

THE MANAGEMENT OF CRITICAL INFRASTRUCTURES KNOWLEDGE APPROACHED FROM SECURITY AND DEFENSE PERSPECTIVES

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Abstract: *In the context of the growing interest in approaches to the resilience of the state, community or society, materialized in the expression of opinions, statements, views, academic studies or projects with viable medium and long term results, conclusions can be drawn regarding the importance of critical infrastructures in the functioning of the society and especially regarding their role in the context of military actions in the context of hybrid warfare. Briefly and from different angles, both from theory to practice and vice versa, the emphasis in this article is to highlight the main lines of effort, both theoretical and factual, necessary to be set and operationalized in order to enhance the specific knowledge of these assets, in terms of security and defense. Against this backdrop, the present approach regarding strategic resources is in fact useful to the military decision-makers from a wider functional perspective, especially in view of the current stage of the researches and studies carried out so far in this field, at national level.*

Keywords: *critical infrastructure; knowledge; security and defense.*

Introduction regarding the intention and conception of the study

The starting point in formulating the research option for this paper is based on the finding that the specialized literature contains relatively few approaches dedicated to the investigation of specific aspects of critical infrastructure (CI) in a military context or about the military dimension of security. For example, the Google search engine generates about 642,000,000 results for the phrase *critical infrastructure*, about 93,900,000 results for *military critical infrastructure* and about 4,550,000 results for *NATO critical infrastructure*. The previous idea is much better highlighted when we perform searches on the general approach of the subject as compared to a customized model for the military field, in international databases (such as Web of Science). This is also valid at national level (research will be developed at this level and correlated with the identified international good practices). In this context, the studies that focus on military perspectives of CI (e.g. CI protection in military actions) are still quantitatively innovative (e.g. according to the number of citations).

The fundamental questions to be answered in the article are subject to the following findings:

- there are still not enough views expressed based on basic research to establish the place and role of CI in security and defense, including it as a field of study, with a potential for generating applicative knowledge;
- the emergence and use of associated concepts (e.g. resilience) in defense planning documents, which lack clarity and a unitary understanding of the terminology;

- the field of CI activates (both as cause and effect) other “disciplines” in the area of security and defense (e.g. preparing the economy and the territory for defense, management of consequences);

- the proliferation of current integrative innovative technologies with global values (e.g. industries 4.0, artificial intelligence) puts pressure on the organization of specific CI knowledge in terms of security and defense.

The organization and operationalization of qualitative research in this context is based on current benchmarks identified in the specialized literature and on the current state of practice specific to the CI approach in terms of their importance for the field of defense, in compliance with classified information protection legislation, having as final objective the synthesis of some essential ideas, proven valuable in the field of knowledge management dedicated to security and defense. We also consider it a natural tendency to cultivate and refresh the scientific heritage of the military field, as a domain belonging to the broader social sphere, starting from the belief that *“military science cannot be replaced, but only completed, i.e. removed from a certain relative isolation, and integrated in the system of general scientific knowledge, in an epistemology of action. It is a direct part of the scientific aspect of the strategic management of modernization of the society, in a complex, conflictual environment, dominated by anomalies and crises of all sorts, with non-linear, unpredictable and even chaotic evolutions.”*¹

Starting from the individual level, and broadening the scope to the organizational level, the critical infrastructures are ubiquitous in the daily life, due to the characteristics that enable the normal development of the social processes. States are on different levels of economic performance, which generate different approaches to the concept of critical infrastructure security, more vaguely or more robustly defined and applied. Security, including military security, can no longer be seen today only in shades of white (lack of threats) and black (multiple, asymmetric threats), as the spectrum of analysis has become much more diverse, with multiple economic, ecological, and social correlations, which determines the military to be implicitly “trained” according to this VUCA (Volatility, Uncertainty, Complexity and Ambiguity) framework.

