for population protection tasks and damage mitigation belong to this area. Those technological developments should be developed here which serve the creation of various procedures required during protection: metering networks, monitoring systems, software, instruments, etc.

### *Training and preparation*

The creation of the conditions of training and preparation required for the prevention and protection against extraordinary incidents can be listed here. Their goal is to prepare the participants in protection to carry out their duties of participating in the development of the conditions of training and preparation tasks required for the self-protection capabilities of the population, furthermore, to prepare entities and persons performing protection duties in the state and public administration fields.

[18] Nuclear emergency management plan, plan for armed defence, the protection plans of the county protection committees, environment protection plans.

## Preparation for the Prevention of Disasters and the Protection against their Effects

The hazard factors endangering Hungary and its citizens, based on the National Security Strategy, have been demonstrated by me in Table 1. Then I examined the complex system of protection, and within the system of disaster management and their correlation. Now I analyse the basic areas of disaster management with a similar deduction method, in relation to prevention tasks. Its starting point is matching the areas of prevention to disasters, as demonstrated in the previous subchapter.

### *Groups of Tasks Aimed at the Prevention of Disasters*

#### *Acceptance of international protection-targeted guidelines, the formation of Hungarian objectives of protection against disasters*

The prevention tasks are defined by the Hungarian National Assembly following the recommendations of international organizations involved in the protection against disasters and their guidelines, based on Hungary's vulnerability. They are implemented through the protection administration system. Since their establishment, international organizations (UN, EU, NATO) have been dealing with protection against disasters and have developed guidelines, framework programs, action plans,[19] which are joined by countries. By taken into account the vulnerability of their own territory, they develop their national disaster management strategies both for prevention and for international engagement. For instance, at the 3rd UN Conference in Sendai, in 2015, a framework was published, titled *Sendai Framework for Disaster Risk Reduction*,[20] which emphasizes the importance of prevention. [10: 13 Item f]

#### *Introduction of protection-targeted requirements, obligations and tasks in legislation to prevent disasters*

The basic legal background of the protection against disasters is provided by, for example, the Act on Disaster Management, the Decree on its implementation and various Minister of the Interior decrees, providing the framework of the implementation of the different tasks. [9] [10] [11] In addition, legislation includes the main tasks of disaster management on the different levels of protection administration and their principles, methods and tools. In connection with preventive disaster management tasks, the legal provisions define different professional specifications and obligations. For example, they regulate the order for the setup and operation of disaster management in Hungary, and in this relation, the tasks of the government, county and local protection committees and mayors. They stipulate the

[19] Such are for instance: The Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters; Framework for Action for the International Decade for Natural Disaster Reduction of 1989; Yokohama Strategy for a Safer World: Guidelines for Natural Disaster Prevention, Preparedness and Mitigation and its Plan of Action; International Strategy for Disaster Reduction of 1999.

[20] In this it is emphasized that the development of technology and research, furthermore, significant steps should be taken in the field of installing early warning systems as well, thus increasing the resilience against disasters. One of its criteria is the cooperation with international organizations and with each other; in order to do so, the conditions for the flow of information must be created. [1: 11 Item 14]

obligations of citizens, preventive protection duties of public administration, the country's vulnerability classification, the vulnerability categories, and the setup of protection levels associated with it. Legislation provides for sectoral disaster management tasks, its protection-targeted requirements for settlement plans, the establishment of central resources, the principles and requirements related to the operation. The Government (based on these laws) defines, for example, the duties of government members and state entities in dealing with protection, related to disaster management, the planned amount of appropriations that may be used for Hungarian and international assistance, provides financial support for the operation and development of disaster management. [9: para 5] [9: para 10] [9: para 14] It also provides for the protection administration tasks to be implemented by public administration. For example, the county, Budapest and local protection committees manage and coordinate prevention-focused tasks based on the above, and prepare the tasks of entities affected in disaster management.

Here, the followings may be listed: the specific regulations of the organizations involved in disaster management and elimination, as the MoD decree defines the establishment of the scope of home disaster management and protection systems. [12]

### *Implementation of preventive technical protection investments, territorial arrangements*

The goal of this group of tasks is to prevent disasters from occurring and to reduce their possible effects in the framework of which it is expedient to perform the following major tasks:

a) At national level, various preventive technical protection tasks and measures should be implemented by the sectors.
b) When drafting settlement development and arrangement plans, protection considerations must be enforced, and in the framework of a specialized authoritative activity the disaster prevention tasks and rules must be enforced.
c) The structure of the public utility network and industrial arrangement of settlements must meet the criteria of protection targets that serve to prevent any accident concerning the transportation and storage of hazardous materials.[21]
d) The placement of industrial plants and food businesses is essential for the subsistence of the population in a safe distance from each other.
e) Multilateral energy supply, protection-targeted investments, installation of water resources, dams, dykes, reservoirs, monitoring and alarm systems.
f) Designation of essential material goods and facilities, definition of their vulnerability and ensuring their preventive protection.

[21] Major special authoritative activities in the system of disaster management nowadays are: fire prevention, (ADR: Accord européen relatif au transport international des marchandises dangereuses par route; ADN: The European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; RID: Regulation concerning the International Carriage of Dangerous Goods by Rail; ICAO/TI: International Civil Aviation Organization/Technical Instructions for the Safe Transport of Dangerous Goods by Air), activities in connection with the transportation of hazardous materials, the protection of vital systems and facilities, control of chimney sweeping public services, special authoritative activity in connection with constructions, special authoritative activity in connection with settlement planning and arrangement. [14: Slides 26–27]

### *Emergency management planning*

Based on national and regional protection plans, local emergency management plans must be drafted. The setup is based on the vulnerability assessment and analysis and the protection classification of settlements. Using this, the required level of protection must be defined in the settlement plans: the number of staff; the structure of protection organizations suitable for the material and technical needs; the form and manner of alert and standby/duty; as well as the time of deployment standby. Plans must include the amount and location of reserves required for the establishment and operation of organizations involved in protection.

### *Ensuring the organizational, human resources and technical-material resources needs of protection*

Disaster management entities play a prominent role in planning, organizing disaster management tasks. The Ministry of Interior and the professional, but other ministries, organizations and entities are also involved in their own areas. The establishment and the number of organizations, the provision of human, material and technical conditions for the operation are segregated in the budget chapters of a given ministry. Providing the conditions necessary for the performance of its professional duties and protection, depending on the nature, magnitude and location of a disaster, originates in the state framework, the stocks of settlements, facilities, resources of businesses and their entirety.

The technical upgrades and the setup of monitoring systems are state tasks; their locations are determined by professional disaster management; testing and corrections are made based on their suggestions.

### *Training and preparation*

Ensuring organizational, human resources, material and technical conditions and preparation altogether provide the protection capability of a settlement, which not only represents the prevention capabilities, but also necessary for protection.[22]

## *Up-To-Date Methods and Means of Prevention and Preparation*

The aspects and tasks outlined above provide a framework for the implementation of prevention, but the specific tasks of implementation depend on the type of disaster. In Hungary, we must count with the emergence of both man-made and natural disasters. The extent of my article does not allow the analysis of all these, so I will highlight only two types. I have searched for up-to-date methods in academic research and in the protection practice for their prevention and the avoidance of their escalation.

[22] "Under protection capability, all planning, organizing, implementation activities, rules, and the entirety of forces and means should be interpreted, which ensure the prevention of the occurrence of hazards, the rescue of the lives and property of the population, the mitigation of damages, the avoidance of further hazards, the establishment of basic living conditions, and the support of the professional rescue forces." [4: 73] [15: 104]

## *Up-to-date methods to prevent wild fires and the tasks in relation*

The protection against wild fires has also attained the attention of scientific research. [16] [17] More and more professionals are involved in developing new, more effective procedures for preventing the propagation of fire. In doing so—beyond the further development of traditional methods—we encounter new solutions.

Below, I will present some examples in order to ensure the effective implementation of preventive protection tasks, what scientific achievements and technical upgrades occurred that may be utilized in practice as well.

*General preparations* include the identification and control of fire hazardous activities and re-regulation of the forms and methods of their implementation. The prevention of the propagation of fires, the drafting of the prevention of wild fires and the preparation for extinguishing them; the purchase of equipment, the creation of conditions necessary for extinguishing fires and the maintenance of the applicability of assets. In order to implement the above, modern GPS devices and GIS systems assist in situation analysis, and risk analysis is also applied. It is important to know how to use them, to be trained for them. [18: Slide 4] [18: Slide 9]

*Developing programs for predicting fire propagation* was also focused on by IT researches. The researchers of the Lawrence Livermore National Laboratory, Los Alamos National Laboratory and Atmospheric Release Advisory Centre started to upgrade existing programs for predicting fire propagation by linking geographic parameters, weather factors and smoke-cloud propagation programs. They are able to optimize the time factor, reduce the vulnerability of humans, animals, and valuables. [19: 158]

Arnie Heller reported on the upgrade of the method in the FIRETEC simulation model that further developed the program to enhance the characteristics of combustion and other factors influencing the propagation of fire as well, such as its type, composition, combustion properties of the vegetation, etc. Nowadays, a newer version of the model has also been completed (HIGRAD FIRETEC), which already takes into account the possible ways and the characteristics of spark and foliage fire propagation and thus can provide a more accurate propagation forecast. By using it in the preventive phase, it is possible to more successfully prepare for what can be expected in a given situation. [20]

Stefan Patzelt—based on the analysis of hundreds of fires—drew conclusions and regards of prominent importance: the length of time between the detection of and the response to fires. He proposed *new methods of fire detection,* which advocated the deployment of fire watch towers and the design of the Firewatch System. There is an optical rotating camera system capable of detecting 16,000 grey colour change values in a distance of 10 km, in an area of 314 $km^2$ and can transmit these signals to the centre in a fire tower. The image analysis program that is located there evaluates the images; and is able to detect the smoke column at a distance of 10 km, identify its characteristics and alert the response units.

Additionally, the researcher considers it important to use simulation fire extinction programs in practice in order to detect the possible fire hazards, especially to reconnoitre inaccessible locations in time as well as the preparation for aerial firefighting. All these would create an opportunity to detect the factors that hinder firefighting, trace natural and artificial water sources, and learn about deployment schedules needed for extinguishing. [21: 167]

In practice, the use of drones is spreading more and more in airborne reconnaissance. They can be used effectively in many areas, such as exploring fire hazardous locations, detecting fires, mapping locations of firewalls and exploring a flammable environment for risk analysis. Photographs and video footage made by drones greatly help the efficiency of detection. [23] [24: 19]

To reduce the propagation of fires, in addition to traditional methods (extinguishing with water or foam, creating blocks on the terrain to stop the propagation, etc.) we are also encountering new solutions. Such are the so-called retardants, containing flame retardants consisting of water, dyes, ammonium salts and silicon or rubber. They are made up of aluminium sulphate and aluminium phosphate which—when mixed with water—have not only fire retardant and heat-reducing effects but also (by their colour) they serve as good indicators for aerial firefighting operations as to where the extinguishing has already taken place. [21: 48] Today many new versions are known,[23] and much research is underway to modernize them. [25] [26]

## *Up-to-date methods and tasks of flood and inland water prevention*

Hungarian and foreign experts and researchers are constantly analyzing the trends of developments and the devastating effects of floods, examining modern prevention options and up-to-date protection principles. They develop methods and make proposals on how to upgrade and use the equipment. [27–34] [44] Up-to-date methods of preventive flood control are summarized below.

One method is to *design and upgrade flood protection levees.* Based on practical experience as well as on research results, the transformation of the floodplain of river sections becomes necessary, in which the design, construction, heightening of new levees is performed through modern methods and can be relocated as needed. Beyond the above, it is an important task to protect existing dykes. It has been proved in recent years that the protection of levees can only be solved in complexity, in which the structure of the dyke itself (soil-binding plants, compression, elimination of holes caused by animals, etc.) should be taken care of. Furthermore, protection is needed against the saturating effects of inland waters that is appearing more and frequently. One method of this is the combination of dyke protection with protection against inland waters.

The protection against subsurface water in the vicinity of the levees can be implemented by draining. The essence is that with the help of a closed water drainage system—consisting of a suction, sub-collection and main collection pipeline, or a simpler version thereof—an open system can be developed which is ending in a canal, so the water can be discharged from the ground in the vicinity of the levee. (Figure 6)

Further points can be made on *the tasks of riverbed and floodplain control.* The solutions that provide rapid and unobstructed access of flood waves to the riverbed or (where necessary) the protection of dykes also serve to drain flood peaks into floodplains, and belong to the preventive flood protection tasks. There are many technical solutions to this, of which I highlight the followings:

– the increase of area of the floodplain by moving or heightening the dykes,
– the transformation of river control structures as needed,

[23] E.g., Phos-Chek 259, types G75, P100. [22]

– the deepening of main riverbed and side branches by dredging,
– the removal of summer dykes and levees, buildings and other facilities from the floodplain. [36]

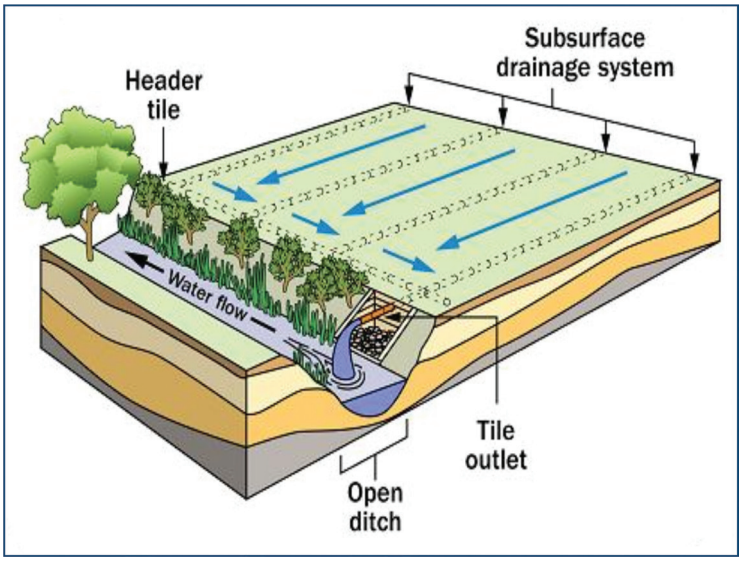


*Figure 6. Ground water discharge with drainage technology.* [35]

Another possible way of protection is *the construction or upgrade of reservoirs*, which are designed to prevent the flood from damaging existing flood protection structures and not compromising settlements and farmlands. If necessary, the drainage of flood peaks takes place in them, later the water will be pumped back to the riverbed or used for irrigation. Nowadays, we have many up-to-date building technologies and materials for the construction of reservoirs. For smaller reservoirs soil-strengthening geogrids, insulating geotextiles and foils are often used.

