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Abstract

One of the major challenges of the new millennium is the increasing consumption, in line with the world's growing population, will lead to increased waste generation. There are many ways to manage waste. These include reuse, recycling, energetic utilization and landfilling. The waste pyramid ranks these methods in terms of their emissions. In Hungary, the share of landfilled waste is considered high. Fires in landfill sites also contribute to unintentional emissions. There are several methods to prevent this and to extinguish the fires that do occur. Incidents on landfill sites require special procedures. In this article we present some of them, based on our own experience.

Keywords: waste management, landfill, fire protection, fire prevention, environmental protection

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Introduction

According to the latest available data for 2021, there are 65 operating landfills in Hungary. The landfill rate of waste generated in Hungary is 51% in 2021, according to the Ministry of Energy. The landfill rate is stagnating at 1-2% over the five-year period preceding the 2021 reporting year. Considering that the consumption and waste management habits of the population have not changed significantly, it is reasonable to assume that a stagnating trend will continue in the period thereafter. Landfills will therefore remain an integral part of the Hungarian waste management system for a long time to come.

The European Union wants to replace the „*consumer society*" with the so called „*circular economy system*". Among other things, the ambitions of the circular economy include reducing the landfill rate to below 10% by 2035. This will increase the rate of reuse, recycling and energetic utilization. As a Member State with a derogation, Hungary must meet this target by 2040. It is important to note that neither EU nor national legislation contains any substantive passages on fire safety in landfills. *Act CXXVIII of 2011 on Disaster Management specifically mentions in § 4 (3) d*, that the scope of the Act does not cover landfill facilities.

There are limited of fire protection technical recommendations for operators on fire safety in landfills. The guidance is provided by *BM Decree No. 54/2014 on the National Fire Safety Regulations (hereinafter: OTSZ)*. Due to the diversity of the purpose of each facility, the materials stored and the terrain conditions, the methods and equipment used also vary.

This study presents an evaluation of the site visits carried out at landfill sites from a disaster management perspective.

Legal and standards background

Government Decree No 124/2021 (12.III.) on the designation of the waste management authority defines the official bodies responsible for the professional and legal supervision of landfill and processing facilities. Accordingly, the waste

management departments of the county government offices are responsible. Their area of competence is the administrative boundaries of the counties. An exception to this is the county of Pest. Pest County also includes the territory of the capital Budapest and is also a national authority. At national level, the Landfill and Waste Control Department is responsible. The Minister responsible for waste management is the Minister of Energy. The Minister carries out his duties through the Deputy State Secretary for the Circular Economy. The Deputy State Secretary for the Circular Economy is responsible for the following departments:

- the Waste Management and Concessions Department,
- the Department of Special Waste Flows,
- the Circular Economy Implementation Department,
- the National Waste Management Authority Department and
- the Waste Clearance, Analysis and Training Department.

The Ministry of Energy (hereinafter: ME) started its operation on 1 January 2023 on the basis of the ME Order 1/2022 (XII. 30.). Previously, the waste management tasks were under the Ministry of Technology and Industry. The staff of the office was helpful and we were subsequently able to accompany colleagues to four different landfill sites in the first half of 2023 to carry out their annual inspection activities as required.

We also had the opportunity to consult the fire safety officers of the facilities. These included three solid waste landfill and processing/sorting facilities and one sewage sludge landfill. The visits to the facilities provided a number of useful lessons learned.

Analyses of professional and scientific literature

The Council of the European Union, Directive 1999/31/EC on the landfill of waste lists, among the general requirements for action on landfills in point 5 of Annex I, an incident which has an adverse effect or a hazard on the installation. It is unfortunate to note that the landfill regulations of the European Union basically set

standards for the landfill and acceptance of waste, but this legislation does not deal with aspects of disaster prevention or fire protection.

There are numerous internationally available scientific journal articles dealing with fire safety in landfills [1, 2]. In a national context, the number of such articles is small. What is common to the work of all researchers, however, is that there is no uniform scientific consensus on the most ideal methods of prevention or intervention.

In Hungary, the general regulation of waste management is provided by the Waste Act, the authorising provision of which provides for the decree 20/2006 (IV. 5.) on certain rules and conditions related to landfilling.

Among the Hungarian literature, we would like to highlight those that approach fire safety issues in the waste sector from a practical point of view: in his book entitled "*Development of industrial safety law, institutions and instruments in Hungary*", Lajos Kátai-Urbán describes all the sub-fields of industrial safety. [3] The main element of the sub-areas is a summary of the knowledge related to the generation and disposal of hazardous waste.

Cintia Morvai and Róbert Révai, in their study "*The task of waste management, aspects and problems of disaster management*" [4], provide an overview of the main directions of waste regulation in Hungary. The consistency between the Waste Act and the National Waste Management Plan. A picture of the state of the art of the domestic hazardous waste management procedure. The main challenges of hazardous waste management are presented through a exact example.

Imre Antal and Rudolf Nagy present an analysis of occupational accident and fire safety issues in the operation of landfills in their thesis entitled "*Occupational safety assessment of municipal waste management*" [5].

Zsolt Nagy, in his paper "*Analysis of the environmental impact of vegetation fires from an environmental safety perspective*" [6], dealt with the comparison of environmental and intervention aspects during wildfires and the possible increase of intervention efficiency while respecting environmental aspects.

We also found that the toxic combustion products produced during landfill fires can have similar consequences for the population and the environment as industrial fires of major accidents involving dangerous substances [7, 8].

Landfill site experiences

The first plant visited serves four municipalities and also receives material from private individuals. During working hours, the site is staffed by between 10 and 20 employees. Outside working hours, however, only the night watchman is on duty. This increases the time needed for fire alarms. As a lesson from a previous fire, the operator wanted to reduce this time. Two commercially available false-color thermal imaging cameras were installed in the dump area. The two cameras were installed in the southern corner of the landfill. The project was carried out in-house and no permit or approval was required. The camera control panel is wired into the office space reserved for the night watchman. Here the guard can see two conventional and two thermal cameras on a single monitor at the same time. A loud siren is also installed in the side of the camera centre's mounting box, so that if the guard falls asleep, the system will still sound an alarm. The two cameras are very useful, but they are installed relatively close to each other (about 10 metres), so blind spots can occur. The thermal cameras are also likely to be used to infer the phenomenon and spread of underground fire spread. The false-colour images show temporally smaller patches of hotter evaporations compared to the ambient air. It is likely that the warmer spots flashing up and down on the thermal camera (+25 - 30 °C) were indicative of landfill gas rising from deeper layers. This would be clearly detectable from the gas composition.

At the time of our visit, the outside temperature was +4 °C, so the difference of 20 - 25 °C could be considered quite significant. This shows the spatial distribution of the plumes, their large thermal variability and their momentary flashes, which strongly suggest a possible landfill gas outflow. No landfill gas was being vented through the vertical inlet tubes during the visit. It is also assumed that this method would not give useful results if depot gas extraction were in operation. A siren

associated with a thermal imaging camera is a very useful and cost-effective means of in-time alerting. An important consideration is also to provide a temperature range that is significantly different but not excessive. Consequently, during the summer period, the exhaust of work equipment can also heat up significantly, which can give rise to false alarms.

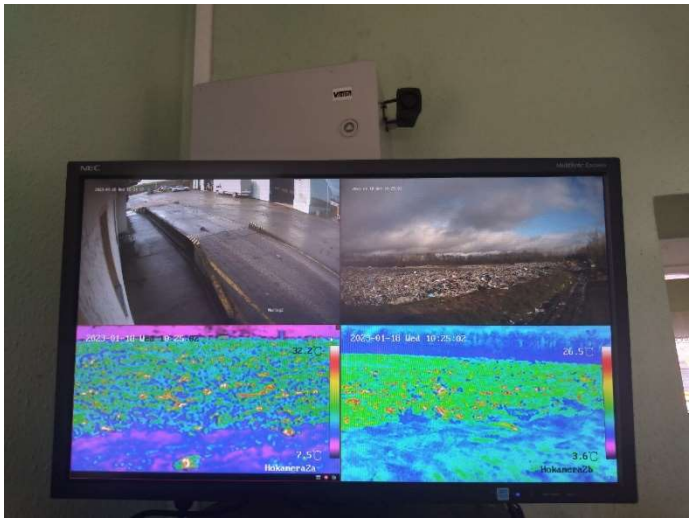

Photo 1: Thermal imaging camera in the operator's room. Above the monitor is the siren.
Made by: Benjámin Hózer.

The second site we investigated had a fire in the composting section [9] involving a week-long post-construction work. Alarm level: '1K'; one fire engine and one water carrier. Covering the compost with dirt also came up as an idea during the extinguishing. However, this was rejected as it would not have been an effective solution. In view of the fact that the fire would not have been eliminated, but hermetic coverage could not have been guaranteed. Rodents are said to be common in the area. And the chimney effect would have been easily exerted because of the tunnels carved into the ground by the mice.

Fire protection on the site is reinforced by several 50 kg portable powder fire extinguishers and a 5 m^3 firewater carrier. A 100 m^3 and a 300 m^3 fire water reservoir

have also been built on the site. The nearest hydrant to the site is more than 2,5 km away by road. We learned that there is no funds for new garbage trucks.

The current fleet of vehicles is 15-20 years old and it would not fit into the budget to install a thermal imaging system. It would presumably be a major professional challenge to get the entire area of the depot properly surrounded by cameras.

The ground is not stable, but the height of the waste body is constantly increasing. In order to keep up with the growth of the body, steel-framed high surveillance towers with high-resolution scanning cameras would be suitable.

At the time of the visit, a large amount of baled sorted plastic waste awaiting transport was present. Looking back at 'Google Maps' images from a year earlier, the number of bales was much higher. Using the area calculator on the 'Google Maps' interface, a rough estimate of the area of the accumulated material is around 15,000 m3. This is almost three times the amount stored at the third site.

Photo 2: Baled plastic waste is a significant source of danger in case of fire. Source: Google Maps, edit by: Benjámin Hózer.

Experiences of the sewage sludge disposal plant

The visited site is not landfill municipal solid waste, but sewage sludge. Sewage sludge also produces biogas, but its composition is completely homogeneous. Prior

to dumping, the Capital Sewage Works mixed burnt lime into the sludge to stabilise its consistency. The moisture content is thus very low. On the other hand, the recultivated material has a Ph of 14, i.e. it is highly corrosive. As a result, the landfilled material hardly produced any biogas. The addition of lime is a very effective way to stop biodegradation, which would be useful for solid waste landfills. Methane gas (landfill gas) is a natural process in landfills and can be used for energy production. However, experience shows that many operators do not invest sufficient resources in their operation and do not exploit their potential.

It is worth considering stopping the biological processes, as unused methane gas is not only a fire and explosion hazard, but also has an ozone-depleting effect. Another side effect of methane gas formation is stench, which is often the subject of public complaints. [10] The secondary function of the plant is compost production and green waste processing. Composting has been abandoned, so this is not a significant problem.

The ground and mixed compost is sorted into long rows, so-called "prisms", in a large concrete loading area. There are no official standards for the distance between the stacks, which is left to the operator's discretion. Previously taken 'Google Maps' images show a relatively narrow strip of concrete between the prisms. Sand has been stockpiled for firefighting, on the side of the concrete loading area. The Capital Sewerage Works, which operates the area, is also required by law to participate in flood protection. As a result, some of the sand excavated during the excavation of the riverbed was transported here after a fire in 2019. There have been no fires on the site since then, so the effectiveness of this drying method has not yet been tested in the field. It is worth mentioning that the drying method was not considered appropriate by the operator of the second site. [11]

A target machine was purchased to continuously rotate the prisms. This can be an effective tool for detecting and eradicating annealing where ordinary extinguishing water jets cannot penetrate.

Photo 3: Komptech Topturn X53 type compost turning machine in the area of the facility.

Made by: Benjámin Hózer.

Assessment of landfill site fire

On the afternoon of March 28, 2023 [12], a fire broke out in the area of landfill we have visited, and it took 56 and a half hours to fully extinguish it. The fire affected an area of nearly 5000 m^2. On the part of the fire department, 1 municipal fire department, 14 volunteer associations, and units from the staff of three counties from the National Directorate General of Disaster Management were involved.