Specifically, in relation to the central approach of this paper, the “National Security” sector is regulated at national level through the following subsectors: *“defense of the country, public order and national security; borders, migration and asylum; national security industry, production and storage capacities and facilities; emergencies; law and penitentiaries.”*²

In the actions of CIMIC (civil-military cooperation) structures, also as frequent, detailed and precise assessments of the civilian environment in the conflict area, the main tool used to analyze an area of interest is the PMESII (TE) – ASCOPE matrix (based on the following dimensions: political, military, economic, social, infrastructure, informational, technological, environmental and, respectively, area, structure, capabilities, organizations, people, events). As an example, the infrastructure-structure pair is detailed by the existence of roads, railways, networks and waterway capacities, port, airports, airport capacities, bridge networks, dam capacity and energy production, areas potentially affected in case of destruction, hospitals and other healthcare facilities.

The pandemic crisis has brought back to attention the utility of the capability of the military institution, in cases where the society is facing systemic deficiencies, in this case, regarding the capacity of the medical sector. Seeking a pertinent response on the use of the army in civilian emergencies, Major General Vlad, the Chief of Defense’s Deputy for Operations and Training, argues that *“military systems are uniquely configured to deal with the harshest conditions of war, a situation that tests, stresses and stretches the limits of all human faculties – physical and mental.*

¹ Gheorghe Văduva, *Rolul științei militare în managementul mediului de securitate și apărare în procesul de modernizare a societății*, “Dimitrie Cantemir” Christian University, Institute for Security Studies, București, 2011, p. 6, available at <https://iss.ucdc.ro/studii-pdf/Stiinta%20militara.pdf>, accessed on 28.07.2020.

² ***, Law no. 225/2018 for the amendment and completion of the Government Emergency Ordinance no. 98/2010 on the identification, designation and protection of critical infrastructures.

*This includes a range of capabilities that very few other organizations can implement – from command and control to logistics and resource management, from healthcare and CBRN protection to transportation and engineering, from intelligence and surveillance to strategic communications, and even internal research and development and so on”.*³

At national level, the military significance of CI is also accentuated by the approach to preparing the national economy and territory for defense, in which they are mentioned as active defense capabilities, such as: specialized production capabilities for manufacturing or repair, in case of mobilization or war, of military equipment, armaments, ammunition and raw materials strictly for military use and the capacities intended for the storage of these products; the means, installations and related arrangements intended to satisfy exclusively, in the event of mobilization or war, the transport needs of the forces of the national defense system; communications and information networks, as well as the means, installations and related arrangements, intended to meet exclusively, in the event of mobilization or war, the needs for communications and information services of the forces of the national defense system; hospitals in the healthcare network and other premises that are set up in emergency hospitals to treat the wounded and sick as a result of military action, as well as units that ensure the production of serums, vaccines, antibiotics, disinfectants and other such materials and substances for these situations; storage spaces where state and mobilization reserves are kept; capacities intended for the storage of mobilization reserves.⁴

The map of critical infrastructures – a useful knowledge tool in the management of military actions

The assumption that underlies this section is that in the management of military action, the time and quality of information used to play a key role in ensuring a successful decision-making process (MDMP – military decision making process). Consequently, knowledge of the territorial arrangement of the CI, in an area of interest, is essential, whether it is offensive or defensive, the advantage provided by computer systems for the management of geographical information being obvious. As an example of good practice, with implications for national security, the usefulness of ArcGis tools can be highlighted and invoked. Variants for each type of CI can be created (some even exist for some of them/Figure 1). The challenge is to integrate them in a single CI map, dedicated to the planning of military actions. Given the level of classification of information specific to the guidelines (critical thresholds, technical characteristics, affected population, etc.) of declaring an infrastructure as critical in a certain field, a problem of interest for military decision makers is the construction of their own working tools, which should also integrate an appropriate standardized symbolism for CI and be interoperable with the specialized symbolism used in accordance with the military regulations in force. The substantive issue addressed in this paragraph is also of interest at the level of military geography and military topography, as compulsory study subjects at bachelor level for the training of officers. In classic or digitized format, the map creates a starting point for specialized knowledge, its importance being underlined by the well-known analyst George Friedman in the preface of a recent topical work: *“In order to make sense of the current events – be they conflicts, political or economic instability, or the effects of a pandemic – it will suffice to take a look at the map. Along with the forms of relief, we must be aware of the layers and substrata of society, which make up and alter the map of the world, due to the speed of events”.*⁵

³ Gheorghiu Vlad, *Reziliența societății în contextul pandemiei covid-19 și rolul armatei în acest proces*, in *Gândirea militară românească*, București, no. 3/2020, p. 8.