It is crucial to use *advanced dyke systems.* The basic function of a dyke is to stop the water from flowing, built parallel or across the water stream, to protect the area behind it. In previous years, one of the methods of preventive protection was to strengthen and heighten existing dyke and levee systems. Various solutions have come to be used, such as heightened temporary levees, and so on. Nowadays, the use of a new type of so-called mobile dykes is spreading more and more. Its advantage is that it can be purchased in the precautionary phase and can be stored centrally, and can be installed and disassembled in a short time after a flood. [37]

The following images are of mobile flood protection walls. They consist of fixable pillars, filling elements made of glued polyethylene and polyurethane to the pillars, water tightness is provided by hollow profile rubber and clamp sliders. [38]

The “Quick-damm” is a type of mobile dyke that can be quickly installed. There are several types. A common element in them is the light geo-membrane fixed to a metallic frame; it consists of pieces to be built together, filled with sand.

*Figure 7. Quickdamm.* [39]

A new development is the so-called Aquariwa, which, due to its dimensions (length: 4.1 m) and materials (fiberglass, elastic, swivel, plastic) can be faster deployed and has a great tensile strength and it can be relatively easily emptied after a flood.

*Figure 8. Rapid-deployment mobile dykes.* (Made by Dapd, [40])

In addition to technical solutions, it is important to have a fast and reliable forecast as well as response to the signals. Among the prevention tasks, the installation and operation of *modern alarm systems* is of paramount importance and also the creation of an IT background necessary for this. For example, there is a common, integrated, real-time hydrological forecasting system on the Ipoly River in Hungary. [41]

The magnitude and extent of the damage by a flood depends largely on how we can prepare for the protection against it, which is dependent on the time available. The preparation is heavily assisted by flood control simulation programs which have spread over recent years. These can be updated with interactive maps to improve damage prevention and mitigation.

## Conclusion

Guaranteeing safety and security are some of the most important tasks of today's hazards factor prevention and the preparation for response. Looking at the security policy objectives of our country, I have found that due to the complexity of the hazard and the preventive protection activity, we can only look for preventive protection issues effectively when it is in a complex systemic manner. Analysing the components and features of Hungary's protection system systematically, it can be stated that the system has two areas, namely the armed and the civil protection subsystem, which are linked to civil emergency planning. From the implementation side, I have distinguished three subsystems: the task, the organization and the resource subsystems, and I defined their constituents.

I have also defined the features of the protection system based on the security policy documents, summarized in 10 points, demonstrating its complexity. Within the civil protection subsystem, I have examined the place and role of disaster management and its subsystems in the protection system and found that the complex system of protection has a significant correlation with its structure, function and system.

Analysing the control of the hazard factors, I have found that the tasks of the three protection periods (prevention, response/protection, restoration) are of utmost importance nowadays and both the Hungarian and the international security aspirations have focused on the prevention period, because the tasks to be carried out here have a significant impact on the feasibility of the other periods (protection, restoration).

By examining the tasks of the prevention phase with a systems approach, I have found that task groups—to be implemented here—embrace different areas and form an integral unit with each other. International and Hungarian protection objectives and guidelines are the *first area* that can be implemented by security policy measures.

The tasks that belong to the *second area*—which are applicable and to be performed during all types of hazards in the prevention phase—through examination and analyses can be classified into 6 categories; such as the appearance of legislation specific protection-targeted requirements, preventive protection investments, spatial (settlement) development, protection planning, training, preparation, and setup of organizations and resources.

The prevention tasks that belong to the *third group*, apply to a specific protection/defense area. I have investigated the prevention tasks of disaster management (a specific area of the complex system of protection) and determined the task groups to be performed there. They show a significant match with the second task group. They are also classified into six categories and are interrelated and form an integral unit.

From the prevention tasks (belonging to the third group) I have presented the technical nature of two specific examples: with regard to natural fires and floods. I have found that in these two types of disasters today—in addition to the traditional forms of prevention—new technologies and developments have become increasingly important, based on the research

results of recent years and the application of new principles and methods of protection. I gave examples from Hungarian and international practice.

The analysis did not address protection-related tasks of the protection factors and their correlations with the components of the protection system, thus they require further research.

## References


[1] United Nations: *Sendai Framework for Disaster Risk Reduction 2015–2030.*

[2] *2073/2004. (IV. 15.) Government Decree on the National Security Strategy of the Republic of Hungary.*

[3] *1035/2012. (II. 21.) Government Decree on the National Security Strategy of Hungary.*

[4] HORNYACSEK J.: A biztonságunkat veszélyeztető tényezők és a katasztrófák elleni védekezés átfogó megközelítése. *Hadmérnök*, 1 (2017), 84–114.

[5] BUCZKÓ G.: *Kelet-Közép-Európa biztonságpolitikája a NATO 1990-es bővítését követően.* Budapest: Budapesti Gazdasági Főiskola, 2004.

[6] *Act CXIII of 2011 on home defence and the Hungarian Defence Forces, and the measures that can be taken in special legal order.*

[7] *90/2011. (XII. 22.) Government Decree on home defence and the Hungarian Defence Forces.*

[8] *The Fundamental Law of Hungary* (25 April 2011).

[9] *Act CXXVIII of 2011 (03. 10. 2011) on the amendment of the Act on Disaster Management and certain relevant acts.*

[10] *234/2011. (XI. 10.) Government Decree on the implementation of Act CXXVIII of 2011 on the amendment of the Act on Disaster Management and certain relevant acts.*

[11] *62/2011. (XII. 29.) MoI Decree on certain rules of the protection against disasters.*

[12] *Act CXIII of 2011 on home defence and the Hungarian Defence Forces, and the measures that can be taken in special legal order.*

[13] *23/2005. (VI. 16.) MoD Decree on the direction and tasks of the protection against disasters by the defence sector.*

[14] BONNYAI T.: *A katasztrófavédelem integrált rendszere.* Budapest: NKE, 2013.

[15] HORNYACSEK J.: *A települési védelmi képességek a katasztrófa-kihívások tükrében.* Budapest: Biztonságunk Érdekében Egyesület, 2011.

[16] Sierra Forest Legacy: *Ecological Burning in the Sierra Nevada.* www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/FireScienceResearch/FuelsManagement/FM-SFLFireWhitePaper2011.pdf (Downloaded: 05 02 2017).

[17] Forest Fire Research Questions the Wisdom of Prescribed Burns. *New York Times*, 18. 09. 2012. www.nytimes.com/2012/09/18/science/earth/forest-survey-questions-effect-of-prescribed-burns.html, https://ec.europa.eu/jrc/en/research-topic/fires (Downloaded: 05 02 2017),

[18] KARDOS I.: *Az erdőgazdálkodók tűzmegelőzési és tűzoltási feladatai és lehetőségei.* www.katasztrofavedelem.hu/letoltes/konferencia/4/2_sefag_Kardos.pdf (Downloaded: 05 02 2017).

[19] BRADLEY, M. M., SCHEMER, C. L., SUMIKAWA, D. A., WALKER, H., YOUNKER, L. W., BOSSERT, J. E., HANSON, H. P., LINN, R. R., REISNE, J. M.: *The National Wildfire*

*Prediction Program: A Key Piece of the Wildfire Solution.* Los Alamos: Lawrence Livermore National Laboratory, 1999. https://e-reports-ext.llnl.gov/pdf/236394.pdf (Downloaded 24 11 2005).

[20] HELLER, A.: *This Model Can Take the Heat: A New Computer Program Simulates the Physics of Fire and Weather Patterns to Help Combat Wildfires.* 2002. www.llnl.gov/str. November02/Bradley.html (Downloaded: 23 11 2005).

[21] PATZELT, S.: *Deutschland: Zukunftsorientierte Strategien und Konzepte unter besonderer Berücksichtigung der Brandbekämpfung aus der Luft*. Dissertation. Mainz: Johannes Guttenberg Univesität, 2008.

[22] *Phos-check.* www.phos-chek.com.au/retardant (Downloaded: 17 02 2017).

[23] Drónok használata a hétköznapokban. *Lendület Portál*, 12. 08. 2014. www.lendulet.hu/dronok-hasznalata-hetkoznapokban/ (Downloaded: 05 01 2017).

[24] TÓTH R.: A repülőeszközök alkalmazásának lehetséges területei és korlátai katasztrófák esetén. *Repüléstudományi Közlemények*, 23 2 (2011), 1–26.

[25] GOLDAMMER, J. G.: Zur Entwicklung von Systemen der Waldbrandbekämpfung aus der Luft: In Kampf dem Waldbrand. *Sonderheft der Allgemeinen Forst Zeitschrift*, 28 (1978), 42–43.

[26] *Chemical Alternatives Assessment of Different Flame-Retardants: A Case Study Including Multiwalled Carbon Nanotubes as Synergist.* https://ec.europa.eu/jrc/en/publication/chemical-alternatives-assessment-different-flame-retardants-case-study-including-multi-walled-carbon (Downloaded: 15 12 2016).

[27] *Leben mit dem Wasser. Hochwasserschutz in Holland.* www.handelsblatt.com/technik/energie-umwelt/hochwasserschutz-in-holland-leben-mit-dem-wasser/8352266.html (Downloaded: 15 12 2016).

[28] LEHNEN-BEYEL, I.: *Gefahr durch Überschwemmungen wächst.* www.wissenschaft.de/home/-/journal_content/56/12054/1118000/ (Downloaded:18 12 2016).

[29] *Flooding.* Ucar.edu, www.ucar.edu/communications/factsheets/Flooding.html (Downloaded: 20 12 2016).

[30] NAGY I.: *A Tisza-völgy árvízi helyzetének bemutatása, árvízi kockázatok, aktualitások.* Szolnok: Jász-Nagykun-Szolnok Megyei Mérnöki Kamara, 2012. http://docplayer.hu/1127391-A-tisza-volgy-arvizi-helyzetenek-bemutatasa-arvizi-kockazatok-aktualitasok-dr-nagy-istvan.html (Downloaded:15 12 2016).

[31] MÉHÉSZ N.: *Árvízi kockázat-kezelés egyes módszertani kérdései.* Nyíregyháza: Víziterv Environ Kft. http://docplayer.hu/34766224-Az-arvizi-kockazatkezeles-akk-egyes-modszertani-kerdesei-mehesz-nora-viziterv-environ-kft.html (Downloaded: 15 12 2016).

[32] BEREK T.: A vízbiztonsági tervezés szerepe a fenntartható vízgazdálkodásban. *Műszaki Katonai Közlöny*, 26 2 (2016), 32–48.

[33] Hungarian Investment and Trade Agency: *The Hungarian Water and Sanitation Industry in the 21st century.* 2013. www.budapestwatersummit.hu/data/images/BWS_news_water_and_sanitation_hu_brossure.pdf (Downloaded: 23 12 2016).

[34] BÁRDOS Z.: *Az önkormányzati ár- és belvizek elleni védekezés feladatai korszerűsítésének lehetőségei.* PhD-értekezés. Budapest: Nemzeti Közszolgálati Egyetem, 2016.

[35] *Drénezés*. http://szolo.blog.hu/2015/05/16/alagcsovezes_drenezes (Downloaded: 15 12 2016).

[36] Pro Aqua Kft.: Az árvízvédekezés feladatai. Budapest, s.d. http://proaquakft.lapunk.hu/?modul=oldal&tartalom=1190518 (Downloaded: 15 12 2016).