Municipal firefighters were involved with 2 vehicles, volunteer firefighters with 20 vehicles, while 33 vehicles from the National Disaster Management Directorate were involved. A total of 55 different vehicles turned up in the area of the fire. Units from the capital, Pest, Fejér and Komárom counties also arrived at the fire scene. After requesting data from the local waterworks, we found out that nearly 1,500 m^3 of extinguishing water was used for refilling from the surrounding fire hydrants during the extinguishing. In the area, as mentioned in the previous example, large quantities of sorted, baled, ready-to-transport waste are being accumulated. Among the bales, paper, plastic and upholstery waste were also accumulated.

The facility is located in a natural wind tunnel and the fire spread quickly. In places, the waste was separated by 'L' shaped precast concrete retaining walls and

gravetti blocks. Consequently, the fire did not spread further, could be contained within the adjacent protective forest and fenced. The intensity of the heat effect is well illustrated by the fact that in some hard-to-reach places more than 10 cm of the concrete elements were shredded.

Photo 4: The intense heat has broken the structure of the concrete wall.
Made by: Benjámin Hózer.

Summary, conclusions and future work

Experience has shown that residential solid waste landfills have a number of potential hazards. A significant proportion of residential waste incidents are protracted interventions. Current firefighting tactics do not specify a specific methodology for dealing with waste fires. A broad spectrum of fire prevention methods and tools has also been identified. These include innovative and useful solutions such as the use of thermal imaging cameras. But also those that would not be expected to produce the desired results based on previous experience. In all cases, operators are trying to work thoroughly and carefully to ensure that disaster prevention aspects are taken into account.

However, there is currently no professional guidance on which tools and methods are effective. Ultimately, new methods will be introduced through experience. One operator pointed out that a separate workshop on fire safety is

organised every year within the international chain of companies. It is clearly visible that the problem area is also internationally relevant and similar of industrial accident prevention issues [13, 14].

In the future, our aim – based on previous research results [15] - is to formulate comprehensive methods and advice that can be generally applied to all operators involved in waste management in Hungary. The aim is to establish a basis for good operator practice and potentially reduce the number of waste-related incidents.

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Scaffolding façade fires

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Unfortunately, fires during construction are common both in the construction of new buildings and in the renovation of old ones. In the case of buildings supported by façade scaffolding, it is often difficult to determine the place of fire. The most frequently asked expert question is whether the fire on the scaffolding caused the building to catch fire, or vice versa, whether the façade scaffolding structure burned down as a spread of the fire in the building. The infernal fire at Notre-Dame Cathedral on 15 April 2019 subsequently shed a different light on the possibility of scaffolding fires and their investigation. The aim of the article is to draw the attention of designers, contractors and, of course, investors to the fact that façade scaffolding as a construction auxiliary structure can be a serious source of fire hazard not only for those working on it, but also for the persons staying in the scaffolding building and the building itself.

Keywords: façade scaffolding, fires, accidents, investigations, case studies, ***prevention***

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Introduction

Many examples draw attention to the fact that a fire on the façade scaffold or, in some cases, a fire on one floor of a building under construction can cause enormous damage through the scaffolding to the entire building. In order to analyze the cause of scaffolding fires and their spread, we first need to know the structure that generates and spreads fire, the scaffolding itself. What is a tripod? According to the interpretation of BM Decree 54/2014 (XII.5) of the National Fire Protection Code: a building whose supporting structure is designed for the stability performance appropriate to the intended use, does not have an external building envelope wall structure, and a space is created on the structure at a certain height for purpose and human habitation.

Among façade scaffolding systems, heavy scaffolding is typically a wooden, heavy-duty scaffolding, which in today's use is used for the installation and temporary storage of natural stones and heavy building elements. Their load capacity is typically 300 kg/m2, but since they are custom-designed scaffolding, they can be suitable for carrying much heavier loads. A typical type is mast racking, which is a frame-like scaffolding structure consisting of masts and working levels connected to them without chairs or chairs. The cylindrical wooden masts, with a central diameter of 18-25 cm and a suitable height (10-20 m), are placed 2.5-3.0 meters apart, in pits dug into the ground 1.5 meters deep. The masts are stiffened by an Andrew's cross per row of floors. [4] In the case of mast racks supported by chairs, each working level is formed by posts placed next to the masts and connected to them by clasps, with tent beams running along the latter. On the tent beams are located the drawer beams forming the working levels in a direction perpendicular to the wall, i.e. the ace beams and the plank spreading on them. In the case of a solution built together with the building, i.e. consisting of a single mast line, the drawer beams lie on the masonry. In the case of wooden racks independent of the building, there is also a colonnade next to the wall and the tent beam on it. Main racks can be single or double-pass. The thread width is 2.2-3.0 meters. There is also a layout where the ground floor is single-pass, and the higher floors are two-pass.

Another type of scaffolding is a main racking system that can be assembled from elements. The pillars of the main stand are 2x 8/12 cm, the insert timber and stiffeners are 5/12 cm, and the slab planks are 5/20 cm. The elements are connected by screw connection. In today's practice, these scaffolding systems are typically used for façade renovation, previously used mast structures are no longer used. In the case of heavy scaffolding with wooden structures, glass beam structures independent of the building are typically used (Photo 1.).

Photo 1: Typical design for wooden scaffolding. Source: https://index.hu/belfold/budapest/2009/12/07/ismet

[12]

The modern heavy racking material is now naturally metallic, which is typically a modular system, not a framed structure. Thus, the load capacity of the scaffolding can be increased almost indefinitely by compressing the supports within the raster system. Modern steel heavy scaffolding can be used both as supporting scaffolding and as a façade scaffolding. With switch-plates welded to the posts at intervals of 50 cm, up to 8 connections are possible, both diagonally and horizontally. [11] Horizontal crossbars come in different sizes. A floor plan with either a right angle or a pointed angle layout is possible. The modular system resulting from the switchboards makes it possible to construct working, protective and space racks in the size of work, protection and space racks (Photo 2.).

Photo 2: Example of a modern metal scaffolding. Source: https://www.submission.de/news.php [13]

In addition to heavy scaffolding, frame façade scaffolding with normal load capacity also appears, on which some materials are stored, which can cause a fire.

Framed façade scaffolding (Photo 3.) is typically an auxiliary structure for the preparation of façade works of a new or under renovation that is already structurally complete. It can be used as a work platform or protective scaffolding, typically up to a construction height of 24 meters. Racks higher than this or not of the type version require individual static calculations. Vertical frames typically have a raster height of 2.00 meters, which is the general working platform height. As an additional element, frame heights of 1.00 and 1.50 meters can be used to precisely adjust the desired final elevation. [1] The horizontal structure consists essentially of two types of systems. One is when a frame structure appears horizontally and the tile is placed on it, in the other case the tiles themselves form the horizontal structure.

In the latter case, fewer elements are installed, so it is faster to assemble and disassemble the scaffolding, but it has a more limited load capacity. In terms of material, the frame structures of modern scaffolding are hot-dip galvanized steel structures [2], while the planks are made of wood and steel.

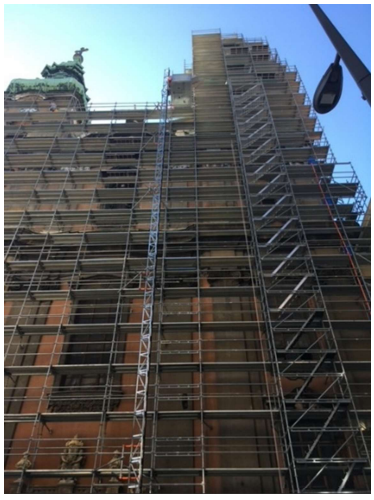

Photo 3: Example of frame façade scaffolding. Source: own University Square church)

Analyses of the Casework

The fire in Notre-Dame Cathedral

2019. On April 15, a few minutes before 7:00 p.m., the wooden roof structure of one of Paris' most important buildings, the Notre-Dame Cathedral under renovation (photo 3), which was almost completely destroyed within a few hours, and the cathedral' s hussar tower collapsed also. Nearly 500 firefighters were deployed to the scene and were only able to contain the fire by midnight. More than a thousand people had to be evacuated from the vicinity of the burning building. The entire roo.f structure of the cathedral was scaffolded, as was the hussar tower under renovation (Photo 4).

Photo 4: Scaffolding of Notre-Dame Cathedral. [14]
Source: https://ma7.sk/kozelet/tuz-utott-ki-a-vilaghiru-parizsi-notre-dame-szekesegyhazban

An investigation into the cause of the fire revealed that six electronic bells — apparently intended to be temporary — had been placed in the tower and cables had run into the attic. Presumably, these cables may have been short-circuited and started the fire. It also considers whether scaffolding workers may have accidentally damaged cables.

Another reason for the fire could be a short circuit in elevators set up on scaffolding or cigarette butts found by workers on the scaffolding. In addition to the damage caused to the irreplaceable monument, one of the most difficult tasks was the demolition of the heavy scaffolding structure that had broken on the roof structure, which completely merged under the influence of the huge fire and heat (Photo 5.).

Photo 5: The fire of the scaffolding of Notre-Dame Cathedral
Source: https://ma7.sk/kozelet/tuz-utott-ki-a-vilaghiru-parizsi-notre-dame-szekesegyhazban

To remove the scaffolding, steel beams were placed around the scaffolding on three levels to form a stabilizing "belt". Hydraulic cranes were then installed, which allowed technicians suspended on ropes to descend into the forest of pipes and cut them apart so that they could be lifted out of the scaffolding structure.

Fire in a Hong Kong shopping mall

More than 170 people have been evacuated from a shopping mall in Hong Kong after a fire broke out in a 42-story skyscraper. (Photo 6.) Firefighters were still battling the flames in the evening the next morning, with the fire visible from across Victoria Harbour. According to eyewitnesses, the upper floors of the building were completely engulfed in fire and flaming, falling debris, including bamboo stands, ignited small fires in neighboring buildings. The fire started on top of the 42-story skyscraper, which is about to be completed, and also covered scaffolding. Extinguishing was made more difficult by the fact that the fire spread to the façade scaffolding. The circumstances surrounding last year's fire are still under investigation.

Picture 6: Scaffolding fire in Hong Kong shopping mall [15] Source: https://www.vg.hu/kozelet

Fire in the Warsaw high-rise

There was a huge fire in Warsaw's tallest skyscraper still under construction**.** The flames erupted in the upper part of the half-finished high-rise, at the height of the 30th floor, and the falling and burning pieces of the building spread throughout the area. (Photo 7.) The investigations could not

establish with certainty whether the ignition of the materials on the building led to the ignition of the façade scaffolding, or whether the scaffolding caught fire first and spread through the building.

Photo 7: Scaffolding fire in Warsaw. [16] Source: https://wesfire.hu/hatalmas-tuz-volt-varso-legmagasab

Fire in the dome of the Mako bath

Firefighters were alerted to a high-profile triple fire in Makó, who marched to the scene with great force, four vehicle syringes and two vehicles capable of rescuing from a height. Eyewitnesses said that the roof structure of the bath, built according to the plans of Imre Makovecz, burned with flames of several meters. (Photo 8.) The workers fled from the scaffolding, fortunately no one was injured. The smoke from the dome was also clearly visible from the city center. After the fire was contained, two jets of water had to be used to cool the steel structure of the roof and the glass wool used as insulation for a long time to prevent the flames from re-igniting. The fire was particularly dangerous because the curved domes and graceful columns typical of Imre Makovecz's buildings are glued wooden supports, which are particularly sensitive to fire. Unfortunately, the walking planks of the façade scaffolding structure were also wooden, which also increased the spread of flames.

Photo 8: Mako scaffold fire [17] *Source: https://wesfire.hu/kigyulladt-a-makoi-furdo-epulo-kupolaja/*

Fortunately, scaffolding fires are not common in domestic construction practice, but they are not negligible. In the capital, the most recent scaffolding fire occurred in District V, on Stollár Béla Street, close to Nyugati Square. An old wooden heavy scaffolding caught fire, burning 100-150 meters along with the uninhabited, scaffolding building.

Analysis of the causes of façade fires

Classification of façade scaffolding fires The following divisions are proposed.

