

CONSIDERATIONS ON SOME AGGRESSIONS AGAINST CRITICAL INFRASTRUCTURE ON THE TERRITORY OF UKRAINE DURING THE „SPECIAL MILITARY OPERATION” CONDUCTED BY THE RUSSIAN FEDERATION

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Abstract: The start of the „special military operation” by the Russian Federation on 24 February 2022 on the territory of Ukraine has brought to the attention of the whole world the danger of military confrontation as a way to achieve the political and military interests of the major global powers.

In order to carry out these measures, the military capabilities of the Russian Federation have launched extensive actions to destroy critical infrastructure on Ukrainian territory, thus undermining Ukraine's ability to defend itself against aggressive forces and to ensure optimal conditions for the conduct of internal social life.

Apart from targeting Ukrainian military capabilities - which fall under the category of military critical infrastructure, which is characterised by secrecy in terms of locations, manpower, equipment, missions, etc., and therefore not the subject of this study - the Russian Federation army's attacks targeted critical infrastructure vital to the Ukrainian state, such as road, rail, sea and air transport, power generation (including nuclear power plants), public health and education, or those whose functionality is achievable through cyberspace communications.

The present study firstly reviews the damage caused by Russian military aggression to the above-mentioned categories of critical infrastructure - through a detailed analysis of the open sources of information that have dealt with this issue - and secondly attempts to confirm the theory that keeping these elements of critical infrastructure functional is likely to thwart the intentions of the Russian Federation and ensure the prerequisites for a return to normality in Ukraine.

Keywords: critical infrastructure, airport, maritime, road, rail, nuclear power plant, cyber attack, security.

1. INTRODUCTION

Starting from the classical definition of the term security - seen as the capacity of a state entity to be able to cope with possible aggression from an external aggressor [45, pp. 4-5] - and in relation to internal security policies - which aim at the imperative of maintaining social and political order, counteracting any aggression against them and defending the fundamental institutions of the state - critical infrastructures are today indispensable elements for the existence and functioning of modern states.

The term infrastructure is used in various

ways to define it - precisely because of the complexity of the matrix that contributes to its definition, which includes social, economic, military, political, legal, academic, IT, etc. references - one of the most representative being „the set of physical or virtual entities that ensure the normal functioning of the components of a state or a community”. The extent to which these infrastructures are of particular importance for defining societal values at individual level - such as health, economic well-being, prosperity, safety and security of citizens - and collectively - the stability and optimal functioning of the representative institutions of states [6, pp. 9-

13], gives them the value of critical infrastructures.

Although the value and societal usefulness of these infrastructures has been demonstrated throughout the history of many of the world's countries - especially in the context of the military aggressions to which they have been subjected - it was the unprecedented virulence of new types of security threats that made it necessary to define the term critical infrastructure in both Europe and North America. The legal framework for defining the concept identifies both the subject of the action - physical resources, systems, installations and assets of great importance to the community, or virtual IT&C assets - and the area affected - health, public safety, security, economic well-being, the functioning of fundamental state institutions - or the effect of the action - disruption, interruption, damage or destruction. [6, pp. 15-16] It is obvious that the protection of these values is part of the priorities of achieving national security of modern states - seen both from the perspective of military defence capability and the need to ensure the resources necessary for the functioning of society - in a complex approach aimed at both reducing the vulnerability of critical infrastructure elements and ensuring their effective protection. [5, p. 13]

The „special military operation” initiated on 24 February 2022 by the Russian Federation on Ukraine reconfirmed that the ability of a state to preserve its critical infrastructure capabilities is crucial for the preservation of its power resources and functionality. During the more than 100 days since the beginning of the invasion of Ukraine, the aggressor state has targeted concentrated attacks on Ukraine's crisis infrastructure in various areas with the aim of maximising its power resource.

The research hypothesis is based on the premise that for the Russian Federation the success of the „special military operation” launched in Ukraine is determined by disrupting, stopping, damaging or

destroying critical infrastructure elements on the territory of Ukraine. All of these are symmetric threats, characterised by intentionality and targeting, assumed by the Russian Federation.

The proposed objective is to demonstrate the idea that ensuring the integrity of Ukrainian critical infrastructure elements can lead to thwarting the intentions of the aggressor state, maintaining national societal life in optimal parameters and preserving the integrity and sovereignty of Ukraine.