[37] DÉNES M.: Mobilgátak: Igen vagy nem? *Magyar Építéstechnika*, 2015. 07. 15. www.magyarepitestechnika.hu/index.php/2015-6/2678-mobilgatak-igen-vagy-nem#&panel2-1 (Downloaded: 15 12 2016).
[38] IBS: *Mobile flood protection walls.* http://mobilgat.hu/mobilewalls.php (Downloaded: 15 12 2016).
[39] *Quickdamm.* www.domobau.hu/mobilgat.html (Downloaded: 15 12 2016).
[40] Bewährungsprobe für die rote Tonne. *FAZ.net*,14 01 2011 www.faz.net/aktuell/rhein-main/frankfurt/hochwasserschutz-bewaehrungsprobe-fuer-die-rote-tonne-1578261/aquariwa-gegen-quickdamm-beim-1587670.html#fotobox_1_578261 (Downloaded: 15 12 2016).
[41] *Ipoly árvízi előrejelzés: Közös, integrált, valós idejű hidrológiai előrejelző rendszer kialakítása az Ipoly vízgyűjtőjére.* Budapest: Közép-Duna-völgyi Vízügyi Igazgatóság, s.d. www.kdvvizig.hu/index.php/projektek/nemzetkozi-palyazatok/149-ipoly-arvizi-elorejelzes/315-ipoly-arvizi-elorejelzes (Downloaded: 15 12 2016).
[42] PADÁNYI J., FÖLDI L.: Tasks and Experiences of the Hungarian Defence Forces in Crisis Management. *Bilten Slovenske Vojske*, 17 1 (2015), 29–46.
[43] PADÁNYI J.: Experience in the Use of Military Forces in Flood Protection. *AARMS*, 12 1 (2013), 59–66.
[44] BÁRDOS Z., MUHORAY Á.: A települések vízkár elleni védekezési feladatainak változása a megváltozott jogszabályi környezetben. *Hadmérnök*, 93 (2014), 48–60.

AARMS Vol. 16, No. 2 (2017) 67–82. **10.32565/aarms.2017.2.5**

# The Role of the Government in the Field of Public Protection in the Prevention of Earthquake Disasters[1]

Örs ANTAL[2]

*Protecting human lives from devastating natural phenomena is among the most relevant goals of public protection at an international level. In this context, the Government has a huge responsibility in each country including the institutional framework of disaster management, knowledge transfer or legislation. The tendencies and consequences of recent natural disasters indicated that prevention has come to the fore globally. This approach is very important in earthquake prone areas as well. Generally, the most common measure after a devastating earthquake incident is the revision of seismic codes and declaring new design standards. On the other hand, strengthening existing building constructions is inevitable for the mitigation of damages and prevention. Italy is one of the European countries most affected by earthquakes. The lessons learned from Italian risk management strategies and retrofitting projects for unreinforced old masonry buildings can be useful for establishing national strategies and governmental measures within the framework of public protection.*

**Keywords:** *public protection, prevention, collapse of buildings, role of government, preparedness, disaster relief programs*

## Introduction

Generally speaking, the significance of previously threatening conventional military conflicts has been pushed into the background, and challenges originating from global terrorism and natural or civilizational hazards have come to the fore. The unpredictability and powerful effects of extreme natural phenomena have indicated that prevention and preparedness have become primary concerns in the modern approach of disaster management. In this context, there is an emphasis on public protection coordinated by the government.

Regarding Hungary, the deficiencies of research and development (R&D) and knowledge technology transfer appear in defence management as well. Besides technological innovation, the main possibilities for enhancing the effectiveness of public protection related to natural hazards are the involvement of citizens in the processes and the increase of participation in international R&D programs.

Thereby, based on the experiences and consequences of severe earthquake incidents and prevention efforts in Italy during recent years, this study discusses the possible methods for the mitigation of earthquake risk within the framework of public protection. The study

[1] The work was created in commission of the National University of Public Service under the priority project PACSDOP-2.1.2-CCHOP-15-2016-00001 “Public Service Development Establishing Good Governance” in the Győző Concha Doctoral Program.

[2] PhD student, National University of Public Service, Doctoral School of Military Engineering, e-mail: antal.ors@gmail.com

furthermore makes a number of specific suggestions for the principals of governmental measures or programs, whereby the effectiveness of prevention can be enhanced.

## General Interpretation of Public Protection

Theoretically, under the protection of civil inhabitants we can understand all efforts, methods, strategies and provisions, which aim to protect human life, material assets, essential, strategic, industrial, sanitary and cultural values or facilities in case of military conflicts or any kind of civilizational/natural disasters. The most important aspects of these provisions are to provide safety for the population in the affected areas and secure the functioning of vital facilities including basic supplies and important governmental organizations. In most cases the protection of civilian inhabitants is undertaken as part of a complex defence system by the mitigation of harmful effects, preparedness and minimizing casualties and injuries.

Based on the experiences of past natural and civilizational disasters, in most cases serious deficiencies and unpreparedness could be observed in the field of public protection, which is indeed highly dependent on the economic potential and social background of the affected countries or regions.

Speaking about the general interpretation of public protection, we need to discuss the main elements of it, including adequate reserving (propellant, food, drinking water and medicines), public preparedness, guidance, dissemination of information, crisis communication, alerting and emergency resource management (emergency protocols, logistics, personal protective equipment [PPE], etc.). [1] Regarding disaster management, those prevention measures that contribute to the increase of safety level of civil population and the defence capabilities of built environment, infrastructure and material or cultural values can also be classified as significant public protection provisions.

It could thus be argued that public protection is based on the active participation of population and central governing bodies during the period of preparedness and response as well.

## Statutory Interpretation of Public Protection

Public protection is among the most important tasks within the framework of civil protection, thus the interpretation of the two concepts are closely related to each other. According to the explanatory notes of the Hungarian Disaster Protection Act, civil protection covers a society-wide concern, instrument and response system aiming to provide safety for the population in case of any disasters or armed conflicts. The system of public protection includes the provisions for public preparedness and the improvement of the conditions for survival, too. [2] Literally, civil protection is considered a responsibility of public society that aims to protect human life, to ensure the conditions for survival and to prepare people for emergency situations and their consequences. Dating from its formation, public protection—as an institutional framework—stands on two main pillars: the cooperation and work of state security bodies and the activities of civil defence organizations. Therefore, besides the official disaster management forces, charity and civil protection organizations, other state or municipal bodies and volunteer citizens assume an important role in this system. [3]

The particular tasks of civil protection were first internationally registered in the Geneva conventions in 1949. In Hungary, Act No. XXXVII. of 1996, concerning civil protection composed it first, and then the provisions were integrated into the Disaster Protection Act currently in force. The most relevant tasks of civil protection related to disaster management are the following: [2]

- public preparedness,
- operation and preparation of civil protection bodies,
- transmission of information,
- supply of personal protective equipment,
- maintaining protective structures like shelters or safe rooms,
- evacuation or resettlement of the affected population in case of emergency,
- food, water and medicine supply,
- reconnaissance of the affected area,
- rescue,
- risk and impact assessment,
- and emergency planning.

The methods of public protection can be divided into the following tasks: 1. personal protection, 2. collective protection. Personal protection implies the individual protection methods, for instance the application of respiratory or radiation protective equipment, while under collective protection we can mean the defence systems suitable for the protection of a large number of people by local or remote protection. Local protection covers sheltering in reclaimed areas or facilities, while remote protection aims at the removal or evacuation of citizens from the endangered territories.

In the European Union, the implementation of civil protection tasks and objectives operates under the EU Civil Protection Mechanism regulated by Decision No. 1313/2013/EU of the European Parliament and the Council. Similarly to the interpretation from Hungarian legislation, this international Mechanism aims to protect human life, property and environmental values or cultural heritage in case of natural or civilizational disasters or severe epidemics. In this case, the Mechanism also covers the preparedness and response activities in the framework of civil protection. The local authorities of the state counties play an important role in the implementation of the Mechanism. From 2013, when this legislation took effect (the Mechanism was originally established in 2001), the EU places a heavy emphasis on prevention and preparedness, thus among the task system of civil protection, risk assessment and emergency planning have emerged considerably. The European Commission provides guidance for planning, analysing and carrying out assessments. Besides prevention measures, the Mechanism is activated when international intervention or response is necessary or justified. Based on monitoring and early-warning information, the Emergency Response Coordination Centre is responsible for the coordination of operations, while by the European Emergency Response Capacity the participating countries can share and develop their capacities, forces and abilities under the aegis of the EU Civil Protection Mechanism. [4]

In the United States, the system of civil protection went through serious changes after the terrorist attacks in September 2011. The basis of the new concept was laid down in the Homeland Security Act of 2002, signed into law in November 2012. The system, controlled by the government, was composed of more than 180 federal agencies including the Federal

Emergency Management Agency (FEMA), formed in 1978, which is responsible for civil protection issues in case of disasters or emergencies. Basically, the main target fields of homeland security are emergency preparedness and response including emergency management and civil protection. In the framework of FEMA, the definition of civil defence originates from the Code of Federal Regulations issued in 1972, and defined as follows: "All activities and measures designed or undertaken for the following reasons: (a) to minimize the effects upon the civilian population caused by, or which would be caused by, an attack upon the United States or by a natural disaster; (b) to deal with the immediate emergency conditions which would be created by any such attack or natural disaster; and (c) to effectuate emergency repairs to, or the emergency restoration of, vital utilities and facilities destroyed or damaged by any such attack or natural disaster." [5] This interpretation put a great emphasis on recovery phase and restoration measures besides the emergency and prevention issues for protecting human life. It does not state that civil defence would be the responsibility of public society, civil defence is usually led by the government agencies and organizations. The meaning of civil protection in the US comes from the comprehensive interpretation of civil defence, but it has a greater emphasis on civil and social participation against the effects of military incidents or natural disaster. [6]

## The Role of Prevention in Public Protection

As follows from the assessment of the explanations of public and civil protection, it is obvious that prevention and preparedness are the most important phases of emergency management. The following table (Table 1) summarizes those strategic-theoretical key factors that confirm the increasing role of preventive actions within the framework of disaster management, including the public protection efforts and programs.

This comparison also points out that within the increasing role of prevention merits derived from modernization and technological development are non-negligible. Furthermore, as a result of scientific research, which focus on risk analysis, risk management and precautionary provisions, advanced technological and strategic solutions are available to increase the efficiency of loss reduction.

*Table 1. Comparison of prevention and response strategies.*
(Edited by the author based on [7: Chapter 1 13].)

| **Response and recovery** | **Prevention** |
|---|---|
| focus on specific, previous disaster events | based on vulnerability and risk factors, focus on future hazards |
| scenario is single event-based | scenario based on multiple risk factors |
| scope of activities covers the responses taken for a specific event | based on the constant monitoring and assessment of changing conditions |
| activities based on commands and control | roles depend on situations, opened for all range of participants |
| communication and relations follow the rule of hierarchy | changing, indirect communication and relations |
| mainly focus on predefined and planned practice | focus on coordinated practices, abilities and competences |

| Response and recovery | Prevention |
|---|---|
| short-term measures | medium- and long-term measures |
| using dynamically changing information | open and public source of information from updating and constantly changing diverse sources |
| specific source of information requiring authorization | information may change or differ according to different perspectives and points of view |
| in-out and vertical flow of information within controlled framework | diversified, lateral flow of information |

In light of the above, it appears obvious that prevention measures constitute a more independent and opened system in time, hierarchy and possible scenarios. This enables the new technologies, scientific results and innovative approaches to be integrated.

## The Role of Civil Protection in the Prevention of Earthquake Damage

In general, within the framework of public protection, civil protection tasks and objectives related to prevention are the following:

- public preparedness for the rules of conduct in emergency situations,
- creation and preparation of organizations dealing with public protection, and providing the necessary financial resources for their operation,
- dissemination of information, warning and alert,
- and emergency planning and management.

Regarding earthquake hazards it is important to clarify the devastating effects of seismic activities before the detailed discussion of civil protection activities. The primary—and in most cases the most devastating—impact of an earthquake is the destruction of buildings caused by the horizontal load generated by the shock waves. Secondary effects include tsunamis, landslides, fire or the outcome of the damage on critical infrastructures or public utility systems. We can mention a number of events, when secondary effects caused greater damage, but generally the most significant danger factor is ruin to building constructions, which usually results in buildings or bridges collapsing, roads cracking or serious structural damages on building constructions. All of these damages are direct consequences of the horizontal acceleration of seismic waves generating shear stress on load-bearing structures. Besides these physical loads, many examples can be mentioned, when building collapse occurred as the consequence of resonance. The building is exposed to the highest vibration load, when its natural frequency corresponds to the maximum vibration frequency of seismic waves thus generating high vibration amplitude and resolution. [8]

In light of the above, within the framework of civil protection the application of earthquake resistant building constructions and the implementation of state-supported projects or programs are the primary missions for preventing earthquake disasters and mitigating seismic risk. In addition to state engagement and coordination, the following actions can be mentioned in order to accomplish these goals:

*Direct prevention efforts:*

- using and developing earthquake resistant technologies and building materials, furthermore enhancing seismic resistance of vulnerable buildings,
- and developing and installing early warning and alert systems.

*Indirect prevention efforts:*

- improving the knowledge about local seismic hazard and risk,
- enhancing innovation and international partnership in the field of scientific research and experimental development,
- risk assessment (including risk analysis) and risk-based planning,
- and public preparedness.

It is important to note that the primary objective of the above-mentioned efforts is reducing human loss rather than economic losses. In the determination of measures for protecting human life, similarly to other natural threats, in case of earthquake events it is also an important aspect that earthquakes by themselves do not cause disasters. For severe damage and deaths, the seismic wave's effect on buildings or built infrastructure, furthermore occasionally secondary effects can be held responsible. From this point of view, the behaviour of masonry structures, seismic relief provisions and early-warning systems are key priorities for preventing earthquake damage and avoiding loss of human life. For the implementation of these objectives, state and government plays an important role besides the fact that successful prevention is based on society-wide involvement. In the following chapter I examine preventive measures (and their results and efficiency) taken within the framework of civil protection through major earthquake events in Italy from recent years.