1. the causes of the fire, such as:

- electric fire:
    - The basic condition for preventing electric fires is that the provisions of the relevant standard ("MSZ HD 60364-4-41-415.2 Additional protection: additional protective equipotential connection") [10] are fulfilled. That is: "The connection of the large-scale metal networks formed during the progress of construction in the buildings under construction between themselves and with the already emerging (formed) EPH system and the protective conductor continuously (as soon as possible after completion!) it has to be implemented."
- fire caused by lightning (TvMi 12.32019.06.12): [8]
    - In the case of wooden scaffolding, fire caused by direct lightning strikes presents a potential hazard. The construction of lightning protection for wooden racking

structures up to 15 meters high is not required. Lightning protection for wooden racking structures made of wood with a height of more than 15 m is adequate if:

- (a) the necessary lightning protection measures have been established with risk management in place

  in which the CoR risk component is less than the risk of loss of human life

  relevant acceptable statutory risk,
- (b) in risk management, the "length of stay" shall take into account the intended period of use of the scaffolding (including construction and demolition),
- (c) lightning protection measures determined by risk management; scaffolding are applied.

A lightning protection system (LPS) protecting scaffolding is suitable for reducing this hazard, if necessary for risk management. In this case, therefore, the lightning protection system (especially the capture and arrest system) should only be installed on the scaffolding and not on the scaffolding. If the construction works are equipped with LPS ('lightning arresters'), they must be connected to a lightning protection system designed to protect the scaffolding.

- Lightning protection of scaffolding structures made with metal supports, irrespective of the intended period of use of the scaffolding, is adequate if:

  (a) the scaffolding is adequately earthed, and

  (b) scaffolding – if the scaffolding already has external lightning protection;

  system – in accordance with the requirements of the lightning protection standard

  It is connected to the lightning protection system of the structure.

- fire caused by smoking:
  - Frequent fires, despite the fact that smoking is prohibited on all construction sites in Hungary, including façade scaffolding. The spread of fire is mostly through the tarpaulin, which endangers the entire scaffolding and the building behind it. [6]
- From the scaffolded building there is an extensive fire:
  - It is perhaps the most common scaffolding fire, as the most typical path of fire in the building is upwards along the façade. This can be strengthened, for example, if the

façade doors and windows are not yet installed, so the fire can spread upwards unhindered. [5]

- and fire arising from construction technology.
    - Fires on this type of scaffolding are perhaps the best accidents to avoid if basic work and accident safety rules are followed. For example, if welding is done on scaffolding, there must be some kind of fire extinguishing equipment on the working level, such as a powder extinguisher or other extinguisher. [7]

2. Based on the substances involved in combustion:

- It can be the scaffolding structure itself or its tarpaulin structure
    - To date, many heavy scaffolding structures are built of wood, so their material also poses a potential hazard in the event of fire. In the case of metal scaffolding, walking surfaces, i.e. paving boards and footboards, can be made of wood, which can be dangerous for fire, especially on wooden working levels. From the point of view of tolerance, tarpaulin scaffolding is, of course, the greatest danger, because here the entire vertical façade surface can act as a continuous fire base. [6]
- and building materials or auxiliary materials stored on racks and being machined.
    - In terms of materials stored on scaffolding, one of the most fire-sensitive technologies is when the roof chair of the building is made of scaffolding structure, especially the planking and battening of the eaves. The best way to prevent fire is to store only the wood currently to be installed on the scaffolding, i.e. there should be no material storage on the scaffolding after the shift or overnight.

3. With regard to the direction of fire propagation:

- horizontal fire,
- vertical fire,
- and fire covering the entire scaffolding.

However, in order to analyze them in detail, we need to know the types of scaffolding structures, their structural design, construction and demolition technology and function. In addition, during the examination of individual fires, it is necessary to know the process of construction technology carried out from scaffolding structures, as well as the combustibility properties of the materials and auxiliary materials used there.

I also found that the toxic combustion products produced during landfill fires can have similar consequences for the population and the environment as industrial fires of major accidents involving dangerous substances [18, 19, 20].

Proposal to take into account fire calculation

There may be a significant amount of combustible material on the scaffolding, which is partly the material of scaffolding (wooden planks, tarpaulins), as well as building materials stored on the scaffolding. Typically, fire can spread upwards, so it behaves similarly to facades In the case of a fire at scaffolding, an external fire curve must be used. Since the flames spread outdoors and heat the façade elements, we may ignite them. [3] Examining the maximum of the curve, it can be seen that it has a significantly smaller maximum than the ISO curve because it takes into account the cooling provided by the outside air. The air temperature can be calculated according to the following formula (Figure 9).

$$\Theta_g = 20 + 660 \times (1 - 0{,}687 \times e^{-0{,}32 \times t} - 0{,}313 \times e^{-3{,}80 \times t})$$

where:

Θg: gas temperature [°C],

T: elapsed time [minutes].

The external fire curve is shown in Figure 9. [9]

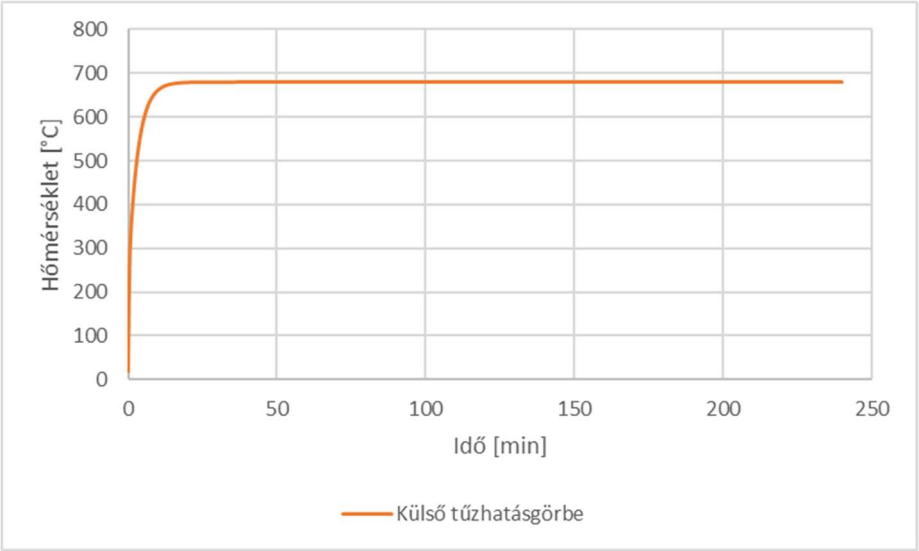

Figure 9: External fire curve (TvMi 11.2:22.01.2019)

In our opinion, it is recommended to calculate fire spread in scaffolding and to use active protection devices if justified, since even if these were installed, the damage would have been much less, which would have meant the preservation of a significant listed building in the case of Notre Dame.

Summary

The purpose of this article was to draw attention to a peripheral segment of damage in the construction industry, such as façade scaffolding fires. Fires during construction are not a rare case of damage to the construction industry, especially during renovation work, but several new construction projects have also been victims of fire damage. Within this, however, fires caused by auxiliary structures, such as façade scaffolding, or fires whose carrier or further propagator is the scaffolding structure itself and its tarpaulin structure. The above numerous examples have demonstrated the serious damage caused by scaffolding fires to buildings and, of course, to the scaffolding structure itself.

Ranking the causes, fires caused by lightning strikes are among the rarest cases, and fires caused by human error should be mentioned among the most common, such as electrical fires caused by smoking, lack of grounding, or even fires caused by carelessly stored flammable materials. The options for preventing scaffold fires are active or passive protection.

By active protection we mean the prevention of the causes of fires mentioned in the above chapters by enforcing and frequently checking the stricter occupational safety rules.

As a passive protection option, scaffolding elements with flammable structures should be avoided, by which we usually mean wooden structures, and of course he recommended the use of systems with a material structure that does not burn with flame in tarpaulin structures as well.

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Microplastics in Hungarian waters and the potential of water treatment technologies

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Abstract

This study focuses on the presence and distribution of microplastics in Hungarian waters and pays particular attention to the potential of water treatment technologies to remove these pollutants. Samples of several important rivers, lakes and other freshwater bodies, including the Danube and Lake Balaton, were analysed and will be discussed in detail. The samples were analysed using microscopic and spectroscopic methods to determine the concentration, types, size and composition of microplastics.

The study highlights the ecological and public health risks of microplastics pollution and assesses the effectiveness of current water treatment technologies in removing microplastics. In addition, new and innovative solutions that can improve water treatment processes to address this challenge are explored.

The results show that microplastics are widely present in Hungary's waters and this is a serious concern. The study underlines the importance of water treatment technologies and makes recommendations for more effective management of microplastic pollution, emphasising the need for environmental policies and technological improvements in this area. The significance of the research goes beyond the local level, as its findings contribute to the global knowledge base on microplastic pollution and its management, and raise awareness of the urgency of protecting freshwater ecosystems.

Keywords: Microplastics, Water Treatment Technologies, Hungarian Waters, Danube River, Lake Balaton, Ecological Risks, Public Health, Environmental Policy

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Introduction

Microplastics are plastic particles smaller than five millimetres (or microplastics are defined as all plastic particles with a size between 0.1 and 5000 µm). Worldwide, more than 300 million tonnes of plastic are produced each year, half of which is designed for single use. Every year, at least 8 million tonnes of plastic used ends up in the oceans. Of the microplastics, 69-81% are found in the marine environment, comes from secondary plastics, which are derived from the degradation of larger plastics. [1] They can be produced by intentionally making small sizes, such as in industrial abrasives or facial scrubbers, or by the fragmentation of larger plastics over time. Microplastics can also be found in water, soil and air and can pose a threat to human health in three ways: physically, chemically and by providing a breeding ground for other micro-organisms. Research on the harmful effects of microplastics is still limited, but it is clear that these particles negatively affect the human body, although the extent to which they do so is not yet clear. The study emphasises the importance of water treatment technologies in removing microplastics and encourages readers to change their thinking and behaviour to reduce microplastics. [2]

Three years ago. in our study entitled "Micropollutant and microplastic content of wastewater", we carried out a detailed study on the microplastic content of the Pécs municipal wastewater treatment plant. The study analysed the microplastic content of raw wastewater, treated wastewater, sewage sludge and mixed surface water. Sampling and analysis methods included the use of hydrogen peroxide and microscopic examination. Based on the results, the researchers determined the amount and types of microplastics in the different samples. The study highlights the relationship between microplastic pollution and wastewater

treatment processes and makes recommendations for managing microplastics and improving water safety. The detailed results and conclusions of the study provide important insights into the microplastic load and potential environmental impacts of urban wastewater treatment. [3]

Concerning the Balaton, the study "Microplastics in the Largest Shallow Lake of Central Europe" examines microplastics in Lake Balaton, the largest shallow lake in Central Europe. The study identified seven different polymer-type microplastics in Lake Balaton in the 50-100 µm size range. The study also suggests that the combined effect of microplastics and progestogens may cause significant changes in the behaviour and biochemical levels of Daphnia magna (waterbolha). The results indicate that microplastics may reduce the fitness of freshwater biota, but the potential threat of microplastics as chemical carriers may be limited.

The study makes a fundamental contribution to the global knowledge base on microplastic pollution and its management, and highlights the urgency of protecting freshwater ecosystems. [4]

Műanyag típus *polymer type*	Sűrűség (g/cm³) *polymer density (g/cm³)*	Tanulmányok száma *no. of studies*
polietilén / *polyethylene*	0.917-0.965	33
polipropilén / *polypropylene*	0.90-0.91	27
polisztirol / *polystyrene*	1.04-1.10	17
poliamid (nylon) / *polyamide (nylon)*	1.02-1.05	7
poliészter / *polyester*	1.24-2.30	4
akril / *acrylic*	1.09-1.20	4
polioximetilén / *polyoxymethylene*	1.41-1.61	4
pilivinilalkohol / *polyvinyl aclohol*	1.19-1.31	3
polivinilklorid / *polyvinylchloride*	1.16-1.58	2
polimetilakrilát / *poly methylacrilate*	1.17-1.20	2
polietilén tereftalát / *polyethylene terephthalate*	1.37-1.45	1
alkid / *alkyd*	1.24-2.10	1
poliuretán / *polyurethane*	1.20	1

Data from a total of N = 42 studies

Figure 1.: Types of microplastics typically found in the environment. Forrás: (Bordós 2016)

There are many methods for measuring microplastics. For example, one study compares two different analytical methods for the detection of microplastics (MP) using micro Fourier Transform Infrared Spectroscopy (µFTIR) imaging. A representative composite water sample from the Danube River was divided into 12 subsamples and processed using two different methods that differed in MP isolation

procedures, optical substrates and detection limits of spectroscopic instruments. The first method detected more MPs with higher resolution, while the second detected fewer MPs with lower resolution. The study shows that the differences between the methods are significant in determining the size and mass estimation of microplastics, emphasising the importance of harmonising the methods. [5]

- Microscopy:
  - Light and fluorescence microscopy for visual identification of microplastic particles.
  - Electron microscopy, especially Scanning Electron Microscopy (SEM), for high-resolution images.
- Spectroscopic Methods:
  - Fourier-Transform Infrared Spectroscopy (FTIR) to identify the chemical composition of plastics.
  - Raman spectroscopy, useful for identifying chemical characteristics of colored or dark plastics.
- Pyrolysis-Gas Chromatography/Mass Spectrometry (Py-GC/MS):
  - Uses thermal degradation of plastics to determine chemical composition.
- Chemical Analysis and Extraction:
  - Solvent extraction and density-based separation for isolating microplastics from samples.
- Static and Dynamic Light Scattering:
  - Methods to measure particle size and distribution.
- Using Reference Samples and Controls:
  - Important for validation to ensure method reliability and accuracy.
- Comparing Methods:
  - Comparing analyses from different methods to check consistency of results.
- Reproducibility Tests:

- Repeated analysis of the same samples under different conditions to check method reproducibility.