The bibliography available at the moment is limited, given the short time since the outbreak of the conflict, and the possible negative effects of military aggression on critical infrastructure on the territory of Ukraine, as well as on societal life as a whole, are under analysis at the time of writing (16 June 2022). In this context, we have made use of the open source information available in the public domain at the moment, to x-ray the issue of interest.

The research methodology is based on multidisciplinary, with the research addressing fields as diverse as security and intelligence studies, political science, international relations, economic studies, technical sciences, etc.

The proposed aim is to objectively present the effects of the war in Ukraine on critical infrastructure elements in Ukraine using descriptive analysis. Establishing the cause-effect relationship (causality method) in the study of the effects of the conflict in Ukraine has enabled us to draw up a realistic and credible picture of the damage caused to the elements of the national critical infrastructure and the fact that keeping these elements in a functional state is likely to ensure the prerequisites for a return to a normal situation.

2. ATTACKS ON CRITICAL AIR TRANSPORT INFRASTRUCTURE

It is well known that during military

conflicts, aggressors resort to intimidation tactics by „attacking critical infrastructure and basic functions of the economy” [29, p. 40], in order to erode citizens' trust in the political class and create a state of fear and panic, conducive to the aggressor's actions. Since the beginning of the military operation, the Russian Federation has been targeting "military infrastructure, air defence systems, military airfields and the air force of the Ukrainian Armed Forces" [25] located in the north, east and south-east of Ukraine, with the aim of lowering the country's defence capacity. Among the first targets were Kiev's Boryspil International Airport (KBP) - the country's main airport [11] -, Hostomel Airport - located northeast of the capital Kiev, also known as Antonov Airport as it houses the headquarters of Antonov Airlines [8] -, Zhuliany civilian airport [34], Herson International Airport (KHE) and nearby infrastructure [36], Vinnytsia civilian airport [37], Mykolaiv International Airport [21], Ivano-Frankivsk airport [30].

Note that by 31 March 2022, according to a press statement by the Ukrainian Ministry of Defence, 15 Ukrainian airports had been destroyed by Russian attacks. [23] With these actions, the Russian Federation aimed to decrease Ukraine's mobility and defence capabilities, as these critical infrastructures play an exceptional role in ensuring the capabilities necessary for the optimal functioning of the societal life of any state entity and, by implication, for Ukraine's support of the defence war.

Such attacks were continued by the military forces of the Russian Federation even after 31 March 2022, as in the case of Nipro Airport (Dniepropetrovsk) - which was completely destroyed by bombing on 10.04.2022, with serious damage to nearby critical infrastructure [18] - or the Odessa airport - bombed on 01.05.2022 to destroy the runway and hangars allegedly storing military capabilities provided to Ukraine by the US and other Western countries. [7]

Armed attacks on Ukraine's critical civilian and military airport infrastructure

were likely to cause serious damage and weaken the aggressor's ability to retaliate. Last but not least, they were aimed at obstructing the efforts of some countries that have shown solidarity with Ukraine to be able to provide it with military aid by air in order to counter the aggression of invading forces.

3. ATTACKS ON CRITICAL MARITIME TRANSPORT INFRASTRUCTURE

Even before the „special military operation” on the territory of Ukraine, the Russian Federation showed serious concerns about the partial blockade of the Black Sea, the Sea of Azov and the Kerch Strait under the pretext of naval military exercises. The reactions of the Ukrainian authorities were swift, so that on 10 February 2022, the Foreign Ministry issued an official protest signalling the unprecedented scale of the manoeuvres planned by the Russian Federation for 13-19 February 2022, considering that they would „make navigation in both seas virtually impossible”, thus violating the norms and principles of international law, including „the UN Charter, UN General Assembly resolutions and the UN Convention on the Law of the Sea”. [42] The Russian Federation's demands were in fact aimed at obstructing Ukrainian agricultural and industrial exports to international markets through the ports of Odessa, Herson, Mariupol, Berdiansk and Mykolaiv, with major consequences for Ukraine's economy [17], as well as securing support for a possible aggression against Ukraine from its southern flank.

Despite the defensive measures ordered by the Ukrainian authorities, including the placement of sea mines in the vicinity of these ports, the official closure of the Black Sea and Azov ports was announced on 25 April 2022, following their capture by Russian forces (with the exception of Odessa port). Moreover, the Russian Federation has openly expressed its

intention to capture both the Odessa port and the entire Ukrainian coast, thus causing significant damage to Ukraine's economy. [10] The blockade of Ukrainian seaports was likely to generate a new food crisis, as a result of the inability to export Ukraine's grain supplies, primarily to vulnerable markets in East Africa.