## The Experiences of Earthquakes in Italy: August 2016 Central Italy Earthquake

According to earthquake statistics, the 2016-year data sheets compared to the previous 16 years (from 2000 to 2015) show that the number of seismic incidents between the strength of M 6–6.9 and M 7–7.9[3] did not increase significantly in the year 2016. [9] However, some really devastating earthquakes hit our planet during this year, from which one of the most severe events was the Central Italy earthquake in August, with a total number of 300 casualties. It is important to note that due to the tectonic conditions Italy is among the most seismically active countries in Europe. The epicentre of the deadly Italian earthquake was approximately 40 km away from L'Aquila, where a previous notorious earthquake devastated the city in 2010, causing hundreds of casualties and serious destruction. This central area of Italy is said to be seismically vulnerable by the typical geological composition and tectonic processes driven by the movement of the Adriatic micro plate and the collision zone of Eurasian and African plates. The epicentre of August 24, 2016 earthquake was close to the town of Accumoli in the Lazio region in the central Apennines. The IX degree intensity scale[4] seismic event caused enormous destruction in Italian towns like Amatrice, Accumoli, Pescara del Tronto, Saletta or San Lorenzo a Flaviano.

[3] On Richter Magnitude scale including 9 degrees of amount of maximum energy released.

[4] Mercalli intensity scale is a seismic scale used for measuring the intensity of an earthquake including 12 degrees of intensity.

The total number of casualties was close to three hundred, furthermore, approximately four hundred persons were injured as a result of ground shake and building collapse. The most important geophysical features of this event were the following: [10]

- Mw (moment magnitude): 6.2;
- Hypocentre depth: 8 km.

These data indicate a fast course seismic phenomenon with strong ground shaking followed by many significant aftershocks. These features and strength were more than enough to cause serious destruction on mostly historical and other masonry buildings. Furthermore, many bridges, roads and other infrastructural facilities were damaged, which were enhanced by the numerous aftershocks during the following days. The narrow streets of historical towns were devastated by a huge amount of debris making the work of rescue forces more complicated. [10] It is known that according to seismic activity this territory is classified as first category in Italian seismic hazard maps. The high level of risk is in close connection with the great number of vulnerable buildings, which can be found in local towns. Similarly, to the application of the international Eurocode 8 seismic building code in Hungary, the design criteria for buildings in Italy is based on probabilistic seismic maps in order to mitigate earthquake damage. [11]

## Prevention and Mitigation Measures

Generally speaking the precautionary actions of a country or a region are relevantly determined by the experiences of previous disaster events. Regarding the prevention strategies and seismic risk mitigation measures in Italy, the first big steps were taken after the consequences of some devastating seismic events from the 1980s and 1990s, but the earthquakes that occurred in 2003 and 2009, and caused major damage were the first significant milestones of mitigation efforts in Italy's modern history. After the 2009 L'Aquila earthquake, about one billion Euros were invested by the Italian Government to enhance the level of preparedness and seismic risk reduction. The main priorities of these interventions and provisions were as follows: [12]

- Improvement of knowledge including scientific assessment of seismic phenomena, seismic hazard mapping, risk assessment and earthquake engineering.
- Mitigation of exposure and vulnerability, like developing seismic codes and emergency planning.
- Reduction of harmful effects by improving the civil protection and emergency plans, developing early warning and alarm systems and public preparedness.

This event led the civil protection authorities to reconsider the future prevention and preparedness measures. Experiences gained from last years' earthquakes in Italy indicated that the solution for the mitigation of earthquake risk is reinforcing buildings and developing emergency management within the framework of preparedness. With regard to disaster hazard, the biggest problem in Italy is the prevalent culture of building construction due to the fact that seismic performance of ancient masonry buildings is very poor and the structural modification of these buildings would be an extremely high expenditure.

Following these above-mentioned principles, the basic objectives of the earthquake related regulations after the 2009 L'Aquila earthquake were to allocate enough financial resources

and to implement new technical standards. During the previous decades, within the framework of "improving of knowledge," a few investigations and assessments took place in order to collect information about the condition of Italian buildings, their vulnerability and function, furthermore national ordinance was proclaimed for the evaluation of seismic behaviour, resilience and level of safety of different constructions. These measures are inevitable for planning, establishing priorities and creating strategies. In regard to the high seismic risk and vulnerability of Central Italy, within the framework of civil protection, some precautions were implemented in order to protect human life and mitigate potential losses.

Post-earthquake investigations included major focus on the damage of school buildings, because the local school in Amatrice suffered serious damage and collapsed in 2016, despite being a newly built building constructed in 2012. The same situation happened with the school of S. Giuliano after a devastating earthquake struck in 2002. The experience with regard to the poor seismic performance of school buildings in Italy led the government to establish a retrofitting program for improving the seismic resilience of schools in high-risk seismic zones in Italy. The Government provided the funds in several phases in order to retrofit the endangered school buildings from 2003. Within the framework of National Seismic Prevention Program, the Amatrice earthquake was preceded by great efforts and enormous investment for improving the seismic safety of school buildings and other important public facilities. On the other hand, previous Italian earthquake disasters pointed out that the damage and collapse of privately-owned dwelling buildings are responsible for most of the casualties, thus it has become evident that despite public facilities private dwellings need to be retrofitted, too, by encouraging private owners to strengthen their homes. Therefore, the National Seismic Prevention Program was extended to strategically important buildings and facilities, furthermore the necessity of retrofitting or reconstructing existing private buildings was realized. [12]

One of the first and most important steps of the Italian National Seismic Prevention Program was the selection of public and private buildings to be retrofitted by new technologies. After the devastating Central Italy earthquake in 2002, participating public buildings were selected by their location, function and a seismic safety revision, which was carried out to evaluate the level of vulnerability. The governmental contribution and subsidy for strengthening private dwellings were different, since these efforts focused on incitement rather than total financial contribution. The selection of participating private dwellings was more complicated than public buildings due to the fact that the vast majority of privately owned buildings did not dispose of risk analysis or safety assessment. The first filter criteria was hazard classification, while the second was the features of the building, including location, age, technology of construction or number of people exposed. A great number of domestic masonry buildings required local strengthening besides the general, regulated seismic upgrading interventions in order to increase the constructions' seismic safety level. According to State legislation, applying comprehensive seismic upgrading, an increase of minimum 20% of safety level had to be reached per construction during the safety verification. Local strengthening or interventions intend to retrofit single structural elements or particular parts of the building constructions to prevent fractures and dislocations and out-of-plane loads in local structural elements without the modification of basic structural features, because in most cases these anomalies are responsible for the collapse of buildings. on the other hand, the former seismic incidents clearly indicated that without strengthening measures falling insulation, chimneys, cantilevers, parapet walls, external supporting walls or other roof structural elements can cause

fatalities and severe injuries. These local interventions did not imply the complex evaluation of the seismic behaviour of the entire construction; the only parts which had to be tested were the resilience, shear and ductility of the retrofitted structural element such as beams, columns, and joints of other load-bearing elements.

As the result of the State's prevention program, a good example for the implementation of successful earthquake resistant design is the small Italian town called Norcia located only 17 km away from the epicentre of the August 2016 earthquake. Not a single dead or injured person was registered, furthermore only a few buildings were damaged during the devastating seismic event. The reason is quite simple and in close connection with the national seismic prevention program, as many buildings had been reinforced after powerful earthquake events hit the territory in the previous decades. However, despite precautionary measures two months after the August 24$^{th}$, 2016 incident, a devastating earthquake with the strength of M 6.6 destroyed the ancient stone masonry basilica of St. Benedict in Norcia. [13]

As the consequence of former earthquake incidents, within the framework of Italian national retrofitting program local strengthening has been widely used on unreinforced masonry in private and public buildings, which fulfils determined and specific conditions through the solutions discussed in the following chapter. [12]

## Strengthening Old, Unreinforced Masonry Buildings

In view of the foregoing, it has been established that Italy is among those countries presenting significant historical values, where the high degree of seismic risk is the consequence of the fact that the substantial proportion of buildings were constructed more than a century ago including mostly unreinforced masonry buildings. Despite being part of cultural heritage, a great number of people live in these houses as their homes. Due to the old technology of construction and usage of locally available materials, these buildings are disposed to seismic damage even during a moderate earthquake. Each construction has special, unknown characteristics. Furthermore, strong deficiencies are present in the education and professional practice concerning old masonry constructions, because recent studies and projects focus on modern steel and concrete structures. [14] In these historical towns or cities, reducing the vulnerability of old masonry buildings to seismic impacts is among the most important measures of public protection in which the State plays a very important role from legislation to operational inventions. The objectives in retrofitting old heritage masonry buildings are complex, since through local strengthening the result is supposed to withstand seismic impacts (or reduce vulnerability) and need to preserve the values of cultural heritage at the same time. Furthermore, providing the conditions of adequate maintenance is also an inevitable task for long term solutions, moreover Italian examples also proved that poor maintenance is itself sufficient for building collapses during earthquakes. [14]

As I mentioned, the seismic behaviour of unreinforced masonry buildings (URM buildings from now on) significantly differs from other traditional concrete or light steel frame structures depending on the age, condition and building material. Based on the experiences of building damages due to Italian and other European earthquakes, the typical seismic damages of URM buildings are the following:

- huge and deep cracks on vertical building structures by lateral loads and torsion stresses,
- fractures and extensive detachments along connections by horizontal shear loads, [15]

- fall of big structural elements (external cladding, wall parts, parapet walls, facade, arch keystones or chimneys, etc.),
- collapse of unconnected intersecting walls exposed to out-of-plane bending,
- failure of walls due to excessive surface of wall openings,
- collapse of load bearing horizontal structures as the consequence of low lateral strength and excessive in-plane loads. [16]

Similarly to exposure and vulnerability, strengthening methods also differ from recently applied, prevalent constructions, since the vast majority of research focus on new seismic resistant technologies and strengthening methods on existing modern buildings in spite of the fact that the ratio of old URM constructions in European urban areas is considerably high. The traditional technique for retrofitting URM buildings is the application of recently used repair materials which act more favourable behaviour against seismic forces. This method needs to ensure the physical cohesion of the original and newly built materials to prevent cracks and dispatches between them. In most cases, modern techniques are more effectively implemented by the usage of steel, carbon, fiberglass or concrete strengthening elements or energy dissipating structures and devices. The latter—for instance base isolation—in most cases is not feasible in existing building constructions or requires overly expensive and significant volume of interventions. The basic principal of strengthening interventions is to increase the load carrying capacity of the connections of structural elements, which can be implemented by bracing and anchoring. [14] On the other hand, another important objective is to create the conditions for the 3-dimensional motion of the structural elements by the interventions. The successful implementation of local strengthening on URM buildings by modern techniques, above all, makes it necessary to carry out thorough analysis and assessment of each URM structures. In view of these principals, implementing retrofitting projects for URM buildings through risk management strategies requires the following main steps:

1. Identification of the level of seismic risk and the evaluation of seismic activity and hazard.
2. Ensure financial funds or support private owners in seismic retrofitting.
3. Evaluation of construction including limit thresholds, seismic performance related to properties like ductility, dissipation or flexibility, material composition, quality and state of integrity. Besides the necessity of detailed description about the URM construction, diagnosis of sensitivity and behaviour for seismic loads is also reasonable. [17] Material assessment requires laboratory testing, while the evaluation of safety is based on numerical modelling and qualitative methods. [14]
4. Testing and modelling of local strengthening or retrofitting techniques in order to identify the most effective feasible method.
5. Implementation of strengthening interventions.
6. Results should be incorporated into technical specifications, regulations and risk management strategies considering the fact that effectiveness can only be tested during seismic events. Furthermore, the final step shall extend to providing handbooks and guidelines for private owners and professionals about retrofitting projects. [14]

The specific conditions mentioned above differ in case of unreinforced masonry buildings and reinforced concrete or steel structures depending on age, size, layout, condition, previous

damage, structural modifications, foundation or the compressive stress that can be measured in vertical structural elements.

## Solutions for Retrofitting URM Buildings

As this study mentioned before, one of the most critical weak points of URM constructions is the structural connection, thus strengthening joints was an important goal in Italian and other retrofitting strategies. Regarding the Italian State programs and legislation, the most widespread technical solutions for improving structural connections to contribute to monolithic response of URM buildings to seismic impacts are the following.

### *Tie-Rods*

It is vital that an important factor of modern seismic-resistant building techniques is transferring horizontal loads into the walls placed in the direction of seismic waves and then to the basement through the structural elements provided with adequate, stiffened connections. On the other hand, another essential aspect of local strengthening is providing three-dimensional, unified movement of structural elements without separation and crack in connections, which makes the masonry building more resistant to out-of-plane effects of seismic waves.