Validating the presence of microplastics in samples is a crucial step to ensure their actual presence in the analyzed samples. This process can involve several steps, such as:

- Sampling: Collection of samples containing microplastics, with an emphasis on minimizing contamination.
- Preparation: Preparation of the samples for analysis, which may include filtering, cleaning, and concentration.
- Analytical Methods: Application of various analytical techniques to identify and quantify microplastic particles. These can include microscopy, spectroscopy, or chromatography.
- Data Analysis: Analysis and interpretation of data, including statistical analysis and comparison with other studies or reference values.
- Validation: Validation of methods and results to ensure their reliability and accuracy. This may involve using duplicates, control samples, and checking the reproducibility of the methods.
- Reporting: Summarizing the research findings and presenting them in a report form. [6]

For a more detailed description of the analytical methods, see the example of the Danube: The study "Microplastics in the Danube River Basin" focuses on microplastics in the Danube River Basin, with an extensive survey of the water column. The aim was to develop a microplastics monitoring strategy involving the collection of suspended solids (SSA) and their analysis by thermal desorption-gas chromatography-mass spectrometry (TED-GC/MS). The study investigated 18 sampling sites in the Danube catchment, finding that microplastics were present in all samples, with polyethylene being the dominant polymer. In addition, further studies were carried out on concentration methods related to density separation and polyethylene labelling of fatty acids from algae. The study determined the mass

concentration of microplastics and focused on the combined effects of progestogens and microplastics on Daphnia magna. This research contributes significantly to the global understanding of microplastic pollution, highlighting the urgency of protecting freshwater ecosystems. [7]

There are many technologies exists for filtering water for microplastics:

1. Membrane Filtration: Uses fine-pore membranes to physically filter out microplastic particles from water.
2. Advanced Oxidation Processes (AOPs): Employ chemical reactions to break down microplastics into smaller, less harmful components.
3. Adsorption: Involves using materials like activated carbon to attract and capture microplastics.
4. Flocculation and Sedimentation: Combines microplastics with other particles to form larger clumps, which then settle out of the water.
5. Biological Treatment: Utilizes microorganisms to degrade microplastics, often part of sewage treatment processes.
6. Gravel Filtration: This method serves to remove larger solid materials. While it is more effective against larger contaminants, it may not be as efficient for smaller microplastics.
7. Sand Filtration: Similar to gravel filtration, this method is more effective against larger solids but has limited efficiency in removing finer microplastics. [8]

Based on the studies, it was observed and established that all three filtration techniques are capable of removing microplastics, thus suitable for supplementary water or wastewater treatment. Gravel and sand filtration technologies allowed some of the three tested types of microplastics to pass through, unlike membrane filtration technology, which completely retained the microplastic pieces at 100% efficiency. Sand filtration technology proved to be the most effective in cleaning plastic fibers. For the removal of black micro-rubber particles, membrane filtration was the most appropriate of the three methods. The average cleaning efficiencies were as follows: Gravel filtration technology: 25%, Sand filtration technology: 59%, Membrane filtration technology: 57%.

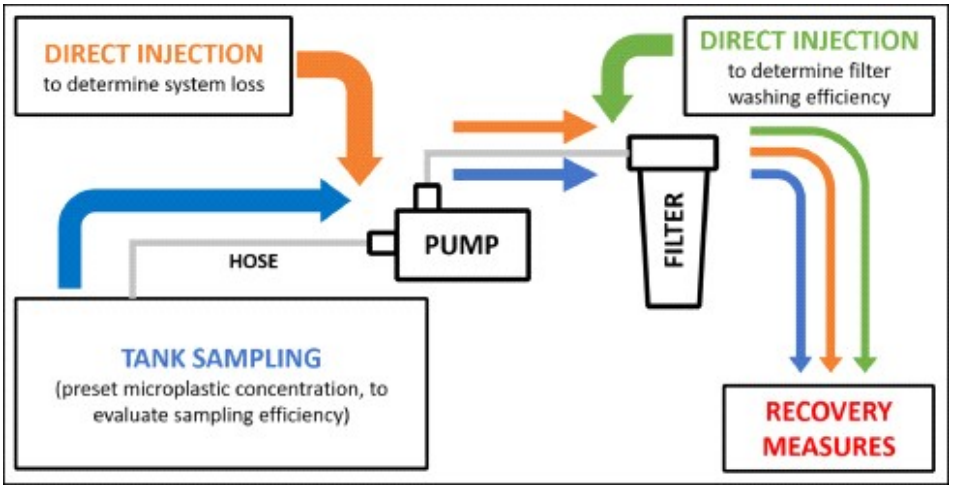

Figure 2. Schematic diagram of a water sampling system to measure microplastic concentration Source: [16])

The image depicts a schematic diagram of a water sampling system to measure microplastic concentration and evaluate the efficiency of recovery measures. It includes a tank for sampling with a preset concentration of microplastics, a hose, a pump for water circulation, and a filter. There are two points for direct injection: one to determine system loss and another to assess the efficiency of filter washing. The recovery measures are indicated by a separate line leading from the filter. [9]

Microplastics risk assessment for surface water

To estimate the risk factor for the human health risk of microplastics detected in living waters from water purification technologies. It is determined by defining the following scales and scores:

- Environmental occurrence magnitude score, 0 - not found in water, 10 - many found in water 10/m3
- Detected microplastic size score, no microplastic in the range greater than 5mm is not expected to be passed by a healthy human intestinal system, so selection is eliminated given a score in this case of 0.
- Microplastics, in descending order from 5mm to 1 micrometer are scored 1-10, so the inversely proportional to the risk of the size of the microplastic detected.
- Score for the presence of micropollutants, if found in the water micropollutants can bind to the surface of the microplastic, thereby increasing the risk (1-10)

The risk number is determined by defining and summing the Ambient Prevalence Score, the Detected Microplastics Size Score, the Microcontaminant Prevalence Score and the sum of these. Therefore, in addition to the shape of the microplastics, the quantity and size of the microplastics and the quantity of other micropollutants should be determined in order to establish the exact risk factor.

Estimation of the risk of microplastics in Budapest Danube water samples:

The sample number from Budapest and the results from two independent laboratories are as follows for the Danube samples:

Danube Sample Number / Detected Quantity	Environmental Occurrence (0-10)	Detected Microplastic Size (0-10)	Micro-pollutants Detection (0-10)	Risk Value (0-10)
Budapest / 45.4±27.7	8	Not Examined	Not Examined	8
Budapest / 50	8	Not Examined	Not Examined	8

Figure 3. Results of Danube samples. Source: Own source

The risk at the Danube sampling locations is high, representing a moderate risk for drinking water safety assessment.

Microplastic Risk Assessment for Drinking Water

The determination of risk factors for the detection of microplastics in drinking waters on human health and water treatment technologies is done by defining the following scales and scores:

- Environmental occurrence score, where 0 means not found in water and 10 means a lot found per cubic meter. Here, since the health risk is much greater than in surface water, the consumer directly encounters microplastics.
- The score for determining the size of detected microplastics, where particles larger than 5mm, expectedly, will not be passed by a healthy human intestinal system and thus will be excreted, the given score in this case is 0. Microplastics, from 5 mm to 1 micrometer in descending order, score 1-10, thus inversely proportional to the risk of detected microplastic size.

- The score for the occurrence of micro-pollutants, if micro-pollutants are found in waters, they can bind to the surface of microplastics, thereby increasing the risk (1-10).
- The risk score is determined by defining and summing the scores for Environmental Occurrence, Detected Microplastic Size, and Micro-pollutants Occurrence. [11]

Location / Detected Quantity	Environmental Occurrence (0-10)	Detected Microplastic Size (0-10)	Micro-pollutants Detection (0-10)	Risk Value (0-20)
North Buda School Tap Water / 7 particles (1501 liters) / >100 micrometers	4.7	8	Not Examined	12.7
Csepel School Tap Water / 10 particles (1500 liters) / >100 micrometers	6.7	8	Not Examined	14.7

Figure 4. Results of Microplastic Risk Assessment for Drinking Water. Source: Own source

Drinking water from Budapest poses a higher risk because the consumer comes into direct contact with it, drinks the water and it goes directly into the body. To increase the safety of drinking water, it is necessary to use more water purification technologies to reduce the risk.

Summary

The health risks of microplastics are a growing concern for the scientific community and public health experts, as these particles are widely found in our environment, including water, food and air. The concern is based on the fact that microplastics can and do enter the human body, where they can potentially contribute to harm. These particles can carry contaminants such as heavy metals and may be susceptible to binding various toxic chemicals that can affect human health. They have been found in the bodies of both adults and babies, and recent research suggests that the risk to human health is high. [12]

Working with dangerous substances also presents a number of hazards [13]. In addition to everyday occurrences, industrial accidents can also increase the chance of microplastics being released into the environment, with potentially serious health effects [14, 15].

Microplastics have been detected in the living waters of Hungary, including fish ponds, Lake Balaton, the Danube, and the Tisza. Wastewater that contains microplastics significantly contributes to the pollution of our natural waters. Micropollutant contamination in water is very often the result of anthropogenic activities and is exacerbated by environmental pollution. In Hungary, there have been a number of serious environmental disasters in rivers, starting with the cyanide pollution in the Tisza in the 2000s, which further aggravated the level of pollution in the water. [16] Due to both ecological and human health risks, it is imperative to reduce the amount of microplastics entering our sewage systems and natural water bodies. Simple technologies such as sand filtration can partially clean microplastics from water, while more expensive and complex membrane filtration can do so on a larger scale. The European Union has taken steps to curb microplastics, but current regulations do not specifically address the prevention of microplastics in water and wastewater. [17] It is essential to assess and develop a valid and comparable methodology for microplastics and to implement further legal measures to preserve our environmental ecosystems and protect human health. Therefore, it is crucial that future legal frameworks include specific limits for microplastics.

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Fighting agains fake news in eduation

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Abstract

Deepfakes, are a new and unique form of communication and visual representation for misinformation and deception. The Deep fakes are the "dark" products of artificial intelligence applications that merge, combine, replace, images and video clips. while created authenti looking but fake information, messages, news, web pages. However, most people are less equipped to recognize when deep fakes are fooling them. A number of polls Indicatethat only about 40% of people correctly identify fakes. That is why it is extremely important prepare young people and schoolchildren to recognize fake news and forgeries.

keywords: artificial intelligence, deepfakes, fake news, misinformation, preparatio, education, deception

Introduction

Today, we may not even be able to realise comprehend how widely they can bring new results, can open new horizons the artical intelligence (hereinafter referred as AI) applications, almost all fields in our lives. Let's think about it. AI is a new – literally vital – practice, what support in medicine. The most difficult medical effectiveness of interventions and complicated surgeries - a monitoring the limit values of the most important hundred vital functions in real time It is an incredibly supportive way of healing.

Elderly tend to give more credit to the written words and they also vote more reability and confidence to the written media. That's why it is common the acceptande and sharing of fake news and conspiracy theories in social media platforms and in the community pages. Of course, the army

can't ignore this technology.Research in progress will further improve the capability of the military leadership and the reability the strategic of decisions.