⁴ ***, Law no. 477 from 12 November 2003 (with the subsequent amendments) on the preparation of the national economy and territory for defense.

⁵ Antonia Colibășanu, *Geopolitică și geoeconomie contemporană*, Tritonic Publishing House, București, 2020, p. 5.

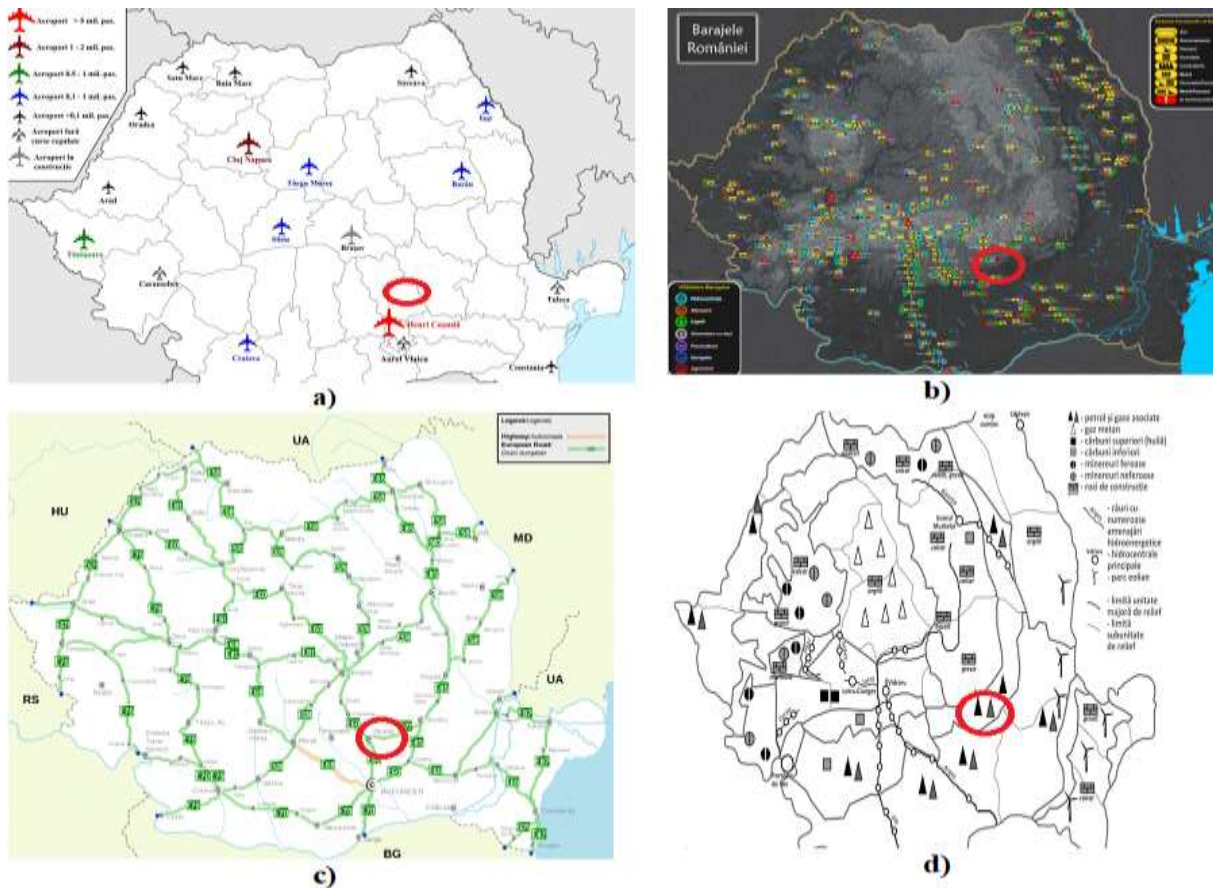


Figure 1 Topical representations (variants) of the different types of national-level CI:
a) airport map⁶; b) dam map⁷; c) European roads map⁸; d) natural resources map⁹