Using metallic tie-rods fixed along the longitudinal and lateral masonry building elements (Figure 1) is among the most favourable solutions to meet the above-mentioned requirements. in most cases the tie-rods are installed in the interior of floor levels and anchored by bearing plates on the surface of exterior walls. Another way for strengthening the wall connections with tie-rods is installing circumferential tie-rods on the exterior surface of the walls. The tie-rods are usually made of stainless steel, composite material or fibre reinforced polymer. [18]

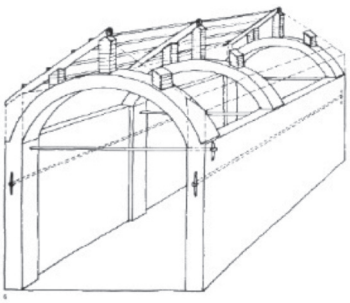

*Figure 1. Implementing structural connections by metallic tie-rods.* [18]

### *Steel Ties*

Using horizontal steel ties for local seismic strengthening contributes for the prevention of out-of-plane failure of walls by fixing floor joist to external walls. (Figure 2) This solution increases the flexural strength of the building and helps the construction's three-dimensional movement during seismic shock, thus avoiding collapse and the separation of load-bearing elements from each other. In addition, as the steel ties fixing the outer leaf to the robust wall

structure are anchored from the external walls. This technology prevents the peeling and falling of the outer layer cavity wall. Steel ties were effectively applied for example in Italian and New Zealand retrofitting programs, too. [19] This solution is sometimes implemented by the disconnection and reconnection of adjacent structural elements. Using steel ties has a particularly favourable result on stone masonry buildings. [18]

*Figure 2. Using steel ties for increasing flexural strength and reinforcing outer structural elements.* [19]

## *Ring Beams*

Another effective solution for improving wall to wall and wall to roof connections is the installation of ring beams made of reinforced masonry, steel or reinforced concrete. A reinforced masonry ring beam is implemented by steel reinforcement in cement mortar connected to the existing wall. (Figure 3) This method is usually applied on good quality masonry material, like brick. As an alternate solution, using steel ring beams is the simple local strengthening method for wall to roof connections, like wood to masonry. Installing steel truss or steel plates connected with bars and rods through the walls are wide dispersive solutions for steel ring beams. Drilled or grouted reinforced steel bars furthermore ensure fix connections of steel ring beams in case of installing them on both sides at the top of the wall. Another effective solution of ring beams for masonry constructions is the reinforced concrete ring beam connected to the existing wall by grouted or drilled ring bars. This reinforcement is primarily useful to avoid the excessive increase of tangential loads between the ring beam and the wall.

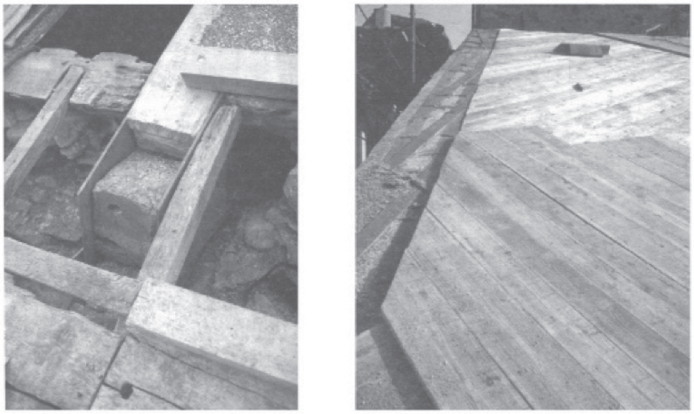

*Figure 3. Strengthening the connections with steel ring beams between the wood roof element and the walls.* [18]

### *Carbon Fibre Reinforced Polymer (CFRP) Wrapping*

This solution is used for reinforcing rigid concrete or masonry columns and beam-column joints by wrapping around or covering them with fibre layers. The most important features and functions of this technology are ductility, high deformation and shear capacity, good corrosion resistance in order to improve the loading resistance of beam-column connections and prevent fracture and failure in axial compression inside the load bearing columns. [20]

## The Implementation of Public Protection and Safety Programs to Prevent Earthquake Disasters

In the implementation of earthquake precautionary and preparedness measures, the role of the State covers the following three principal tasks:

- the determination of types of measures and the establishment of regulatory and operational conditions (seismic codes, construction standards, maintenance);
- the recognition and determination of priorities in the affected territories;
- and providing resources and financial funds.

In practice, the determination of types of measures covers the technologies and precautionary interventions, which are necessary to enhance the level of safety. Furthermore, threat assessment, previous earthquake incidents and other seismic events and prevention efforts that took place in the surrounding areas have a major role to play in this context. Regarding the fact that in most cases planned interventions concern the private property of the population, in effective prevention programs the involvement of residents and private owners is essential. in this context, incitement, financial support, comprehensive preparedness and dissemination of information about risk, possibilities and future steps are among the most important governmental issues.

Another important aspect is the selection of target areas and priorities in the light of risk and vulnerability within the framework of public protection. Regarding the assessments and evaluations of old towns and cities like Budapest in Hungary or many others in Italy, the main reason for vulnerability originates from the deteriorating condition of old masonry buildings, unfavourable subsoil conditions, high degree of built-up space and high density of population in central urban areas. The best way for the identification of priorities is risk mapping, which concerns seismic zone maps based on peak horizontal acceleration values and details about building constructions exposed to seismic hazard. Besides the target fields of the prevention interventions, this type of digital mapping system facilitates the operational decision-making processes, defence planning and the implementation of rescue actions. The use of a spatial information system shall provide accurate data about the number of residents, the function of buildings, technologies of construction and previous strengthening or structural modifications about each building in a designated settlement, part of a city or a specific planning area. This type of seismic risk mapping furthermore contributes to the preparation of seismic codes for existing URM constructions including multi-storey dwelling-houses and cultural heritage buildings.

In order to ensure the conditions of the above-mentioned provisions on State level, in close relationship with governmental innovational strategies, defence management should comprise a flexible institution system and "innovation-friendly" legislation, furthermore these provisions and objectives should be built into policy strategies. Within the framework of defence management, the infrastructure or technologies should be built on innovative services in which international knowledge transfer, local territorial features and needs are taken into account.

Regarding the constant flow and extension of knowledge, another aspect for developing preparedness and the level of efficiency of prevention both in Italy and Hungary is the necessity of guidelines and handbooks for the inhabitants and professionals as well. This approach is particularly due within engineering education, since courses and forms of training related to architecture mainly deal with modern steel and reinforced concrete structures and the lack of knowledge related to specific innovative anti-seismic technologies and historical URM constructions results in a large gap in sufficient expertise and the understanding of seismic performance of historic and old masonry constructions. [21]

## Summary

Regarding earthquakes as the result of natural geophysical processes, the cause of their formation cannot be influenced by human factors; therefore, risk must be taken into account. However, through adequate public protection programs and interventions implemented by the Government, seismic risk can be significantly decreased.

There is a close connection between the tectonic processes formed in the territory of Italy and the Pannonian basin even if the central region of Italy is exposed to higher seismic hazard, which can be considered significant at a European level as well.

Analysing the seismic vulnerability and post-earthquake risk mitigation strategies and efforts, it has been established that the main reason for vulnerability in old historical towns and urban areas originated from the high proportion of existing unreinforced masonry buildings. This indicates the necessity of retrofitting programs, local strengthening and adequate main-

tenance of these buildings in order to fulfil the most basic requirement of public protection, which is considered the protection of human life. In this context, following the provisions and retrofitting programs implemented in Italy, the consequences can be built into governmental defence and prevention programs, national legislation and innovational strategies. In addition, this study makes a number of suggestions for criteria, aspects and development opportunities, which contribute to decision-making and prioritization of interventions. In close correlation with these measures, the involvement, participation and preparation of residents, furthermore enhancing the knowledge about existing URM constructions should be treated as an important factor as well.

## References


[1] HORNYACSEK J.: A lakosság védelmének újszerű értelmezése és alkalmazási lehetőségei a New Orleans-i Katrina hurrikán eseményeinek tapasztalata alapján. (The new understanding of the civil protection and recommendations on its use with the help of the example of the events of Hurricane Katrina in New Orleans.) *Műszaki Katonai Közlöny,* 21 1–4 (2011), 370–393.

[2] *Act No. CXXVIII of 2011 concerning disaster management and amending certain related acts.*

[3] KOZÁK A., HORNYACSEK J.: A polgári védelem kialakulása, szerepe a katasztrófavédelem egységes rendszerében. (The development of civil protection, its role in the uniform system of disaster management.) *Bolyai Szemle,* 21 2 (2012), 157–184. http://uni-nke.hu/downloads/bsz/bszemle2012/2/10.pdf (Downloaded: 25 01 2017).

[4] European Commission, Humanitarian Aid and Civil Protection: *EU Civil Protection, Echo Factsheet.* October, 2016. http://ec.europa.eu/echo/files/aid/countries/factsheets/thematic/civil_protection_en.pdf (Downloaded: 25 01 2017).

[5] *Code of Federal Regulations, National Defense parts 700 to 799, National Archives of the United States.* Washington, January 1st, 1972, 253.

[6] BLANCHARD, B. W.: *Hazards, Disasters and U.S. Emergency Management: An Introduction. Select Emergency Management-Related Terms & Definitions Course.* July 28, 2006. http://training.fema.gov/ (Downloaded: 29 01 2017).

[7] *The Management of Disasters.* Tokyo: Waseda University, s.d. www.waseda.jp/gsaps/eaui/educational_program/PDF_WS2015/Lecture1_Reading2_Zha.pdf (Downloaded: 03 02 2017).

[8] *The Effects of Earthquakes on Buildings.* HUN-Reng Hungarian Earthquake Information System. www.foldrenges.hu/index.php?option=com_content&view=article&id=20:foeldrengesek-hatasa-epueletekre&catid=1:altalanos-fogalmak&Itemid=23 (Downloaded: 10 02 2017).

[9] USGS Science for a changing Word: *Worldwide Earthquakes 2000–2015. Earthquake Statistics.* https://earthquake.usgs.gov/earthquakes/browse/stats.php (Downloaded: 10 02 2017).

[10] PAUL, N., AUSTIN, B.: *Summary of Impacts to Lifelines and Utilities from the August 24, 2016 Amatrice, Italy Earthquake, Central Italy Earthquake Clearinghouse.* September 14, 2016. www.eqclearinghouse.org/2016-08-24-italy/2016/09/14/summary-of-impacts-to-

lifelines-and-utilities-from-the-august-24-2016-amatrice-italy-earthquake/ (Downloaded: 15 02 2017).

[11] MURRU, M., TARONI, M., AKINICI, FALCONE, G.: What Is the Impact of the August 24, 2016 Amatrice Earthquake on the Seismic Hazard Assessment in Central Italy? *Annals of Geophysics*, 59 5 (2016). www.annalsofgeophysics.eu/index.php/annals/article/view/7209 (Downloaded: 15 02 2017). DOI: https://doi.org/10.4401/ag-7209

[12] DOLCE, M.: The Italian National Seismic Prevention Program, Italian Civil Protection Department, Rome. *15th World Conference on Earthquake Engineering.* Lisbon, 24–28 September, 2012.

[13] POLITI, D.: Italy's Strongest Earthquake in 36 Years Destroys Ancient Basilica. *Slate*, 30 October 2016. www.slate.com/blogs/the_slatest/2016/10/30/italy_s_strongest_earthquake_in_36_years_destroys_ancient_basilica_but_claims.html (Downloaded: 20 02 2017).

[14] Seismic Retrofitting, Conservation Perspectives. *The GCI Newsletter,* 3 1 (2015). www.getty.edu/conservation/publications_resources/newsletters/30_1/ (Downloaded: 20 02 2017).

[15] MUCCIARELLA, M., INDIRLI, M., CLEMENTE, P.: Conventional and Innovative Restoration of the Apagni Romanesque Church, Damaged by the 1997 Marche-Umbra Earthquake. *7th International Seminar on Seismic Isolation, Passive Energy Dissipation and Active Control of Vibrations of Structures Assisi.* Italy, October 2–5, 2001.

[16] TAMA, Y. S., SOLAK, A., CENTINKAYA, N., SEN, G., YILMAZ, S., KAPLAN, H.: Damages to Unreinforced Masonry Buildings by the Van Earthquakes of 23 October and 9 November 2011. *Natural Hazards and Earth System Sciences,* 13 (2013), 329–337. www.nat-hazards-earth-syst-sci.net/13/329/2013/nhess-13-329-2013.pdf (Downloaded: 25 02 2017). DOI: https://doi.org/10.5194/nhess-13-329-2013

[17] LOURENCO, P. B., ROCA P., MODENA C., OLIVEIRA, D. V.: *Reducing the Seismic Vulnerability of Cultural Heritage Buildings.* https://repositorium.sdum.uminho.pt/bitstream/1822/8329/1/Lourenco11.pdf (Downloaded: 25 02 2017).

[18] FRUMENTO, S., GIOVINAZZI, S., LAGOMARSINO, S., PODESTÁ, S.: Seismic Retrofitting of Unreinforced Masonry Buildings in Italy. *75 Years of Seismic Design in New Zealand – NZSEE Conference.* New Zealand, 2006. www.researchgate.net/profile/Sergio_Lagomarsino/publication/44897662_Seismic_Retrofitting_of_Unreinforced_Masonry_Buildings_in_Italy/links/00b7d5211bd5ce2473000000.pdf (Downloaded: 28 02 2017).

[19] TURNER, F.: *The Performance of Unreinforced Masonry Buildings in the 2010/2011 Canterbury Earthquake Swarm: Techniques for Seismic Improvement of Unreinforced Masonry Buildings.* Canterbury Earthquake Royal Commission, September 2011. http://canterbury.royalcommission.govt.nz/documents-by-key/20110920.46/$file/ENG.ACA.0001F.pdf (Downloaded: 10 03 2017).

[20] MASIA, M. J., SHRIVE, N. G.: Carbon Fibre Reinforced Polymer Wrapping for the Rehabilitation of Masonry Columns. *Canadian Journal of Civil Engineering*, 30 4 (2011), 734–744.

[21] MILTIADU-FEZANS, A., OCHENSDORF, J.: Mastering the Mechanics of the Past: A Discussion About Preserving Engineering, Seismic Retrofitting, Conservation Perspectives. *The GCI Newsletter,* 3 1 (2015). www.getty.edu/conservation/publications_resources/newsletters/30_1/ (Downloaded: 10 03 2017).