The experiences of operations made it clear mast be changes are needed of training and education for the Army Officers in the Hungarian Defence Forces. Opens up a range of new effective strategic decision-making possibilities options. detection the the vulnerable artificial intelligence systems, blcoking of the critical decisions in his fields The opponents fighting will attack definitely to the intelligent systems in order of maintain information superiority. Thus rhe Al applications will certainly play a significant major role in the future military systems.

1."Deepfakes", the bet is too hight. and scary

According to a McKinsey[1] study, by 2030, robots will replace at least 30 percent of human work, i.e. nearly 400-800 million jobs, will have to change jobsfor which 375 million people . It's huge and scary.It is tremendous and scary at the same time! Fake videos generated by Al first caught the public's attention in the late at the end of 2017 when an online account called Deep posted/published fake videos generated with a face-swapping algorithm. There is more to the successful implementation and introduction of artificial intelligence than the determination of appropriate technology.

It is a vital requirement that the military leadership should be responsible for their key-significant decisions. 1 Business leaders need to be aware of the technical requirements of the initiative undertaken. By them of these requirements conditions are as most important the data security and truth of the news.

2. Advantages and disadvantages of artificial intelligence.

2.1 Zero human error

This is the reason why the acceptance of artificial intelligence has been booming in various fields. Machines make accurate decisions based on past information that is regularly collected while utilization appying certain, sets stocks supply of algorithms. If we can completely exclude human

[1] McKinsey Global Institute, The age of analytics: Competing in a data-driven world, December 2016

errors, we can get accurate, trustworthy creditable results. So can be achieved the appropriate accuracy thereby reducing the possibility of errors.

2.2 Zero risk.

Smart machines work endlessly, without breaks, even if the same thing must be repeated several times, in contrast with humans. Placing machines in tasks that could pose a serious threat to humans is undoubtedly an important application area. The smart machines do not get tired. It is obvious helping (for example) If we enabling for machines to cope with natural disasters will help:

- the recover faster, in vulnerable human communities.

- may result in less physical and mental strain.

2.3 Disadvantages: "Fake news".

Fake news: means "deliberately and verifiably false news" intended to manipulate people's perception of real facts, events and claims. This definition eliminates inadvertent reporting errors, non-newspaper rumors, suspicions, conspiracy theories, satire, and biased (but not false) reporting.

Fake news is fabricated information that imitates the content of the news media in form, but the basic editing standards and processes of the news media are missing to ensure the accuracy and credibility of information.

3. Types of Fake-News

- Websites: have created stories or fake news that are passed hand over as under pretence of factual news.

- Links: use sensational, misleading, or exaggerated headlines and images to trick individuals into visiting their website. The articles then provide information unrelated to the original "eye-catching" page.

- Native Advertising

Native ads are designed to look like additional stories, but are actually ads from sponsors. Readers treat their links as legitimate news, bewilding/deceiving them in order to achieving more turnover/traffic to their website.

- Astroturfing

Organizations or sponsors (political, religious, etc.) publish their shared message as if would originate come from an organisation unederneath. Messages are targeted as if people support them who belong to that community It can also be a serious concern that with the number of "selfies" taken by the average person in their lifetime and along (with the rapid technological development) anyone can be used as a source.

This new "technology" will probably be used more and more often for revenge amd harassment and fake videos in the future. In fact, additionally they can even appear as evidence in courts. While the early examples of deep fakes focused on actresses, comedians and entertainers, nowadays:

- highlighted of spread of political fake news distribution,
- terrorist propaganda,
- and market manipulation have come to the fore./come into view.

3.1 Deep fakes

Nowadays It occurs more politicians and celebrities are often the subject of deep forgery fakes. Among the most convincing examples of deep forgery have been created by using many well-known personality that imitate the source's voice and specific gestures of the characteristic.

University of Washington - using neural network artificial intelligence - modeled the shape of Obama's mouth and programmed the lip sync. Peele's (famous American actor)[2] mouth was glued to Obama's, and the former president's jaw was replaced with one that followed Peele's mouth movements.

[2] Jordan Peele "The racist American past has never been so exciting"

Figure 1: Did Obama ever say such things[3]

In the long term, these forgeries can spill over to the Internet and furthermore into the areas to civic culture, potentially problematic norms and behaviors too. Deep political forgery falsifications do not necessarily only mislead individuals, but may result in uncertainty that can significantly reduce trust in social media news.

The asked question:

- What was the result of the fake clip?
- Will you belive what Obama say?
- Has Obama ever said anything like that?

Certainly not. These are typical examples of deep counterfeiting!

4. What can be done to recognize fake news and deepfake falsifications?

4.1 The most important is the Education: Tutorial Education about fake news should be part of teacher training. .

[3] https://infoguides.wtamu.edu/msnmodule/evalonlinemod1deepfake

The basic condition of interference intervention system is that trained skilled teachers deal with the topic. For this, it is extremely important to incorporating the relevant and decent knowledge, skills, abilities and the necessary methods about the fake news, into teacher training with the participation of specialized civil organizations and professionals.

Figure 2: The education system must open up[4]

It would be absolutely necessary for the school to cooperate with parents and external cast feature.. External actors (e.g. civilians, experts) can take a large burden off the shoulders of teachers and adopt introduce bring new methods into education in the development of knowledge skills against fake news.

- The education system must be open to competent external actors, and the management of education and the management of the institutions, must motivate cooperation with them.

- The topic of fake news can and should be dealt with dealing (Must be making available the supporting materials (related to professional framework)

  - The primary specialized subjects which are suitable for a deeper discussion of the topic are the following: media knowledge, technology, lifestyle, history and citizen knowledge, Hungarian language and literature, and foreign language classes.

[4] sources: https://www.brookings.edu/articles/why-we-must-transform-our-education-systems-now

- The topic can be included integrated incorporated into the curriculum, even focusing on the fake news and misinformation of the given subject.

- We need specific proposals related to each subject. Profession waits for supporting materials, guides and lesson plans containing specific suggestions, ideas, and examples related to each subject, fit adapted to the needs of different grades.

- It would be of great help in the processing of the topic if there were developed teaching materials with concrete examples and tasks teachers' materials, worksheets, tools, toolkits and lesson plans containing elaborated, concrete examples and tasks were available to teachers.

5. There are eight hints to make it easier to recognize fake news.

1. Make you suspicious should be raised if the title of an article tries to persuade you to open it with statements that contradict all common sense, or if it only wants to cause a strong emotional impact.

2. Let's pay attention to whether forgery is noticeable in the opening image used, or whether an older photo has been used for an article that looks fresh anyway.

3. If the name of the page is completely unknown to us, or simply too general, then we have to think about its reliability.

4. Sentences full of spelling mistakes, excessive use of emoticons, click-hunter catches formulations or unverified/uncontrolled of private opinions in the text; the credibility of such news is questionable.

5. We check whether the author of the article has added his name to the article, and whether his other articles can be found online. Fake news often has a fictional, fake author, or no author at all.

6. When was written is an important information. An article with an older date can be real news, but if it is set as new, it probably only collects clicks.

7. Even more revealing than spelling mistakes is when the text contains statements that are not supported/confirmed by names, dates, and sources. If we do not find such information on the given topic on other sites, it is probably because they are not correct. They are irrevelant.

8. Misleading news portals, articles and advertisements usually have the same identification, characteristics, which, if we pay attention, we can recognize and report them more easily after a while.

We often come across advertisements on news sites, but if their number exceeds the average or if they have nothing to do with the content of the article, then it can be reasonably assumed that the article is actually nothing but fake news!

6. Summary:

Private institutions, the media and individual citizens can find out expose the lies and they can decide for themselves the true value of various deep fakes and false statements of opinion. Some organizations have already experienced the benefits of Artificial Intelligence as it becomes common in business, and they are afraid that who do not apply the result of AI will be left behind. Businesses that embrace continuing education and retrain their employees will see tangible progress and are expected to realize additional benefits.

Deep political fake news forgery do not necessarily mislead individuals, but can cause provoke evokes uncertainty that can significantly reduce trust in social media news.

In some cases government attempts to outlaw misleading political messages could do far more harm to democracy than the mere existence of such speech. In order to remain competitive, for companies investing in artificial intelligence should be invested invest in training of their employees.

There is no doubt that the impact of artificial intelligence applications is increasing and even causing further changes. The education system must open up. It would be absolutely necessary for the school to cooperate with parents and external cast feature. External actors (e.g. civilians, experts)

can take a large burden off the shoulders of teachers and adopt introduce bring new methods into education in the development of knowledge skills against fake news.

Preparing the young people for new challenges is essential for lasting success. The key is modern education, which does not hide the possible dark sides of our everyday life.

The most successful organizations will be those that embrace acquires by mastered by a culture of lifelong learning.

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Platform as a Service application in Military Cloud Architecture

from monolithic applications to a microservices architecture

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Abstract

Cloud computing is changing the provision of its information and communication infrastructure. The direction of IT development has shifted towards the implementation of a loosely-coupled set of services under the banner of a system-centric approach, where services can be quickly and easily assembled to provide agile and cost-effective support for operations. Traditionally IT capabilities were delivered as independent collections of monolithic systems. The modernizing efforts nowadays mean to migrating to cloud native applications built as microservices. These applications then deployed using container technologies. NATO as well as countless other organizations moved form the monolithic software solutions to the direction of microservices architecture to improve scalability, development speeds, and service iteration. Service-Oriented Architecture (SOA) is an architectural approach that organizes software components, or services, to enable interoperability and flexibility within a system or across different systems. The future IT infrastructure of NATO will be available in a few data centers, utilizing shared hardware platforms, centralized Operations and Maintenance, and provided as an Infrastructure as a Service (IaaS). In order to successfully deliver this new architecture, a platform is required that is suitable for rapidly developing and introducing new capabilities within NATO's functional environment. In case of cloud computing, this is known as Platform as a Service (PaaS).

Keywords: cloud computing, military cloud, service oriented architecture, microservices, software containerization, middleware, NATO

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Introduction

NATO is changing the provision of its information and communication infrastructure. The direction of IT development has shifted towards the implementation of loosely-coupled set of services under the banner of a system-centric approach, where services can be quickly and easily assembled to provide agile and cost-effective support for operations. In the past, NATO's IT capabilities were delivered as independent collections of unique systems. Necessary hardware, software, and services for achieving the required capability were acquired separately within specific projects, each operating within its own information silo. Information was shared ad-hoc among these silos, often resulting in redundant creation of certain functionalities. With these characteristics, the systems failed to leverage the benefits of economies of scale or the rationalization of IT infrastructure, which NATO otherwise intended. NATO's future computing systems will be implemented adhering to the accepted paradigm of modern cloud architecture, as originally outlined by the NATO Network Enabled Capability (NNEC) feasibility study. The future IT infrastructure of NATO will be consolidated in a limited number of data centers, utilizing shared hardware platforms, centralized O&M (Operations and Maintenance) environment, and provided as an enterprise-level service (Infrastructure as a Service, IaaS).[1] However, for the successful introduction and delivery of these new systems, a platform capable of rapidly developing and introducing new capabilities within NATO's functional environment is required. In terms of cloud-based computing, this is known as Platform as a Service (PaaS). This article intends to call the attention of the NATO member states military decision makers to shift from the traditional monolithic IT defense application development towards the Service-Oriented Architecture (SOA), as an approach that organizes software components, or services, to enable interoperability and flexibility within a system or across different systems in the microservices philosophy.