Although the Russian Federation authorities have announced the demining of Mariupul port [31], Ukraine refuses to initiate demining operations in Odesa port, claiming that the area once demined would allow Russian Federation forces to deploy military capabilities to capture the town. [46] Government authorities say the ports will only resume operations if Ukraine is in full control. [9]

The above situation shows that critical infrastructure in the category of military ports, of vital importance for Ukraine's economy and with major influence on the export of grain or other raw materials, has been/is unable to be used for strategic and military reasons.

4. ATTACKS ON CRITICAL INFRASTRUCTURE IN LAND TRANSPORT SYSTEMS

The actions taken by the armed forces of the Russian Federation during the „special military operation” on the territory of Ukraine were aimed at disabling critical land transport infrastructure - road and rail - in order to cause serious disruption to the functioning of the national economy and weaken Ukraine's defence capacity, including by obstructing the transport of military equipment offered by some Western countries that have expressed solidarity with Ukraine to Ukrainian territory. The targets were the destruction of road and rail bridges, viaducts, strategically important works of art linking the country's geographical regions, major railways and rail junctions which helped to secure exports of certain products - iron ore, coal, agricultural products - which provided

important financial resources for the state budget, and, last but not least, strategically important roads. Ukrainian Prime Minister Denis Shmihal reported that „more than 25,000 kilometres of roads and several hundred bridges” [15] have been destroyed by the Russian Federation's armed actions throughout Ukraine.

The strategically important Zatoka bridge, built across the Nistru estuary in the Odessa region, which connects the region with the rest of Ukraine, has been subject to multiple attacks by the Russian Federation's army, aimed on the one hand at obstructing the export of grain through the ports of Romania and Bulgaria, and on the other at isolating the region from the rest of Ukraine, in the prospect of a „possible Russian air-raid” [27] and in the context of increasing military aid from Western countries to the Ukrainian authorities.

In the western part of Ukraine, the Vinnitsa region, military attacks on 25 April 2022 targeted „transport infrastructure” in the vicinity of the towns of Khmerinka and Kozeatin, causing significant damage. [12] Also were damaged railway electric traction substations in the city of Lviv. [20]

On the other hand, in an attempt to consolidate its positions in eastern Ukraine, the Russian Federation has initiated armed actions that have almost completely destroyed civilian infrastructure in Donetsk and Luhansk [35] in order to strengthen its land corridor with Crimea, with significant damage also to road and rail transport infrastructure. It should be noted that on 14 June 2022 all three bridges providing road and rail access to the city of Severodonetsk in the Kharkov region had been destroyed by the armed forces of the Russian Federation, causing major damage and affecting the ability to defend against the aggressor. [1]

Similar actions have also been initiated in southern Ukraine, where critical road and rail infrastructure in the cities of Nicolaev and Mariupol have suffered serious damage, in addition to disrupting the supply of electricity, heat, fresh water, food or

medical equipment and supplies. [13]

It can be concluded that aggression on these categories of critical infrastructure has been one of the priorities of the Russian Federation's military, the damage caused having a major impact on Ukraine's defence capacity and the way of carrying out activities necessary for functioning even in a crisis situation of societal life.

5. ATTACKS ON CRITICAL INFRASTRUCTURE IN THE CATEGORY OF NUCLEAR POWER PLANTS

Nuclear power plants are critical infrastructures of exceptional value for any state entity, both in terms of their contribution to ensuring energy security - which is becoming an increasingly topical issue - and in terms of environmental or human safety, as the well known catastrophic effects of the Chernobyl incident in 1986.

Energy security is currently seen from multiple perspectives: firstly as an economic problem - an approach specific to the European Union -, secondly as a problem with political and military implications - an approach specific to the USA and NATO -, and thirdly „as part of a comprehensive system” for securing critical infrastructures - an approach that has recently tended to gain ground at global level. [29, pp. 172-174]

Here are four active nuclear power plants on the territory of Ukraine, with 15 nuclear reactors operating, providing about 50% of the country's energy needs, plus four decommissioned reactors at the Chernobyl plant. Since the beginning of the „special military operation” launched by the Russian Federation in Ukraine, nuclear power plants have been the target of concerted action by the Russian army, with the Chernobyl plant being captured on 24 February 2022 and bombing on 4 March 2022, followed by the seizure of the Zaporizhzhia power plant, which provides about 25% of Ukraine's energy production. [22] While there are

several theories about the motivation of these actions by the aggressor entity, it is worth noting the Russian Foreign Ministry's statement that the occupation of the two nuclear power plants was done „exclusively to prevent any attempts to stage nuclear provocations, which is a risk that clearly exists.” [26]