AARMS Vol. 16, No. 2 (2017) 83–95. **10.32565/ aarms.2017.2.6**

# Quo Vadis Sustainable Military Operations?[1]

Mihály NYITRAI[2]

*"Sustainability is not a distinct program or initiative within the Army; it is an organizing principle being instilled in everything the Army does to support its mission, including planning, training, equipping, and operations."* [1]

*Nowadays a well-prepared army must be able not just to rapidly deploy and fight with success but also to sustain itself for a certain period in a challenging environment. For this reason, there is no question that sustainability plays a crucial role in military operations. In addition to sustainability, there are other aspects, like reducing costs and environmental protection, which are associated as well with military activities accompanying the technology development. Sustainable development seems to be a magic expression and stands at the head of the most interesting and researched questions of all societies and organizations of science, and the army is not an exception to this tendency. The high energy consumption of modern military technology and equipment is widely known. Energy for the equipment, water for the personnel, and for both waste management. This paper examines how these ambitions, energy security and sustainability take shape in military operations.*

**Keywords:** *sustainability, military operations, energy security, environment, operational logistics*

## Introduction

Since the end of the Cold War the world has changed a lot. This statement concerns not only ever-changing nature and human society but military operations as well. In addition, because of some specific requirements, nowadays a soldier and his equipment have more capabilities than they had many decades ago, making today's army more ready and resilient. For example, a soldier can provide power resupply for his battery load giving it 72-hour endurance while on the move or to his mounted platforms to which have been added protection and command[3] capabilities. Despite their advanced technology, these capability changes demand more energy[4] or at least an increased efficiency in the use. Miniaturization or a combination of these capabilities into a single device offers only one option to reduce the power demands, other ways could be opened up by using a new type of energy, the main characteristic of which is renewability. [1] So, what actually are the main drivers for these changes and what do they

[1] „The work was created in commission of the National University of Public Service under the priority project KÖFOP-2.1.2-VEKOP-15-2016-00001 titled "Public Service Development Establishing Good Governance" in the Ludovika Research Group Program."

[2] Practical instructor, National University of Public Service, Faculty of Military Science and Officer Training; e-mail: nyitrai.mihaly@uni-nke.hu

[3] e.g. Joint Tactical Radio System

[4] Fuel, electricity, etc.

bring for the actual military operations? There are driving factors: environmental protection[5] with climate change in its background and the limited access to natural resources.

In 1987, the idea of Sustainable Development (SD) was born, defined by the Brundtland Commission. [2] The thought behind this notion was the recognition that resources available for mankind's development are not without end. According to the definition of sustainable development "the needs of the present must be met without compromising the ability of future generations to meet their own needs." [3] The Brundtland Report[6] meant a start for a new era of a socially and environmentally acceptable, sustainable economic growth. [2] The report had and continues to have deep long-term impact on our everyday life including military operations. Governments and international organizations started to establish different goals, build up widespread programs on energy security[7] and sustainability. Regarding energy security ambitions usually they are pursuing either to reduce the use of petroleum or to increase the consumption rate from renewable sources,[8] which are first on the list of alternative energy.[9]

The energy hunger of modern military technology and equipment is widely known. Energy for the equipment, water for the personnel, and waste management for both. This paper in the next chapters examines, how United Nations' ambitions for energy security and sustainability take shape in military operations.

## Operational Energy and Sustainability

During slightly longer military operations, it becomes clear quickly that being ready, effective and resilient is not so easy to achieve and maintain. Long supply chains are costly and jeopardize the army's ability to complete its missions, in which a unit's endurance, flexibility and freedom of action are highly appreciated. The army is one of the biggest fuel consumers around the world and its reliance on fuel deepens its operational vulnerability, which stems from operating with platforms and systems that require assured access to large amounts of fuel. Recent experiences in Iraq and Afghanistan proved that the delivery of fuels were often costly both in terms of casualties and finances. Afghanistan not only lacks proper infrastructure and has challenging geography, but due to increased roadside bomb attacks, it is a dangerous country, too. As a landlocked country, the fuel is transported by road, from

---

5 Environmental protection is not a subject of this paper, yet a main theme, in military terms, is the reduction of operational footprint on the environment by incorporating Life Cycle Management (LCM) in defence procurement, treating end-of-life material and cutting emission of Greenhouse Gases (GHG). By making decisions affecting the environment, the military contingencies and the army itself have the same responsibility to the population and the nation to protect and preserve their environmental resources as the civil sector.

6 "Our Common Future".

7 Energy Security: "Having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet mission essential requirements." [31: para 2924 (3)(A)]

8 It is only a matter of time before oil reserves run out, therefore, we need to find other energy supplies than fossil fuels. It should be mentioned here that according to some opinions the decreasing level of common energy supplies like fossil fuels in the future generates additional tensions, conflicts over the remaining resources, which implicates more military involvements with a higher rate of energy (fuel) consumption. So the whole process could turn into a self-reinforcing loop if we do not pay attention.

9 Another option for alternative energy source provision could be the development of hydraulic fracking for recovering gas and oil from shale rock. This kind of energy source is already remapping the economy and energy sector.

Karachi (Pakistan), where the fuel tankers for the US troops arrive to the storage locations in Afghanistan. The military transport distributed this fuel to forward operating bases through long lines of logistics.[10] [5] According to a 2009 report, in Afghanistan US forces suffered one casualty for every 24 fuel resupply convoys, on this basis 170 US service members were killed or wounded in action securing fuel convoys in 2007 alone.[11] Plus, transporting that fuel miles into battlefields along risky and dangerous routes raised the cost of a $1.04 gallon up to $400 or even more.[12] [5] Deloitte[13] conducted a study of energy use in wartime from World War II through the current wars on the Middle East, and found that there has been a 175% increase in gallons of fuel consumed per U.S. soldier per day since the Vietnam conflict, which means an average annual increase of 2.6% in the last 40 years and with an expected 1.5% annual growth rate through 2017.[14] [7: Sec1 1] Therefore, it was no wonder that new operational energy and technologies[15] have begun to take shape on the battlefields.

This new type of energy used during military activities, regardless of its nature, started to be called "operational." This operational energy increases the troops' endurance to operate on the field and cuts the number of casualties by reducing the risk originated from moving fuel. [8] But different army components (Land, Navy, Air Force, Marine Corps) require different approaches to operational energy, inasmuch as they are facing different operational challenges. Just for common and broader understanding, each form and type of energy (not only the new ones) used in military operations is called "operational." Of course, the really new operational energy has a determinant characteristic feature of renewability, but each of them—regardless of their nature—must adapt the principles of high effectiveness and efficiency. For this reason, only those forms and types of energy could be used for military purpose, which respect these principles. Having higher effectiveness or efficiency like the Improved Turbine Engine means less consumption, fewer resupply convoys, less risk, less cost and fewer casualties with improved military capability.[16] But energy efficiency does not apply just to deployed operations. "We train like we fight, we fight like we train" is the main message. For this reason, it is important to have a closer look, how different world organizations (UN, NATO, EU) and their determinant member states with powerful and energy dependent economies regard the problem of energy security and sustainability.

---

[10] For many remote locations, the fuel supplies must be provided by air (in bladders carried by helicopters), which makes this way of supply even more expensive.

[11] It is estimated that 3,000 US soldiers were killed or wounded in attacks on fuel and water convoys in Iraq and Afghanistan between 2003 and 2007.

[12] For many Forward Operating Bases (FOBs) the fuel could have been provided by helicopters, which is the most expensive option for supply.

[13] "Deloitte" is a brand under which dedicated professionals in independent firms throughout the world collaborate to provide, among the other things, risk management.

[14] According to this study, the main reasons for this increase of fuel consumption were increased technological mechanization, the expeditionary nature of conflict and the rugged terrain.

[15] This technological advancement usually meant mainly solar cells, but it also pointed to improved engine efficiency, like Improved Turbine Engine (ITE) in Blackhawk and Apache helicopters. The former T700 helicopter engine was developed with 1960s technology and periodically upgraded. But despite all upgrades by 2003, the potential improvements had already been maximized and a new design was necessary to improve the engine's capabilities. The new ITE engine of the same or less weight expands operational range with increased payload and altitude through significant operational energy savings.

[16] Endurance, readiness, unit autonomy, resilience.

## United Nations: Greening the Blue Helmets

On 5 June, 2007, UN Secretary General Ban Ki-moon called on all UN related organizations to "go green and become climate neutral." In October 2007, at the meeting of the UN System Chief Executives Board for Coordination the Executive Heads of UN agencies, funds and programs agreed to estimate the UN GHG emission consistent with international standards and undertake efforts to reduce the emissions. "Greening the Blue" is an official UN campaign to achieve a more sustainable United Nations. [9]

The Greenhouse Gas inventory of UN peacekeeping operations, which rely almost exclusively on petrol and diesel fuel for generators, and the 17,000 vehicle fleet as well as jet A1 fuel for the 257 UN aircraft[17] found that they contribute 56% of the UN system's total climate footprint of approximately 1.75 million tons of CO2 equivalent per year. So, the major source of UN GHG emission is the significant fuel consumption,[18] creating a substantial cost as well.[19] In converting this GHG emission per UN personnel per year, the most interesting finding was that the UN missions behave like people living in developed countries and greatly surpass the host country's GHG footprint per capita per year.

*Table 1. Emission Inventory for 20 peacekeeping missions: 972,304 tons $CO_2$ equivalent (2008).* [10: 29]

| **Source of emissions** | **Percentage** |
|---|---|
| Air travel (troop rotation, UN air fleet and commercial) | 46% |
| Power generation | 26% |
| Road vehicles | 15% |
| Refrigeration/air conditioning | 9% |
| Purchased electricity | 4% |
| Other emissions | < 1% |

Inasmuch as UN military operations are set up in technologically less developed countries and regions not having a proper power grid, something had to be done. For example, the UN logistics base in Brindisi is piloting around forty electric cars, forklifts and reach trucks. Due to the "Greening the Blue" program the UN vehicles either are to be purchased according to fuel efficiency standards or electric cars, forklifts are to be used.[20]

Another way to reduce fuel consumption is to operate CarLog systems monitoring fuel consumption and speeds. A committee monitors energy use and informs staff of wasteful practices (idling times of vehicles, heating and cooling units set not at efficient temperatures, etc.).

---

17 Troop deployment, rotations, road transport, power generation, etc.

18 On the basis of a US Army Environmental Policy Institute (USAEPI) study which found that for every one litre of fuel used in remote bases, more than 6 litres of fuel were used to transport it. Adding to this finding, 70% of all tonnage shipped to these remote bases was fuel.

19 The costs of fuel resupply can be calculated (see later) not only in dollars, but also in lives. So decreasing fuel consumption with raising efficiency has the potential to lower casualty rates.

20 UNIFIL—United Nations Interim Force in Lebanon; actually uses 10 electric cars in UNIFIL headquarters in Naquora.

This CarLog system[21] in Timor-Leste[22] has led to a 22% drop in UNMIT vehicle idling times and 15% drop in energy consumption over 12 months.[23] [10: 29]

In the pursuit of ambitions to reduce its own GHG emission and help the regions of UN peacekeeping operations meet their energy needs, the UN has also other projects to implement. In this area of renewable energy, the UN has laid down a way forward. One of the latest outcomes in the field of using renewable energy for UN military installation and operations is a solar farm in Naqoura (Lebanon), the solar energy of which powers a UNIFIL base. [11] According to the UN Environment Programme (UNEP)—which issued the Global Trends in Renewable Energy Investment 2016 publication—it noted the annual global investment (265,8 Mrd$) in new renewable capacity was more than double the estimated investments (130 Mrd$) in coal and gas power stations in 2015. [12] As comparative data from UN peacekeeping operations show, the capital investment for some renewable technologies could be recovered in up to 5 years. [10: 31]

Not only in Africa but all over the world water is a key issue. For planning purposes, the UN Department of Field Support estimates water use at 84 litres per person per day.[24] Over a course of a year a peacekeeping operation of 15,000 personnel would consume 459,900,000 litres.[25] [10: 26] For this reason it is vital for a mission to find a feasible solution for water supply. Water quality, of course, is an important issue solved usually by the use of UN-contracted water treatment plants.[26] But there are other solutions for improved water use, like setting up rainwater tanks. The use of rainwater tanks is the less expensive way to access the water. Although these rainwater tanks are relatively low-cost tools, they are not used at most UN missions. One of the exceptions is United Nations Mission in Sudan (UNMIS). The mission has installed 5,000 and 10,000 litre rainwater collection tanks to supply non-potable uses (toilets, laundry, washing equipment, irrigation, dust suppression, etc.). But rainwater combining with careful collection and filtration can be used for potable purposes also. [10: 26] it is quite a new image to see wastewater treatment units in UN peacekeeping missions, and used to reduce demands for external water resources. Nevertheless, this is the case for African Union/United Nations Hybrid operation in Darfur (UNAMID),[27] which operates 106 of these units, each of them capable of treating the grey and black water generated by 200 people. Reducing annual freshwater use by up to 40%, the final product is satisfactory for activities with limited human contact such as toilets, fire-fighting and irrigation. [10: 37]

---

21 Plus the application of awareness stickers to vehicle windscreens.

22 UNMIT—United Nations Integrated Mission in Timor-Leste.

23 A common rule of thumb says that 1 degree of reduced artificial heating/cooling demand translates to 5% savings in energy use for heating/cooling the building. Usage of 50,000 litres equates to an annual savings of USD 360,000.