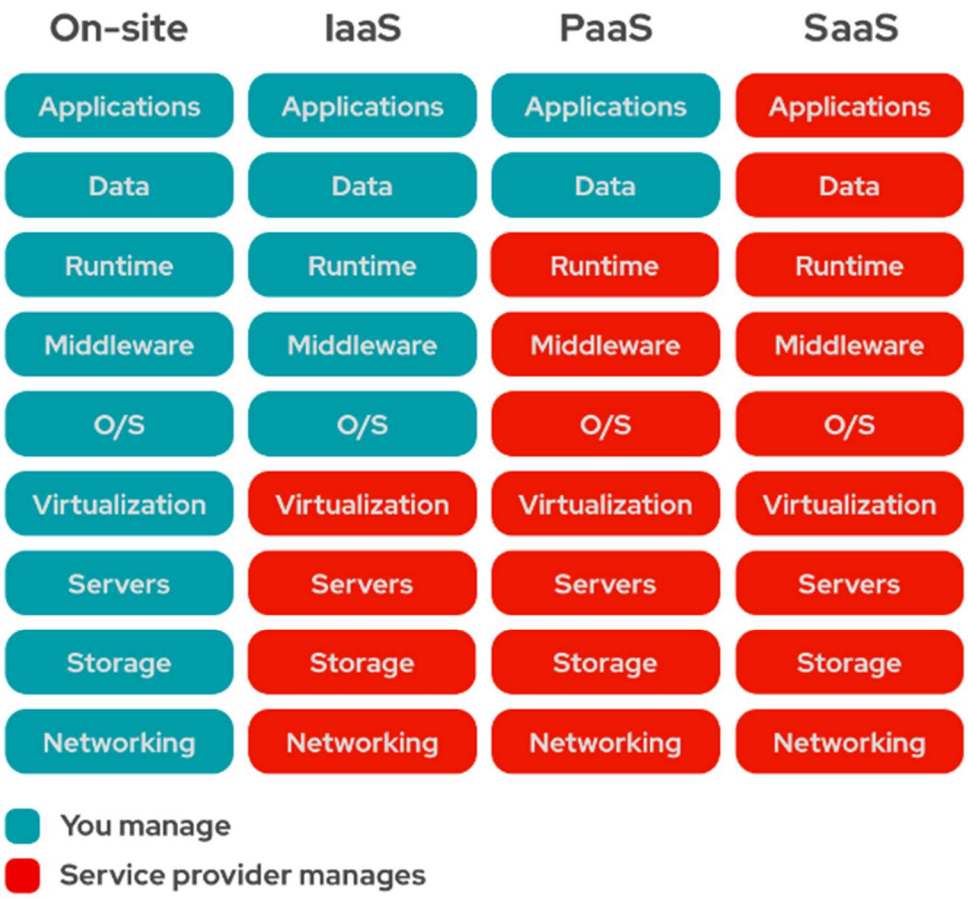
The Service Oriented Architecture approach

Service-Oriented Architecture (SOA) is an architectural approach that organizes software components, or services, to enable interoperability and flexibility within a system or across different systems. The SOA services are self-contained, reusable software components that perform specific functions. They can be accessed and utilized independently of the applications that use them. The SOA offers high level of interoperability. SOA allows services to communicate and interact with each other irrespective of the platforms, technologies, or programming languages they are built upon. This

fosters seamless integration and data exchange. Services in an SOA are loosely coupled, meaning they are independent entities that can function and evolve without being tightly connected to each other. Changes in one service should not significantly affect others. Services are designed to be reusable in various applications or contexts, promoting efficiency and reducing redundancy in development efforts. SOA enables scalability by allowing easy addition or modification of services, adapting to changing business needs without disrupting the entire system. SOA often employs a service registry or repository where available services, their descriptions, and information on how to access them are stored. This makes it easier for developers to discover and utilize existing services. Overall, SOA provides a framework for creating distributed, modular, and adaptable systems, offering agility and efficiency in software development and integration.[1]

Overview of PaaS

Platform as a service (PaaS) is a cloud infrastructure layer that provides resources to build user-level tools and applications. The underlying infrastructure includes computing, network, and storage resources, as well as development tools, database management systems, and middleware. The software developers have direct access to all the resources needed to support the entire application lifecycle, including to design, develop, test, deploy, and host applications from the cloud with platform as a service (PaaS). The user teams have access to the resources they need, on-demand, without the need to purchase and maintain a costy on-premise infrastructure. PaaS is a key service feature of modern cloud infrastructures. The PaaS sits on infrastructure as as ervice (IaaS), which provides compute, network, and storage capacities. As shown in *Figure 1.* PaaS is placed between IaaS and software as a service (SaaS). SaaS provide full services for user teams and while PaaS is dependent on IaaS but also enables SaaS.[2]



1. *Figure - Differences between on-site applications, IaaS, PaaS, and SaaS services* [2]

The NATO SOA IDM project

The project aims to deliver the underlying SOA and IdM Platform, enabling NATO to achieve faster implementation and delivery of integrated information systems. This platform allows future projects to apply consistent, coherent, and proven solutions to common problems, allowing them to focus on delivering business value. It forms part of the IT Modernization Project (ITM), alongside infrastructure as a service (IaaS) capability. The platform changes the way NATO constructs and acquires Functional Area Service (FAS) applications by facilitating the reuse of common functions to reduce stovepipe solutions and enable easier data sharing. The project offers a Middleware platform in the form of a common set of web services responsible for security, integration, registry/repository, service management, information discovery, and sofisticated identity management (IdM) for responsible business processes. The IdM provides services for FASes and other foundational services,

including additional security services and control mechanisms, integrating with NPKI (NATO Public Key Infrastructure) to support strong authentication, and interfaces with other existing and future IdM-related systems. The Alliance Replication Hub (ARH) serves as the directory interface between NATO and Member States.[3]

In case of NATO, the SOA platform is able to deliver a foundational set of core services and components that can be easily reused within new applications. Rather than having to consistently reinvent the wheel, Functional Area Service (FAS) providers will be able to reach into an existing toolkit for common building blocks such as Messaging, Mediation and Identity and Access Management (IAM). The components provided will offer proven, clear and well-documented interfaces that can be easily integrated. This will enable the FAS providers to concentrate on their subject matter expertise to understand, denote and visualize the business logic that supports the operational requirements of their Communities of Interest (CoI). Together with delivering the functional components themselves, the Platform comes with a clear set of guidelines, tools, best practices and process definitions that will support the whole lifecycle of a FAS. The integration components will also support the integration of legacy systems into the broader, service-oriented ecosystem, thus ensuring continuing Return on Investment (ROI) and wider information sharing.

The main features of the SOA approach in military environment

Messaging

One of the primary functions of the SOA Platform is to provide interoperability between systems, so that data from one system can be easily and efficiently distributed with others regardless of the data payload (images, text, video etc.). This means that one of the core features of the Platform is to provide component to component messaging. In order to support a wide range of scenarios, then the Platform needs to support a common set of Message Exchange Patterns (MEP). These include, but are not limited to, Request-Response, Publish-Subscribe, Message Streaming and Message Queues. Additional messaging features may also be applied on top of these MEPs, such as Reliable Messaging and Message Routing, based on the contents or metadata of the message.

Registry and Repository

The Registry and Repository are used to organise and store information that can be accessed by services and service developers at both design time and runtime. This includes metadata about

services, such as the endpoint and interface implemented by a particular service, the schemas of particular XML data models (in different versions), ontologies, transformations and so on. It will support the dynamic discovery of services and information sources.

Mediation

It is important to understand that the consumers of services are not necessarily known when the service is created there are always unanticipated users. This means that the SOA Platform needs to be able to provide easy to implement mediation, both between data formats (such as FFI to KML) and protocols (FTP to HTTP). The mapping between the various data elements will be reusable, so the mediation services will be able to access the Registry directly to retrieve the correct stylesheets. Some mediations will be delivered as part of the platform, whilst tools will be provided to enable different CoIs to deliver their own mediations as part of FAS integration.

Improved Security

The SOA Platform will increase the use of a common, centralized security framework. This will improve the time to deliver systems, through more streamlined accreditation processes, while at the same time hardening the security posture. Administrators will not have to constantly be provisioning and de-provisioning accounts. Instead, a single identity will be used across the whole Military structure with a single set of credentials, providing Single Sign-On (SSO). The identity information will be passed through different systems and services, delivering true, end to end authentication. Access control will again be m action on the data.

Service Management and Control (SMC)

In order to optimize the efficiency and availability of services, it is important that their status is continuously monitored, not only at the machine level, but also at the service level, so the SOA Platform should be integrated with the SMC system. This will also be linked to other services, such as the Registry, to allow the dynamic allocation of service endpoints based on current service performance. The monitoring of services will also support meeting SLA targets, and if necessary, the metering (and charging) of services.

Information Platform

Military systems provide vast amounts of information, which are usually only available within specific CoIs or in formats that are not immediately accessible to, or exchangeable with the data stores

of other systems. The SOA Platform can provide the mechanisms to make information sources discoverable and accessible across organizational boundaries and communities of interest.

Service Orientation

In order to support the implementation of SOA within military systems, it is imperative that the SOA Platform itself comlies the principles of SOA. This means that, for the majority of functions, there will be both a Service Component, running as a separate, loosely-coupled instance and a Compiled Component that can be readily incorporated into applications. The services will all be based on clearly defined, open standards, so that they can, if required, be used independently of the compiled components.

Runtime Environment

The SOA Platform does not constrain the development of FASs in terms of programming language or runtime environment. This means that the building blocks need to be available in most common development environments, such as e.g., Java. The interfaces that are offered by the supported components will be standardized across development environments, both by the components and the supporting services.

Enterprise Application Integration

Defense sector made considerable investment into its CIS capabilities. In order to service-enable these systems, the SOA Platform provides discovery and disclosure of information contained within the system, thus allowing sharing of data and business processes among any connected application or data source in the organization.

Composition

In order to rapidly scale and build new services, the SOA Platform can provide Composition Services with the ability to orchestrate services into compound services, or use message routing to control information flow. By defining business processes, services can be reused and integrated into different contexts, or rearranged to deliver a more efficient operating environment.

Multi-tenancy

Platform tenants need to be isolated from each other, while at the same time being able to easily share information. The execution and memory storage will be separated, granting the isolation

between FASes, avoiding any adverse impact on performance and security. Multi-tenancy will be implemented at both the IaaS and PaaS layers, giving a wide range of multi-tenancy options.

Performance and Scalability

The SOA Platform can be quickly scaled to cope with new operating environments or operational conditions. This means that it will be able to scale up (i.e. increase the level of resources available to a set of machines) or scale out (i.e. increase the number of machines providing the service). This process of scaling will be automated, within agreed parameters, so that additional capacity can be dynamically provisioned at runtime or from remote management centres.

Event-driven Architecture

As well as supporting messaging in a SOA environment, the SOA Platform will also support event-driven communication. In this case, the control and routing of information is in response to events or changes of state. The software-defined process reacts to certain events or states, and these may in turn trigger additional processes or activities.

Federated Integration

Although the scope of the SOA Platform in military domain maintains its exclusivity, there can be a federation aspect considered. This means that the Platform will be able to provide and consume information from outside of the military domain, with authorised partners. The services that can be federated will comply with agreed, open interfaces that can be shared with and agreed by a range of partners using heterogeneous systems.

Documentation, Guidance and Training

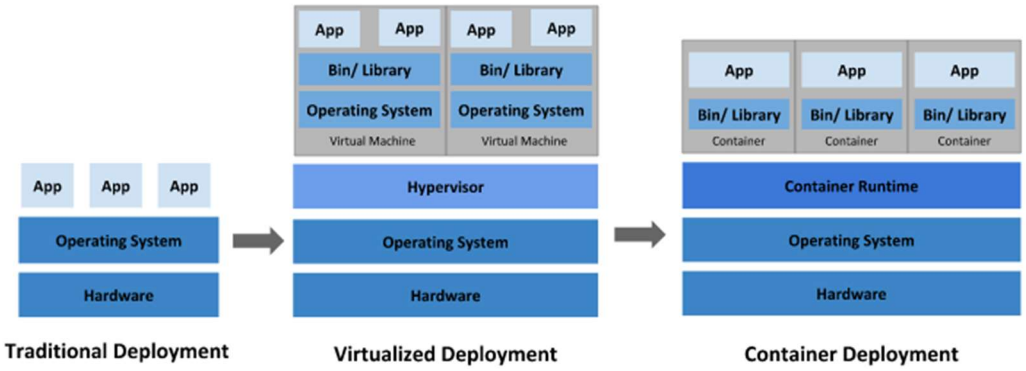
Individual FASs will need guidance and support in preparing their systems for incorporation into the Platform. This will take the form of documentation (such as Service Interface Profiles and Interface Control Documents), toolsets (for verifying interface implementations) and manpower to guide them through the full lifecycle of development and deployment, which will include training.

Microservices and containerization

SOA development is made possible by the microservice architecture and containerization technology of cloud computing.