In the West, it has been reported that by occupying nuclear power plants - especially Chernobyl, located near the capital Kiev - the Russian Federation authorities aim to „secure the facilities in case of a prolonged war in Ukraine”, thus having control over them and the possibility of inducing additional fear among the world community. It should also be noted that, by occupying the nuclear power plants, the Russian Federation is also gaining control over the transport infrastructure serving them, and can use it to deploy heavy weapons to various regions of Ukraine. [22] On the other hand, it is also suggested that the occupation of nuclear power plants by the Russian Federation's armed forces is aimed at obtaining information from the Ukrainian authorities about possible intentions to develop applied research leading to the production of nuclear weapons that could be used against the Russian Federation's military.

In any analysis of the aggressions - including military attacks - of the invading forces on the targets that make up the infrastructure of nuclear power plants on the territory of Ukraine, the major danger of damage to the safety of the environment or personal safety in the event of a provoked or accidental nuclear accident should not be overlooked.

6. ATTACKS ON CRITICAL OIL AND GAS INFRASTRUCTURE

Critical infrastructure for the extraction, refining and transportation of oil and gas products is of vital importance in both peacetime and armed conflict.

In the context of the „special military

operation” targeting the Ukrainian state, these infrastructures have been under attack by the military forces of the Russian Federation, with the aggressor forces attacking gas pipeline systems in the Ukrainian city of Kharkov from the very beginning, the energy company Naftogaz shutting down operations at the nearby Shebelinsky oil refinery and the gas producer Ukrgasvydobuvannya suspending work at several production facilities. [32] Similar incidents also took place at an oil depot in Vasylykiv, near Kiev. [34]

It is also worth mentioning that the Kremenchuk oil refinery, vitally important in the context of providing much of the fuel support for the defence forces, was subjected to military aggression on 2 April 2022, destroying it completely, including oil storage facilities. [33]

With Ukraine importing about 75% of its fuel needs before 24 February 2022, the shutdown of the Kremenchuk refinery has made Ukraine „completely dependent” on fuel imports. [44] This state of affairs has adverse consequences for the whole of Ukrainian societal life, including the possibility of logistical support for the armed forces involved in the country's defence war.

7. CYBER-ATTACKS ON CRITICAL INFRASTRUCTURE

The Russian Federation and entities connected to it carried out, even before the launch of the „special military operation”, multiple destructive cyber attacks, circumscribed by the forms of the hybrid war against Ukraine, which aimed to, on the one hand to disrupt the proper functioning of Ukrainian governmental authorities and economic, financial and military capabilities [24], and on the other hand to alter or collect information from environments of interest that could provide tactical or strategic advantages to Russian armed forces. [38]

Cyber attacks have been correlated and synchronized with kinetic military

operations against targets of strategic interest to Ukraine, as was the case with the attack launched on 3 March 2022 against the headquarters of the Public Broadcasting Company: Herson TV and Radio Broadcasting [19], after the Kiev TV tower had been bombed two days earlier, on the very day that the Russian army announced its intention to destroy the so-called Ukrainian disinformation systems. Also of note is the confirmed cyber attack on 28 March 2022 on Ukrtelecom, Ukraine's national internet service provider, which led to the cessation of acces to data at the national. [16]

Ukrainian government authorities have claimed to have thwarted a large-scale cyber attack on the national power grid, believed to have been orchestrated by the Russian military group Sandworm, which involved the deployment of several types of malware in the computer equipment of high-voltage power substations in Ukraine. [43]

By mid-April 2022, the Ukrainian Computer Emergency Response Team had identified „at least two successful attack attempts” on the national power grid, one of which began on March 19, just days after the completion of operations to synchronize the Ukrainian power system with that of some European. [28, 14]

According to a Microsoft report, the destructive cyber attacks the company has observed since the beginning of the invasion of Ukraine have directly targeted „Ukrainian government organizations at the national, regional and local levels” or „critical infrastructure sectors that could have secondary negative effects on the Ukrainian government, military, economy and civilians” using various techniques, mostly destructive wiper malware. It is believed that state actors originating in the Russian Federation will also carry out such attacks on some of the states providing various forms of aid to Ukraine, in which context it is recommended that resilient defensive measures should be adopted, targeting critical infrastructure in particular.