24 This amount of 84 litres can be compared to the UNHCR recommendation for water in refugee situations of 15 litres per person per day, and an absolute survival minimum of 7 litres.

25 In such a way, it can be seen that a mission can easily exacerbate local water scarcity using ground or surface water at rates beyond the ability of the natural system to recharge.

26 In case of having own UN water infrastructure, at the closure of a mission, the infrastructure can be handed over to local communities.

27 UNAMID is a mission of some 20,000 uniformed personnel. High temperatures ensure a high demand for potable water for everybody including the local community, which might see the peacekeepers as resource competitors. The local water supply is scarce because of inadequate groundwater recharge, low annual rainfall and competing demands from local agricultural communities. So everything is given to establish such wastewater treatment units.

One of the Millennium Development Goals[28] is to ensure environmental sustainability. [14] In the year 2015,[29] UN Member States adopted a new sustainable development agenda *Transforming our world: The 2030 Agenda for Sustainable Development*[30] with 17 Sustainable Development Goals and 169 targets. [15] Among these 17 goals are to ensure availability and sustainable management of water and access to affordable, reliable, sustainable, modern energy. [16] So the security concerns need to be embedded in sustainable development. Currently, the Department of Peacekeeping Operations (DPKO) runs 16 peacekeeping operations consisting of almost 100,000 military personnel that needs around 2.2 million gallons of fresh water per day. It is a huge amount of water to provide. Of course, nowadays, several water efficient technologies exist to reduce consumption, but sometimes they do not even require any investment, they simply make personnel pay attention to water use. It was found that token operated showers UN Mission in South Sudan (UNMISS) can half the water consumption during a 10-minute shower.[31] Very low-cost rainwater tanks are installed either for non-potable water use activities or combined with proper filtration and careful collection to supply potable use. [10: 28] It must be added that sometimes wastewater investments are just one side of the coin. The other one is the mission staff's education about the proper use to avoid having water-borne diseases and to overcome certain cultural barriers.

In 2012, at the Rio+20 Conference Member States requested the UN to improve the management of facilities and operations by taking into account sustainable development practices. [32: para 96] In September 2014, it was stated by the Secretary General that the UN will be climate neutral by 2020. With the participation of DPKO and the Department of Field Support (DFS) there is a UN-wide working group on sustainability management.

## NATO: Framework for Green Defence

In February 2014, the NATO Defence Policy and Planning Committee agreed to the NATO Framework for Green Defence, which provides a basis for Member States to cooperate on green solutions for defence. Later, in 2016 the NATO Member States in the Warsaw Summit Declaration stated also that they would further improve the energy efficiency of their forces through establishing common standards, reducing dependence on fossil fuels and demonstrating energy-efficient solutions. [17] These steps were necessary because till that the development of green policies and strategies had primarily been a national concern. For the NATO Green Defence Framework there is no new imperative than those mentioned above for UN operations.[32]

Fuel consumption before the Afghanistan (2001) and Iraq (2003) operations was not considered a distinct operational problem. When these operations continued, it became clear that the

---

28 As a side note, according to the World Bank and the Office of Disarmament Affairs (ODA), only about 5% of the amount of money spent on the defence sector ($4.7 billion a day or $249 per person) would be needed each year to achieve the Millennium Development Goals by 2015.

29 25 September, 2015.

30 The Agenda has five pillars (5P): Peace, People, Planet, Prosperity and Partnerships.

31 Because of severe climate conditions, the mission is a UN "spearhead" of water efficient technologies. Besides token operated showers, waterless urinals are pilot tested in UNMISS through funding from the Swedish Government. The mission in UNAMID operates wastewater treatment plants to supply non-potable uses.

32 Greenhouse gas emissions, fuel costs with hidden casualty costs, scarce local water supplies, etc.

provision of fuel used to power ground and air vehicles with advanced weapons, to surveillance and protection systems was a real challenge for logistic service personnel and cost a lot in dollars for taxpayers[33] and in lives for troops on the battlefields.[34] [8] For this reason, the development and use of alternative energy with increased efficiency can directly reduce wartime casualties.[35] In order to reduce casualty factors, the alliance should reduce troops' needs for resupply (fuel and water) convoys, which means increased energy efficiency, renewable energy use and onsite water production. Referring to the findings of the Sustain the Mission Project: Casualty Factors for Fuel and Water Resupply Convoys report by the US Army Environmental Policy Institute, a 10% reduction in fuel consumption over a five-year period could lead to a reduction of 35 fuel-related resupply casualties over the same period. [19] While it is not a question that energy saving can also save lives in the front line,[36] the military commanders should always find a healthy balance between vulnerability and supply efficiency. But next to casualties, there might be other reasons to move away (at least partially and to some extent) from fossil fuels, these are the likely disruptions of supply chains due to weather and possible political fallout. For example, in 2011, after a US airstrike killed 24 Pakistani soldiers, the country shut down the NATO supply routes for over a year. The closure of supply routes forced NATO to find alternative methods of moving supplies, 70% of which were fuel into Afghanistan. The fuel trucks already in the supply line were vulnerable. Up to 34 fuel and goods trucks—supplying NATO troops in Afghanistan and parking on a NATO temporary trucking terminal after the supply line was shut down—were destroyed in a rocket attack in Quetta, Pakistan. [20]

While the operations in Afghanistan and Iraq were continuing with increased financial and logistics burden,[37] the defence budgets of the NATO Member States started shrinking. This process encouraged the stakeholders to revise their energy consumption and find solutions for the shrinking defence budgetary problems. The solution found was renewable (green) energy itself. So, the defence expenditures started being associated with green solutions, while the latter's research and development required centralization and change of information on lessons learned. The NATO Green Defence concept in overall terms concerns military operations, defence expenditures, energy security and climate change.

---

33 Or to free up military resources for other missions.

34 Around 80% of US military casualties in Afghanistan are due to improvised explosive devices, many of which are placed in the path of supply convoys.

35 For example, the casualty factor for fuel resupplies in Afghanistan is 0.042, which means basically one casualty for every 24 fuel resupply convoys.

36 Lighter weapon systems mean more fuel savings, less resupply convoys and greater range with increased operational effectiveness but this could impose risk on troops by providing less capability to protect.

37 On 28 November, 2011, after a US airstrike killed 24 Pakistani border troops. In retaliation Pakistan closed its borders for seven months to supplies, 70% of which were fuel. During the closure, the US was forced to use more costly and lengthy routes through the former Soviet Union. As an additional consequence, in the next month up to 34 NATO fuel trucks were destroyed in a rocket attack on a NATO trucking terminal in Quetta. That time around 130,000 US-led international troops were fighting in Afghanistan.

*Table 2. The Green Defence concept, the associated security challenges, general and specific solutions. [8]*

| Concept | Security challenges | General solutions | Specific solutions |
|---|---|---|---|
| Green Defence | – military operations<br>– defence<br>– expenditures<br>– energy security<br>– climate change | – reduce energy demand<br>– increase and diversify energy supply<br>– adjust force structure and defence planning | New green technologies:<br>– more efficient combustion engines<br>– solar panels<br>Green strategies and management systems:<br>– green strategy for defence<br>– key performance parameters |

Regarding the security challenges in Table 2, it is quite interesting to mention the Net Zero Initiative of the US Army, which was announced in October 2010. The objective of this program is to make military installations net zero in terms of energy, water and solid waste. For energy, this means producing as much renewable energy on-site as they use in a year. For water, this means limitations for the consumption of fresh water resources and returning water to the same watershed, so as not to deplete the groundwater and surface water resources. For waste, this means that the military installation reduces, reuses and recovers waste streams, converting them to valuable, usable resources, disposing of no solid waste in landfills. The army invested more than $100 million of appropriated funds in energy efficiency and water conservation projects in 2013—an investment expected to save 500 billion British Thermal Unit (BTU) per year starting from 2014. [1]

In NATO, to address the challenge of energy security, Lithuania as a Framework Nation established[38] the NATO Energy Security Centre of Excellence[39] (ENSEC COE). One of the basic missions of NATO ENSEC COE is to provide energy security related solutions for the development of environmentally friendly and efficient military capabilities in support of NATO operations and forces through Smart Defence[40] and Energy.[41] For example, in June 2015, NATO ENSEC COE conducted the Capable Logistician 2015 exercise in Hungary. The exercise took place at Bakony Combat Training Centre near Veszprem with the support of NATO's Science for Peace and Security Programme. The exercise tested how the equipment interacts when using different energy-efficient technologies. The featured scenarios consisted of responding to power cuts, generators breaking down and diesel/water contamination. The technologies which were applied included inter alia, micro grids to improve a camps' energy management, renewable energy sources, such as wind and solar power, low-energy technologies for water purification, small portable fuel cells for NATO soldiers and LED lights. [23]

NATO places strong emphasis on scientific work and education as well. NATO's annual Energy Security Roundtable brings together experts from academia, international organiza-

[38] Created on 10 July 2012, and credited on 12 October, 2012.

[39] The organization is coordinated by NATO Allied Command Transformation in Norfolk.

[40] NATO Smart Defence is a cooperative way of generating modern defence capabilities that NATO needs in a more cost-efficient, effective and coherent manner. Through this culture of cooperation, Member States are encouraged to work together to develop and maintain military capabilities to undertake core tasks agreed to in NATO's Strategic Concept.

[41] *NATO Smart Energy* is a program to improve the energy efficiency of allied armed forces through a wide range of means, such as the increased use of renewable energy and better energy management.

tions and the private sector to discuss global energy developments and their security implications. In 2015 NATO conducted its first ever Energy Security Strategic Awareness Course at the NATO School in Oberammergau, with participants from allied and partner countries.

## European Union: Military Green and Energy Management

At the Gothenburg Summit in June 2001, EU leaders launched the first *EU Sustainable Development Strategy* (SDS). The Strategy set objectives for seven challenges for the period until 2010: climate change and clean energy; sustainable transport; sustainable consumption and production; conservation and management of natural resources, public health, social inclusion, demography and migration; global poverty and sustainable development challenges. In July 2009, the European Commission adopted the *2009 Review of the European Union Strategy for Sustainable Development*, [24: 2] according to which Sustainable Development was still set out as an overarching, long-term goal for the EU under the Lisbon Treaty. The Commission's communication—*Rio+20: Towards the green economy and better governance*[42]—from 2011 on also included sustainable development. The communication refers to the *Europe 2020 Strategy*, [25] launched in March 2010, and aiming at achieving "smart, sustainable and inclusive growth" as an effective tool for delivering sustainable development in the EU. The Strategy sets three key targets:

1. 20% cut in greenhouse gas emissions (from 1990 levels);
2. 20% of EU energy from renewables;
3. 20% improvement in energy efficiency.

The European Defence Agency (EDA) was established[43] to support the Member States and the Council in their effort to improve the European defence capabilities of the EU Member States in the field of crisis management and to foster cooperation to become more cost efficient. "Military Green"[44] is an initiative which is building on legislation and EU directives and an effort through the Agency[45] to achieve an environmentally acceptable defence. The initiative is aiming at establishing principles and responsibilities to meet the requirements of Environmental Protection during EU-led military operations. as the EU is committed to sustainable development and security, Military Green promotes good environmental management during military operations with reduced logistical burden on the forces. in 2014, next to "Military Green" the European Union Military Staff (EUMS) developed its *European Union Military Concept on Environmental Protection and Energy Efficiency for EU-led military operations* to provide strategic guidance for the consideration of environmental protection and energy efficiency. [26] The concept addresses not only energy efficiency but also the use of renewable energies during military operations. [27] For example, in 2015 energy

[42] In 1992, the Sustainable Development Strategy was approved by more than 170 state representatives at the UN World Summit in Rio de Janeiro. Twenty years later in 2012, a UN Conference marked the 20th anniversary of this 1992 UN Conference on Environment and Development. The expression Rio+20 highlights the place and time elapsed between the two conferences. The objective of this 2012 Conference was to manifest a renewed political commitment to sustainable development, to assess the progress and the remaining gaps and to address new and emerging challenges.

[43] 12 July 2004.

[44] Launched in 2011.

[45] Since 2014 there is an EDA working group (Energy and Environment) addressing energy issues for military activities.

management equipment[46] was installed for a test period of twelve weeks at camp Koulikoro (EU Training Mission in Mali — EUTM Mali).[47] The equipment is part of EDA's Smart Camp Technical Demonstrator (SECTD) project, which analyses the benefits of integrating new technologies into traditional power grid for deployed camps. [28] The SECTD is part of those three EDA initiatives, whose objectives are to promote moving towards environmentally more sustainable military operations. The project has three main objectives:

1. to test and verify the efficiency of combat suitable solar photovoltaic panels in specific climatic conditions;
2. to test "demand management" technology and its impact on inhabitants;
3. to collect data for planning support tools.

Smart Blue Water Camps is the second EDA initiative focusing on water management techniques and technology interventions to reduce water consumption for fixed military installations. The third EDA initiative is closely connected to the use of the Energy Management Systems (EnMS). Experience shows that efficiency of renewables greatly depends on the EnMS being employed or not. A comprehensive EnMS training course helps EU Member States to apply a system-based approach to energy management. [29] The basis of this approach is shown in Figure 1.