Microservice architecture provides a fast development model, decomposing the application in several components, each of them with an independent lifecycle. The underlying execution

environment should provide the same level of agility while supporting different languages and frameworks. Containers are enablers for microservices applications, being a perfect execution foundation for microservices architectures. They provide sophisticated execution environments, while the application isolation allows the coexistence of several components or even versions of the same component. Containers are extremely lightweight and because they do not require the operating system spin-up time associated with a virtual machine, they are more efficient at initialisation. Their quick instantiation allows reacting to highly irregular or unpredictable workloads associated to microservices applications. Containerization allows packaging an application with all its dependencies into a standardised unit for software development. The container image wraps up a piece of software in a complete filesystem that contains everything it needs to run (e.g. code, runtime, system tools and system libraries). This guarantees that it will always run the same way, regardless of the environment it is running in. [4]



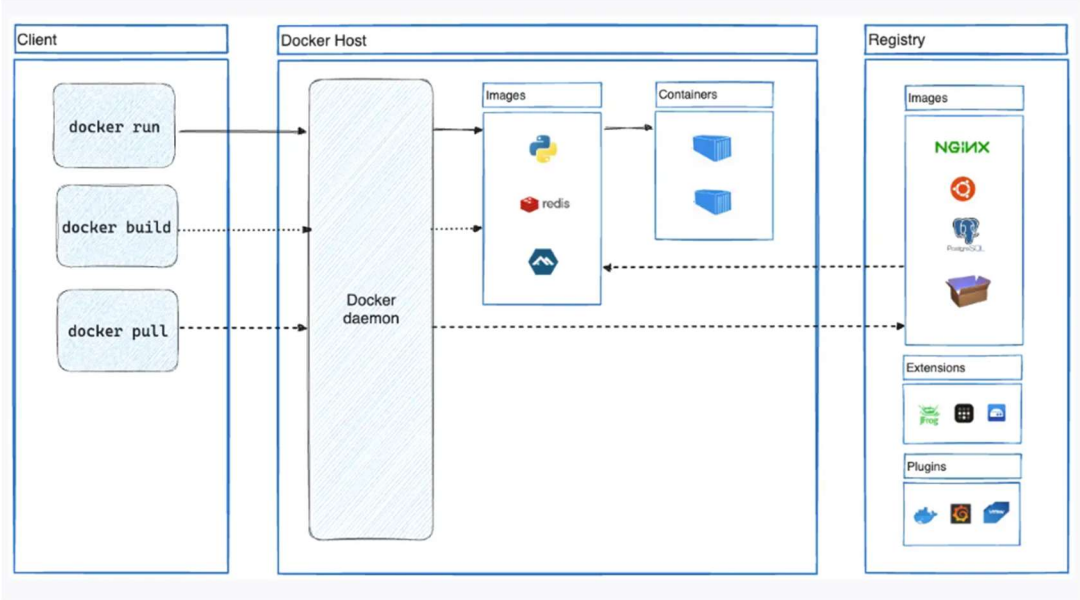
2. *Figure – The evolution of application deployment in cloud environment* [5]

Containerization and orchestration tools

The Docker platform

Docker is an open platform for developing, shipping, and running applications. Docker enables to separate applications from the infrastructure so the software can be delivered quickly. Docker provides the ability to package and run an application in a loosely isolated environment called a container. The isolation and security make it possible to run many containers simultaneously on a given host. Containers are lightweight and contain everything needed to run the application, so what is installed on the host is not relevant. Containers can be shared while in work, and be sure that everyone share with gets the same container that works in the same way. With Docker, the

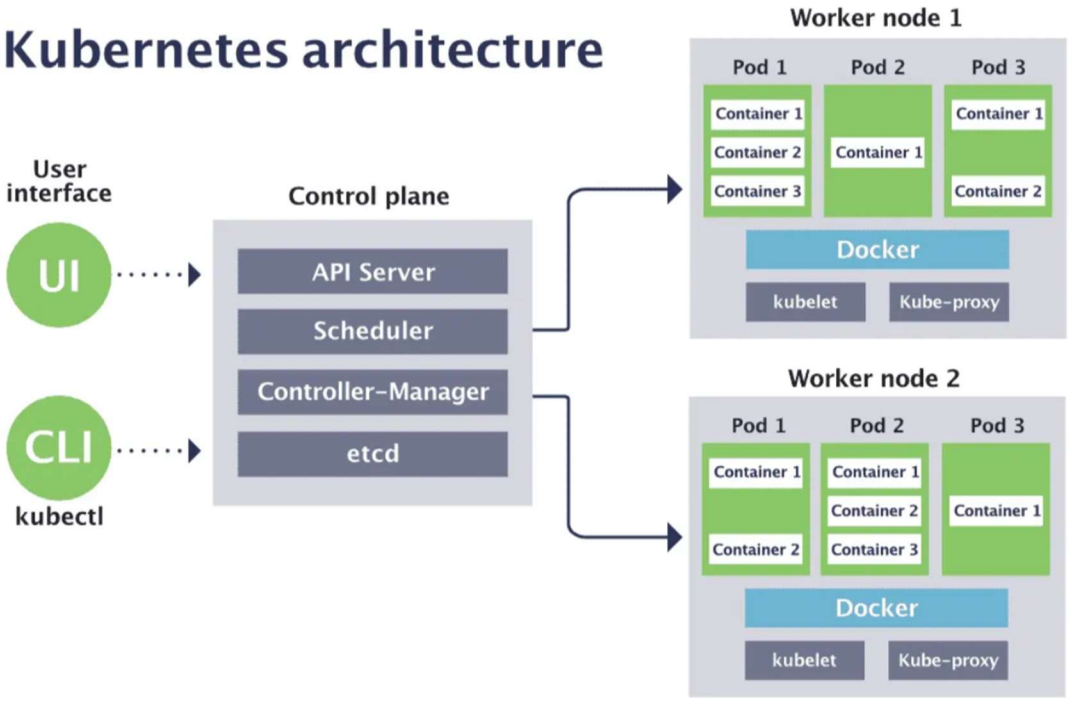
infrastructure can be managed in the same ways as managed the applications. By taking advantage of Docker's methodologies for shipping, testing, and deploying code, the delay between writing code and running it in production can be significantly reduced. [6]



3. *Figure – The Docker architecture* [6]

The Kubernetes platform

Kubernetes or also known as K8S, is an open-source, container-based application orchestration platform. Kubernetes is responsible for orchestrating the entire infrastructure of our application, both the computing, networking and storage parts. Kubernetes also automates all types of operational container management tasks, including commands to deploy, update, and scale containers, according to the needs of the project. [7] Google released the Kubernetes project in 2014 based on the company's internal experience running applications in large-scale, productive environments, combined with best ideas and practices from the community. [8]



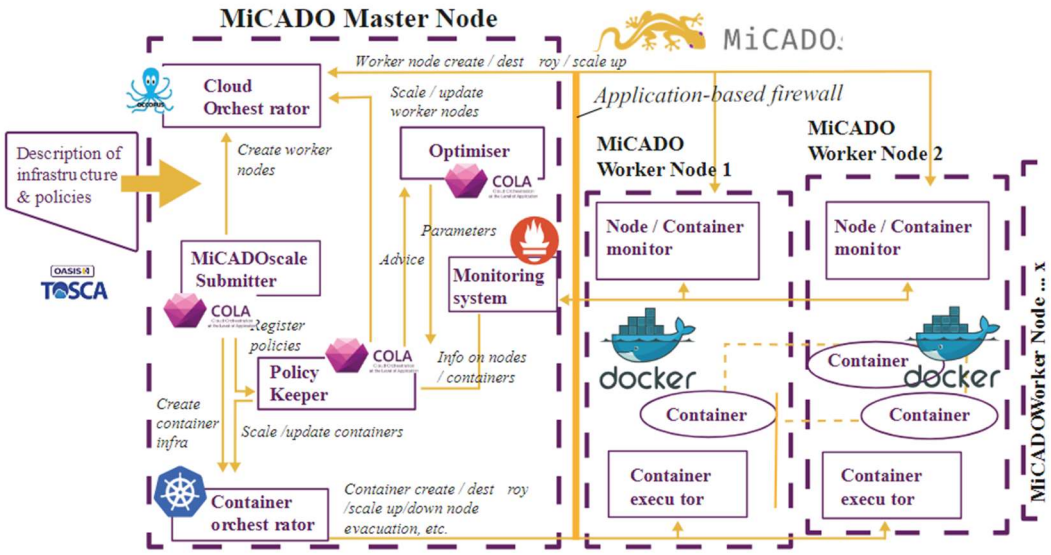
4. *Figure – The Kubernetes architecture* [8]

Docker and Kubernetes are the most frequently used tools in the containerization ecosystem. Docker is used for creating and running containers, while Kubernetes is used for managing and automating the deployment, scaling, and operation of containers across clusters of hosts as orchestrator. So while Docker is a container runtime, Kubernetes is a platform for running and managing containers of various container runtimes. Kubernetes therefore supports numerous container runtimes including Docker, containerd, CRI-O, and any implementation of the Kubernetes CRI (Container Runtime Interface).

MiCADOscale framework

MiCADO is an auto-scaling framework for Docker containers, orchestrated by Kubernetes. It supports autoscaling at virtual machine (VM) level, where a built-in Kubernetes cluster is dynamically extended or reduced by adding/removing cloud virtual machines. Autoscaling also works on Kubernetes level, when the number of replicas tied to a specific Kubernetes Deployment can be increased or decreased. MiCADOscale supports several types of infrastructures like AWS, Microsoft Azure and Google Cloud, as well as OpenStack Nova. The MiCADOscale Optimizer component allows further improvement for scaling rules and a machine learning algorithms determine

the decision for the maximum required number of virtual machines in operation, MiCADO was developed in a EU H2020 project by the University of Westminster and the Hungarian SZTAKI.[9]



5. Figure – The MiCADO framework [9]

Conclusion

The purpose of the SOA Platform is to support the development, operation and evolution of NATO capabilities, and the Platform is going to be used by FASes and other services, throughout their lifecycle. Apparently in military environment prior to the deployment of such service an Independent Validation and Verification (IV&V) is carried out. It also involves the services at the various acceptance and integration tests before acceptance of the FAS, and support for the development of necessary predeployment documentation, such as security accreditation. n order to deliver more flexible, responsive Functional Services, in a more efficient and agile manner, it is essential that there is a platform that delivers common services in a consistent way. By delivering these services, and guiding FASs on how they can be most usefully exploited, the SOA Platform expects that the way the military enhances its capabilities will evolve and improve.

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A new approach to the protection of critical infrastructures: the new directive on the resilience of critical entities

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Abstract

The altered security challenges, especially the consequences of the coronavirus pandemic and the Russian-Ukrainian war that began on February 24. 2022. have necessitated the introduction of measures to enhance the resilience of critical infrastructures at the EU institutions, along with other measures, and the acceleration of legislative processes. With the emergence of new risks and threats, the EU has declared that it is urgent to strengthen the capacities of member states in order to be able to act more effectively against potential attacks on critical infrastructures. The study compares the directive of the European parliament and of the council of 14 December 2022 on the resilience of critical entities and repealing Council Directive 2008/114/EC and the old directive on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection. In addition to the content of the Directive, the article discusses the duties of the member states related to the protection of critical infrastructures.

Keywords: critical infrastructure, resilience, directive, critical entities

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Introduction

In 2008, the Council Directive 2008/114/EC (ECI Directive) emerged as a milestone in the protection of critical systems elements. The ECI Directive specifically provided for procedures for designating critical infrastructure in the energy and transport sectors and allowed member states to establish additional sectors and develop more detailed procedures. Following the establishment of this regulation, several events occurred that changed the security policy situation in Europe and the world, such as the COVID-19 pandemic and the Ukrainian war. Changes in the security policy and social environment further highlighted the vulnerability of critical infrastructures and the importance of their protection.