[41]

It is obvious that due to the high degree of interdependence between critical infrastructure sectors on the territory of Ukraine, as a result of their connection through complex information systems, cyber attacks can generate some „cascading” effects [6, p. 29], which produce unintended consequences for the entire Ukrainian societal life .

8. ATTACKS ON CRITICAL EDUCATION AND HEALTH INFRASTRUCTURES

Education and population health are of particular importance for any state entity and are considered a priority for the actions of modern states' decision-makers and are included in their security strategies. We can consider that the education and health systems are critical infrastructures of exceptional value, since both contribute decisively to the existence, manifestation and evolution of states.

„The special military operation” carried out by the Russian Federation in Ukraine has fundamentally affected the foundations of the Ukrainian state, through the damage caused to the education system at all levels, as well as to the health units, which have been reduced in their ability to react in crisis situations caused by the armed actions of the aggressor state.

Available data show that in the context of the current crisis in Ukraine, a total of 1978 educational institutions of all levels have been targeted by armed actions, 194 of which were completely destroyed. [2] About a month after the start of the operation, Save the Children claimed that some six million Ukrainian children were at risk, with more than 1.5 million children already leaving the country as a result of schools and hospitals being prime targets of the Russian military, in which context it opined on the need for prompt intervention by international institutions and for the conflicting parties to „support and protect the civilian nature of schools, students and

education staff - and refrain from using educational facilities for military purposes”.

[47]

Armed attacks by the Russian Federation have targeted hospitals and medical clinics, maternity hospitals, blood banks, cancer treatment centres, psychiatric rehabilitation institutions, emergency centres, etc. [40], arousing the indignation of the entire international community, both because of the manner of operation and the immeasurable damage caused.

The images of particular drama recorded following the armed attacks on medical facilities in Mariupol [3], as well as the messages left by the aggressors after they destroyed a school in the town of Katiujanka – „Children, we are sorry for such a mess, we tried to save the school, but there were bombings. Live in peace, take care of yourselves and don't repeat the mistakes made by your ancestors. Ukraine and Russia are one people!!! Peace be with you, brothers and sisters!” [4]-, shows that we are faced with acts of extraordinary cruelty and the aggressors show barbarity and hypocrisy.

In the context of the effects of military aggression in Ukraine, the strategic dimension of the medical system, in relation to the other components of Ukrainian state security, must be addressed as a key factor of development and an action priority, likely to help support resources for all components of the defence system.

9. CONCLUSIONS

The conflict in Ukraine, which is triggered by the deployment of the „special military operation” by the military troops of the Russian Federation on the territory of Ukraine, starting from 24 February 2022, is the most important security threat that mankind has faced since the end of the Second World War.

An analysis of the public data on the concerted actions of the armed forces of the Russian Federation reveals that the aggressor entity has targeted the disabling

of a wide range of critical infrastructures in the fields of road, rail, sea and air transport, electricity generation in conventional and nuclear power plants, public health and education, industry and energy resources, as well as those whose functionality depends on cyberspace communications.

The military attacks caused serious damage to critical infrastructure in the areas of road, rail, sea and air transport, which affected the Ukrainian army's ability to fight back and hindered the efforts of some states sympathetic to Ukraine's cause to provide it with military equipment and combat techniques to give a determined response to the invading army.

On the other hand, the disruption to the functioning of these critical infrastructures has significantly disrupted Ukrainian grain exports to foreign partners, exacerbating the global food crisis, itself one of the most serious security threats facing humanity.

The damage to critical public health and education infrastructure seriously undermines fundamental components of the concept of human security - in the context of today's society's need to ensure „the preservation of a lifestyle acceptable to citizens (...), compatible with the legitimate needs and aspirations of others” [45, p. 6; 39, pp. 18-19] - and accentuates the state of fear that has been installed in Ukrainian society since the invasion of Ukraine.

The evolution of the conduct of the „special military operation” from its inception to the present confirms the theory that the success or failure of a military operation is determined by the manner in which the systems comprising the critical infrastructure of the target are affected and rendered inoperable, it then takes up its functional capabilities.

On the other hand, it confirms the idea that the protection of critical infrastructure is one of the basic pillars of state security, indispensable for ensuring the ability of state decision-makers to ensure good governance, security and economic stability [6, p. 24], as it provides a diverse range of products and services that are vital to the

normal functioning of society.

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