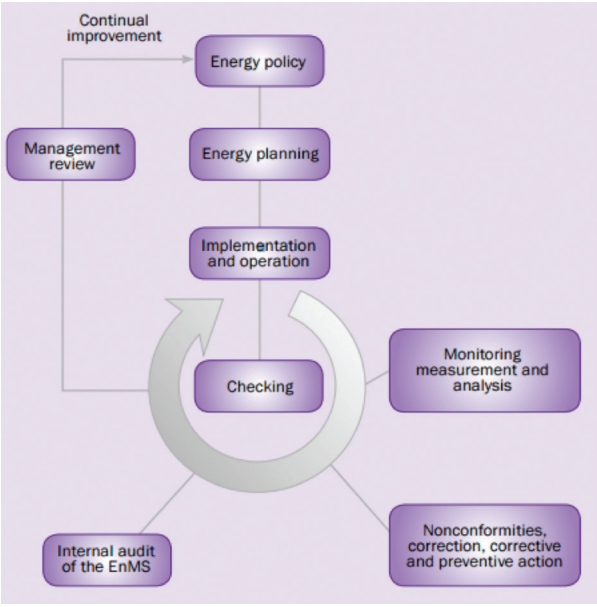


*Figure 1. Energy Management System model.* [30: C1]

[46] The systems include fixed solar photovoltaic panels (16KWp), flexible soldier portable solar photovoltaic panels and monitoring-metering equipment for water and electricity.

[47] The test equipment integrated into the power generation grid for the camp supplied 33% of the test building's electrical load and allowed all rooms to have functioning air-conditioning when no external supply was available.

## Conclusions

Energy availability is an essential part of operations and of the logistical footprint. From a historical operational view, there is a marked change in the approach towards decreasing the use of energy and other natural resources. This U-turn demonstrates that resources are no longer constraints of operational effectiveness, but on the contrary, they are rather mission enablers. Nowadays the forces must move rapidly and manifest being self-sustaining at least for 72 hours in a challenging environment. Implementation of these requirements cannot be done without mastering energy security and sustainability, as both play a crucial role in the success of military operations. Energy security means having assured access to reliable supplies of energy and the ability to deliver sufficient energy to meet operational needs. But the available resources have their limits and without making their optimal use with the lowest possible logistics footprint, we cannot reach our goals. So, we need to improve our resource efficiency, expand alternative and renewable energy opportunities. Meanwhile doing so, we should not forget about environmental protection issues and maintaining fair relationships with local communities.

Regarding the complexity of serving energy supplies there are other aspects to be considered. First of all, they are costly in dollars and in lives. Secondly, resupply convoys themselves contribute to environmental damage. Therefore, increased energy efficiency reduces the logistical footprint, costs, environmental damage and saves lives. Since energy efficiency is not satisfactory, we must develop environmentally conscious behaviour and culture as well. This will take long years but the world organizations have already started working on such changes.

## References

[1] US Army: *Sustainability Report 2014.* RefID: A-D9DAFD3, 2014. www.army.mil/e2/c/downloads/367149.pdf (Downloaded: 17 11 2016).

[2] UN C. o. S. D.: *Framing Sustainable Development: The Brundtland Report – 20 Years On.* Sustainable Development in Action (2007). www.un.org/esa/sustdev/csd/csd15/media/backgrounder_brundtland.pdf (Downloaded: 17 11 2016).

[3] United Nations: *Our Common Future, From One Earth to One World. An Overview by the World Commission on Environment and Development.* www.un-documents.net/our-common-future.pdf (Downloaded: 17 11 2016).

[4] US Army: *Energy Security & Sustainability (ES2) Strategy.* RefID: 2-204FF1C, 2015. www.army.mil/e2/c/downloads/394128.pdf (Downloaded: 17 11 2016).

[5] TIRON, R.: *$400 per Gallon Gas to Drive Debate over Cost of War in Afghanistan.* http://thehill.com/homenews/administration/63407-400gallon-gas-another-cost-of-war-in-afghanistan- (Downloaded: 17 11 2016).

[6] NATO: *NATO and Its Partners Become Smarter on Energy.* www.nato.int/cps/en/natohq/news_118657.htm (Downloaded: 17 11 2016).

[7] Deloitte LPP: *Energy Security. America Best Defense.* 2009. www.offiziere.ch/wp-content/uploads/us_ad_EnergySecurity052010.pdf (Downloaded: 17 11 2016).

[8] LARSEN, K. K.: *Unfolding Green Defense. Linking Green Technologies and Strategies to Current Security Challenges in Nato and the Nato Member States.* 2015.

[9] United Nations: *Greening the Blue.* www.greeningtheblue.org/ (Downloaded: 17 11 2016).
[10] JENSEN, D., HALLE, S. (Eds.): *Greening the Blue Helmets. Environment, Natural Resources and UN Peacekeeping Operations.* Stevenage: United Nations Environment Programme, 2012.
[11] United Nations: *Solar Energy Powers UN Mission Base in Lebanon.* www.unmultimedia.org/photo/detail.jsp?id=516/516761&key=50&query=organization:UNIFIL%20AND%20category:%22Field%20coverage%22&lang=&sf (Downloaded: 17 11 2016).
[12] FS-UNEP C. C.: *Global Trends in Renewable Energy Investment.* 2016. fs-unep-centre.org/sites/default/files/publications/globaltrendsinrenewableenergyinvestment2016lowres_0.pdf (Downloaded: 17 11 2016).
[13] ARCHER, C., WILLI, A.: *Opportunity Costs: Military Spending and the UN's Development Agenda: A View from the International Peace Bureau.* 2012. sustainabledevelopment.un.org/getWSDoc.php?id=3260 (Downloaded: 17 11 2016).
[14] United Nations: *Millennium Development Goals and Beyond 2015. Goal 7: Ensure Environmental Sustainability.* www.un.org/millenniumgoals/environ.shtml (Downloaded: 17 11 2016).
[15] United Nations: *Sustainable Development Knowledge Platform. Transforming our world: The 2030 Agenda for Sustainable Development.* https://sustainabledevelopment.un.org/post2015/transformingourworld (Downloaded: 17 11 2016).
[16] United Nations General Assembly: *Transforming Our World: The 2030 Agenda for Sustainable Development.* Annex 2015. www.un.org/ga/search/view_doc.asp?symbol=A/69/L.85&Lang=E (Downloaded: 17 11 2016.
[17] NATO: *Smart Energy: NATO Documents.* www.natolibguides.info/smartenergy/documents (Downloaded: 17 11 2016).
[18] KABLE: *Casualty Costs of Fuel and Water Resupply Convoys in Afghanistan and Iraq.* www.army-technology.com/features/feature77200/ (Downloaded: 17 11 2016).
[19] EADY, D. S., SIEGEL, S. B., BELL, S. R., DICKE S. H.: *Sustain the Mission Project: Casualty Factors for Fuel and Water Resupply Convoys. Final Technical Report.* Fort Belvoir: US Army Environmental Policy Institute, 2009. assets.documentcloud.org/documents/563651/smp-casualty-cost-factors-final1-09.pdf (Downloaded: 17 11 2016).
[20] TIFFEN, A.: *Going Green on the Battlefield Saves Lives.* 2014. warontherocks.com/2014/05/going-green-on-the-battlefield-saves-lives/ (Downloaded: 17 11 2016).
[21] US Department of Defense: *Strategic Sustainability Performance Plan.* 2016. www.denix.osd.mil/sustainability/dod-sspp/unassigned/department-of-defense-strategic-sustainability-performance-plan-fy-2016/ (Downloaded: 17 11 2016).
[22] NATO: *Smart Defence.* www.nato.int/cps/en/natohq/topics_84268.htm (Downloaded: 17 11 2016).
[23] NATO: *NATO "Smart Energy" Exercise Gets Underway in Hungary.* www.nato.int/cps/en/natohq/news_120481.htm?selectedLocale=en (Downloaded: 17 11 2016).
[24] European Union: *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions. Mainstraiming sustainable development into EU policies: 2009 Review of the European Union Strategy for Sustainable Development.* http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028 (Downloaded: 17 11 2016).

[25] European Union: *Europe 2020: A European Strategy for Smart, Sustainable and Inclusive.* ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf (Downloaded: 17 11 2016).

[26] European Union: *European Union Military Concept on Environmental Protection and Energy Efficiency for EU-led military operations.* blogg.forsvarsmakten.se/miljo/wp-content/blogs.dir/17/files/2012/09/EU-koncept1.pdf (Downloaded: 17 11 2016).

[27] European Union Military Staff: *European Union Concept for EU-led Military Operations and Missions.* data.consilium.europa.eu/doc/document/ST-17107-2014-INIT/en/pdf (Downloaded: 17 11 2016).

[28] EDA: *EDA Installs Energy Management Equipment at EUTM Mali Camp.* eda.europa.eu/info-hub/press-centre/latest-news/2015/10/13/eda-installs-energy-management-equipment-at-eutm-mali-camp (Downloaded: 17 11 2016).

[29] McMANUS, S.: From Military Green to Mali: How the European Defence Agency Meets Energy Challenges. *Engineer Journal*, 17 May 2016. www.engineersjournal.ie/2016/05/17/military-green-european-defence-agency/ (Downloaded: 17 11 2016).

[30] *Win the energy challenge with ISO 50001.* www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/iso_50001_energy.pdf (Downloaded: 17 11 2016).

[31] *National Defense Authorization Act for Fiscal Year 2012, Public Law 112-81, December 31, 2011.* www.gpo.gov/fdsys/pkg/PLAW-112publ81/pdf/PLAW-112publ81.pdf (Downloaded: 17 11 2016).

[32] United Nations: *The Future We Want. Rio+20.* United Nations Conference on Sustainable Development. Rio de Janeiro, 20–22 June 2012. https://sustainabledevelopment.un.org/content/documents/733FutureWeWant.pdf (Downloaded: 17 11 2016).

AARMS Vol. 16, No. 1 (2017) 97–98.

# Authors' Guide

AARMS is a peer-reviewed international scientific journal devoted to reporting original research articles and comprehensive reviews within its scope that encompasses the military, political, economic, environmental and social dimensions of security.

Manuscripts and editorial correspondence should be addressed to

Prof. Dr. László KOVÁCS, Editor-in-Chief
National University of Public Service
P. O. Box 15, H-1581 Budapest 146
Hungary
Phone: +36-1-432-9000/29-004
Mobil: +36-30-9359-776
Fax: +36-1-432-9208
E-mail: aarms@uni-nke.hu

***Manuscript Submission Form.*** All manuscripts should be accompanied with a completed Manuscript Submission Form signed by the author who will be responsible for all correspondence and proofreading ("Corresponding Author"). Manuscript Submission Form can be requested from the Editorial Office through mail, fax or e-mail or can be downloaded from the website of the journal.

***Form of the manuscript.*** Manuscripts (text, tables and illustrations) should be submitted in triplicate. Although every effort will be made to guard against loss, it is advisable that authors retain a copy of all materials submitted. Text (in English only) should be typed double spaced on one side of a good quality paper, with generous margins, and bear the title of the paper, name of the author(s), and the institute where the work has been carried out. An abstract of 50 to 150 words should precede the text of the paper stating briefly the main results and conclusions of the work. It should be suitable for use by abstracting services. Authors are encouraged to use descriptive headings, e.g. Introduction, Methods, Results, Discussion, Conclusion, Acknowledgements (if any), Appendix, Notes, References, etc. The paper should preferably not exceed 32 typewritten pages (about 40,000 characters) including tables and references. The approximate location of tables and figures should be indicated on the margin.

***Tables and Figures.*** Tables, each bearing an informative title, should be self-explanatory and numbered consecutively. Black-and-white or gray scaled illustrations should be selected carefully and the number kept to the essential minimum. The author's name, the title of the paper, and the serial number of the figure should be written on the back of each print. Figure captions should be brief and collected on a separate sheet.

***References.*** References should be to peer-reviewed literature whenever possible, so technical reports, conference proceedings, and other "gray literature" should be referenced only when no other source of the material is available.

References should be numbered in order of occurrence in the text, where the numbers are given in square brackets as, e.g. [12]. In the References section, the bibliographic elements of the numbered references should be given according to the following examples:

*For a journal article*
[1] WRIGHT, S.: Surfaces of Selective Value Revisited. *The American Naturalist*, 131 1 (1988), 115–123.

*For a book*
[2] WALLACE J. M., HOBBS P. V.: *Atmospheric Science: An Introductory Survey*. Cambridge: Academic Press, 1977.

*For a chapter in a book or monograph*
[3] KAUFMANN, S. A., JOHNSEN, S.: Co-Evolution to the Edge of Chaos: Coupled Fitness Landscapes, Poised States, and Co-Evolutionary Avalanches. In. LANGTON, C. G., TAYLOR, C., FARMER, J. D., RASMUSSEN, S.: *Artificial Life II, SFI Studies in the Sciences of Complexity*, 325–369. Boston: Addison-Wesley Publishing Company, 1991.

*Web references*
As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

[4] NULAND, V.: *2012 Conference on a Middle East Zone Free of Weapons of Mass Destruction (MEWMDFZ), Declaration of USA Department of States.* Washington, D.C., 23 11 2012. www.state.gov/r/pa/prs/ps/2012/11/200987.htm (Downloaded: 14 04 2013)

***Submission in electronic format.*** Definitely no electronic version of the manuscript is supposed to be attached to the original submissions. Such attachments will not be archived or kept for later use by the Editorial Office. In case of acceptance, the authors are kindly asked to send an electronic version of the final, accepted manuscript (on magnetic or optical media or via e-mail). In case of any doubt, always the printed paper copy of the manuscript is considered authoritative.

***Copyright Transfer Form.*** Accepted manuscripts cannot be published unless a Copyright Transfer Form is completed and signed by the Corresponding Author. Copyright Transfer Form can be requested from the Editorial Office through mail, fax or e-mail or can be downloaded from the website of the journal.