Since many situations have arisen since 2008 that both the member states and the world had to contend with, it became necessary to develop a new system in line with the challenges of the modern era and providing adequate protection for critical system elements. For this purpose, the European Parliament and Council Directive 2022/2557 on the resilience of critical entities and the repeal of Council Directive 2008/114/EC came into force on December 14., 2022 [1]

Literature review

Several foreign studies have analyzed the content of the Directive and the expected changes related to its entry into force and implementation. In their study "From European critical infrastructure protection to the resilience of European critical entities: what does it mean?" Christer Pursiainen and Eero Kytömaa describe the creation of the Directive as a recognition of the limitations of the defense strategy. In light of this, greater emphasis should be placed on adaptability and recovery processes in relation to critical infrastructure disruptions. However, the question arises as to how to determine whether a particular critical infrastructure or sector is indeed resilient. The problem is that in the absence of accepted or standardized methods, each member state tries to assess this in its own way. [2]

Another article highlights that the COVID-19 pandemic revealed a more complex risk environment that included increasing risks leading to various crises, tighter sectoral interconnections, and necessitated more coordinated response mechanisms in the EU. The pandemic created an entirely new situation for everyone, from the government to the healthcare system, to the citizens, presenting unusual and previously unexperienced challenges. Existing plan systems, plans, and professional procedures (such as infection control) were applied, but more strictly and in an unusual environment, which meant significant physical and mental strain for the staff and the healthcare system. [3]

On the other hand, with the creation of the Directive, the European Commission believes that a solution is provided by extending EU regulations to resilience, which previously focused only on a single sector or specific issue. The CER Directive recognizes that the impact of significant disruptions extends beyond the virtual realm, affecting facilities, roads, railways, energy production, and other infrastructures providing essential services. Additionally, the inconsistent definition of the term "critical" could pose a problem to the European Commission's goal of ensuring equal competition conditions among member states. According to national laws, different requirements may apply to organizations, with what is considered "critical" in some member states not being so in others, potentially leading to doubled administrative requirements, endangering essential services, and hindering the functioning of the internal market. The Directive recognizes the need for consistency among stakeholders to build trust and ensure a well-functioning EU market. Furthermore, the Directive contributes to the continuous improvement of the quality of life for EU citizens. [4]

According to an article published in 2023, the application of uniform and comparable methods can help develop a common approach to managing risks affecting the member states and the European Union. This facilitates efforts to prevent and reduce common risks, such as cross-border risks. The creation of a unified terminology and common concepts can significantly speed up the achievement of consistency and comparability. Such cooperation frameworks enable EU member states to work together more effectively in identifying, assessing, and managing risks, thus improving collective security and defense capabilities. [5]

Numerous domestic and foreign studies on the topic all support the timeliness of the Directive's "update" and the establishment of a new system. It is also important to mention that in the field of the industry sector, the implementation is carried out through the fulfillment of regulations on the prevention of serious accidents related to dangerous substances [6-8].

The justification for the creation of the Directive

The justification for the creation of a new directive was highlighted by the evaluation of the ECI Directive prepared in 2019, which established that the vital system elements are increasingly connected and that it is no longer sufficient to develop and apply protection measures only for certain elements, but to create a completely revised system which takes into account newly emerging risks as well as cross-sector impacts. In order to do this, the focus has shifted from vital system elements to the resilience of critical organizations, so we need to better define the role and tasks of critical organizations that provide essential services in order to increase the resilience of critical organizations. Critical organizations must develop their ability to prevent disruptions in the provision of essential services, their defense methods, and their response in order to react as flexibly as possible, mitigate and mitigate any damage that may occur and adapt to the situation. [1]

The European Union is constantly striving to improve the protection of critical infrastructure, which is vital for the smooth functioning of society and the economy. Several EU and national measures have already been taken for this purpose, for example the program aimed at protecting European critical infrastructure. Nevertheless, it appears that further steps are needed to strengthen the resilience of organizations operating critical infrastructure. The aim of these measures is to manage the risks that could threaten the continuity of priority services.

The threat landscape is constantly changing, dynamic threats such as hybrid and terrorist threats, and complex dependencies between infrastructure and sectors must be faced. In addition, natural disasters and climate change increase physical hazards. Climate change is increasing the frequency and severity of extreme weather events, causing long-term changes in infrastructure. If operators do not take appropriate measures in the future, climate change may reduce the capacity and efficiency of certain infrastructures. [1]

Figure 1 Legislation (create the author)

It is a problem that not all EU member states recognize critical infrastructure in the same way. As a result, the protection measures can also be varied. The aim of the CER Directive is to achieve a high level of harmonization in the identification and protection of critical entities across sectors and organisations.

As a result of the growing dependencies between infrastructure and sectors, networks have emerged that operate across borders and are interdependent. These affect energy, transport, finance, healthcare, digital infrastructure and other areas. The CER Directive aims to identify and protect critical areas, taking into account interdependencies.

The Covid-19 pandemic has highlighted the vulnerability of societies to rare but significant risks. However, differing national regulations can hinder effective responses and negatively affect the internal market. In order to prevent this, the aim of the directive is to introduce coherent and harmonized protection measures throughout the Union. [1]

Analysis of CER Directive

The Directive consists of 26 articles and 7 chapters, created with the unanimous participation of the member states. Unlike the 2008 regulation, the Directive places the protection of critical infrastructures in a different system. It emphasizes the importance of critical organizations in maintaining the economic and social order. Improving the resilience and reliability of critical organizations contributes to creating a sustainable and secure environment in the European Union. [9]

The CER Directive covers eleven sectors:

- energy,
- transport,
- banking services,
- financial market infrastructures,
- healthcare,
- drinking water,
- wastewater,
- digital services,
- space,
- public administration,
- food production, processing, and distribution. [10]

The Directive introduces the new concept of critical entities, which member states must first identify.

It shifts from the previous focus on the physical protection of system elements (like highway sections, food processing plants) to developing resilience for critical organizations, infrastructures, and their essential services.

For achieving high-level resilience, member states must identify critical organizations subject to special requirements. These organizations receive specific support and guidance regarding relevant risks. It's crucial to apply a coherent approach in cybersecurity. The Directive doesn't limit member states' authority in national security and defense and doesn't affect fundamental state functions. Its purpose is to strengthen the resilience of critical organizations while considering national security and state autonomy. In the critical infrastructure system, it continues to maintain infrastructures and essential services but pays special attention to risks and their assessment. Under the Directive, member states must adopt a risk-based approach in identifying critical organizations and ensuring their resilience. This means focusing on organizations most critical to essential services and economic activities. The identification process of critical organizations must consider natural and man-made risks, intersectoral interactions, and cross-border risks. [11] [12]

Figure 2 Medical staff assisted a Covid patient into an ambulance in Wuhan, China, in March 2020.Credit Agence France-Presse — Getty Images

The Directive also emphasizes the importance of supply chain security. Crises such as the Covid-19 pandemic have highlighted the vulnerability of supply chains and their negative impacts. The Directive aims to consider the effects of supply chains when identifying critical organizations.

Within three years of the Directive's entry into force, member states must develop a strategy that defines their objectives and priorities and includes the interdependencies between sectors. This strategy should specify the various authorities and their responsibilities. It must include the authorities' tasks, the national risk assessment, which is also a new feature in the critical infrastructures system. The completed strategy must be updated every four years by the member states to reflect the changing environment.

In addition to the strategy, a mandatory element is the member states' risk analysis, which places significant emphasis on sectoral, cross-border risks, and hybrid threats. The national risk assessment must consider general and other relevant risk assessments in the field, risks arising from intersectoral dependencies, and the characteristics of events that have occurred so far.

After completing the risk analysis, member states have until 2026 to identify critical organizations. In the identification process, the following criteria must be considered alongside the results of the risk analysis and the strategy:

Identification of critical entities	The entity provides one or more services
	It operates on the territory of the state and its critical infrastructure is located there
	A specific event would have a significant disruptive effect

Figure 3 Identification of critical entities (the author)

Tasks arising in connection with the CER Directive

Based on the participation in the central and national defense sector working group held in connection with the implementation of the CER Directive, the following is expected during the implementation.

The CER Directive does not cover the defense and law enforcement sectors, so its scope does not extend to these areas. Under the CER Directive, member states are required to:

- Develop a national strategy related to critical system elements, which must be harmonized with other strategies,
- Conduct a national risk assessment, which includes hybrid threats and armed conflicts,

- Based on the completed risk analysis, develop a national list of essential services,
- Identify critical organizations,
- Critical organizations must conduct their own risk analysis,
- Determine their measures and steps to enhance resilience, which should be documented in a plan that replaces the current Operator Security Plan,
- Subsequently, it's necessary to designate national authorities and ensure their operation financially, and from human and technical perspectives,
- It is recommended that the state provide support to critical organizations not only financially but also through organizing exercises, training, and information.

Additional obligations for member states include designating a central competent authority and a single point of contact, as well as sectoral authorities, informing the European Commission, and participating in the EU expert group on the resilience of critical entities. The purpose of regulatory oversight is to ensure that critical organizations have a higher level of resilience through the implementation of new domestic laws and other regulations. Authorities oversee and regularly check the completeness, compliance, revision, and feasibility of resilience plans based on risk analysis, resilience exercises, and register data necessary for implementing authority actions. Authority inspections are conducted at regular intervals and as extraordinary checks in cooperation with the relevant administrative bodies. Based on the results of inspections, critical organizations may be required to conduct an extraordinary review and modification of their resilience plans. [13]

The Directive emphasizes the principle of cooperation, operating international and national cooperation frameworks between authorities and critical organizations. As part of this, authorities regularly exchange information and inform each other about changes affecting the resilience of critical organizations and share experiences of best practices. The coordination of cross-border cooperation

and liaison among national authorities is performed by the designated single point of contact, which also represents Hungary in the group dealing with the resilience of critical organizations.

To ensure the continuity of essential services, a uniform and risk-proportional resilience requirement system is established for critical organizations and infrastructures.

Tasks of domestic critical organizations include:

- Creation of a resilience plan and risk analysis,
- Implementation of resilience measures,
- Employing personnel with the appropriate professional competencies,
- Reporting extraordinary events,
- Conducting resilience exercises.

The essence of risk analysis is for the critical organization to define and monitor risk management measures in response to identified risks. A critical organization assesses, identifies, evaluates, and manages all risks that may affect the safe and continuous operation of the organization and its critical infrastructure, based on its external and internal environment.

A critical organization, based on risk analysis, prepares a resilience plan concerning its organization and infrastructures, which is the successor to the current Operator Security Plan. The resilience plan outlines the operation of the critical organization and infrastructure, including the procedural and equipment system required to ensure the continuity of essential services, including preventive measures, organizational preparedness, special risk and extraordinary event management, and recovery procedures. It's important to note that existing risk analyses and plans suitable for this purpose can be used for the plan preparation, which the critical organization already has under other sectoral regulations.

Critical organizations need to conduct two types of exercises. The first is a resilience exercise modeling their preparedness, which is documented

and reported to the authority with details and results. The second is a complex resilience exercise, conducted with the involvement of the professional disaster management service and other relevant entities.

Unlike before, the Directive and subsequent national regulations provide support for operators, where the state assists critical organizations in executing their resilience tasks through administrative bodies. Critical organizations and infrastructures, in line with their obligations to ensure the continuity of essential services, must be granted rights that effectively support them in enhancing their resilience, facilitated by amendments to sectoral legislation.

Summary

The events of the last 10 years have highlighted the importance of protecting critical infrastructures, but it has become clear that the regulation is not flexible enough to deal with the constantly changing security policy situation. Through the new directive, it is possible to create an environment that flexibly adapts to sudden future threats and can quickly react to emerging risks. The Hungarian regulations following the directive will enter into force in October 2024, as a result of which the operators will find themselves faced with a completely new system, however, during the implementation, the competent authorities paid special attention to ensure that the changes in the legislation do not impose an excessive burden on the operators.

The introduction of the term "critical entities" has shifted focus within the topic. The European Commission defines this term as equivalent to critical infrastructure operators. This, in itself, does not bring much innovation to the field but rather complicates the regulatory terminology with various national translations. However, it seems that this attention has shifted from critical infrastructure sectors to specific facilities, operators, or entities without explicitly elaborating on this. Consequently, the focus is now on concentrating on essential social functions. The Directive focuses on individual "units" rather than creating a comprehensive system that serves the fundamental needs of societies. This approach may lead to a more fragmented

view of critical infrastructure protection, focusing more on specific entities rather than the broader system they support.

The legal background and protection level of essential infrastructures in Hungary are strong, with Hungary already implementing several of the security measures prescribed by the CER directive. Due to the expansion of the CER directive's sectoral scope and the changed approach to critical infrastructure protection at the international level, the number of critical organizations and infrastructures is expected to increase.

When implementing the new regulation, the experience of operators and authorities concerning dangerous establishments involving dangerous substances can also be taken into account [14, 15].

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