A useful working tool in the sense of the ideas included in this section of the article is the economic-military monograph of the county, a document that comprises (according to the legislation) data and information regarding the main geographical and infrastructure elements, material, energy and human resources, as well as other data and information from the administrative-territorial units, provided by the local public administration authorities, other public institutions and economic agents, necessary to support the defense effort, ensure public order, national security, as well as provide support to the host nation in actions with NATO partners. The document contains the main data and information, which are important for defense, regarding the following: the history and geography of the administrative-territorial unit; demographic structure and housing stock; hydrographic network; forest fund; road networks and genetic arrangements; railway networks; communication networks; electricity networks; economic agents; water sources; storage spaces; accommodation and food preparation spaces; healthcare; pipelines for pipelines; means of transport and construction equipment; airports, ports and berths; educational and cultural institutions; publishing houses and printing houses; the objectives of preparing the territory for the protection of the population; tourism – infrastructure.

⁶ <https://ro.maps-romania.com/aeroporturi-din-rom%C3%A2nia-hart%C4%83>, accessed on 07.01.2021.

⁷ https://www.reddit.com/user/Adrian_Judu/comments/9hz7mw/barajele_romaniei/, accessed on la 07.01.2021

⁸ https://ro.wikipedia.org/wiki/Drumuri_europene_%C3%AEn_Rom%C3%A2nia#/media/Fi%C8%99ier:Drumuri_europene_in_Romania.svg, accessed on 07.01.2021.

⁹ https://3.bp.blogspot.com/-2vsIeyIzP5Y/WTJxZmk195I/AAAAAAAAInw/ou4tWF-NynENqHBXwwybWfQFLyymHr5PACLcB/s1600/12.%2BResurse_Romania.png, accessed on 07.01.2021.

Increasing the power of specialized knowledge in the field of ci by using the map and modeling and simulation

Based on the information explosion characteristic of the 21st century, we could argue that whoever manages to create “recipes” for understanding the new environment in which they operate, takes an important step towards gaining a competitive advantage in that particular environment. It is also the case of understanding the realities specific to the operation of CI networks, increasingly connected by specific vectors of information technology. Against a military backdrop, we are faced with a highly hybridized social reality, which requires tailored solutions in terms of keeping functionality under control, in different action contexts, leading to at least an acceptable level of societal resilience (interpreted as a possible integrative indicator of the normality of a society). In this framework, modeling and simulation (as science, art, process and activity) constitutes an ingredient with high potential to improve the perception of complexity, a generator of knowledge for building methods and methodologies to explain specific phenomenology, ultimately useful to decision makers. First of all, from the point of view of military competitive advantage, this ensures a reasonable time saving in the stage necessary for the analysis of plausible courses of action to follow, based on the most realistic scenarios, in which the complexity of CI interdependencies and the causal chain of some CI specific events are judiciously harmonized. No less important in the modeling process in question is the possibility of connecting and using emerging technologies in the area of artificial intelligence.

Software products dedicated to modeling and simulation of military actions support the possibility of considering CI (for example in field configuration) in the design of training scenarios through simulation and implicitly in their management (e.g. MEL-MIL). In this regard, relevant examples are JCATS/Joint Conflict and Tactical simulation, VBS/Virtual Battlespace (Fig. 2) and SWORD table.



Figure 2 Marking CIs for a real military area using VBS3 and pre-defined symbols¹⁰

Another useful tool for the main idea of this section is the TTX (table top exercise) application in which the key personnel of an organization discuss simulated, hypothetical scenarios, in an informal setting, in order to evaluate plans, procedures, policies. The American expertise (e.g. – Homeland Security Exercise Evaluation Program - HSEEP) proved their usefulness even for crisis situations generated by incidents specific to critical infrastructures. At national level, the application organized by the New Strategy Center, entitled “The Focșani Gate – a key terrain for European security with special operative value” proved extremely useful.¹¹

¹⁰ https://www.fgdc.gov/HSWG/ref_pages/AnnapolisERSmaps/AnnapolisPhotoMap01.jpg, accessed on 11.01.2021.

¹¹ <https://www.newstrategycenter.ro/wp-content/uploads/2019/12/Policy-Paper-Focsani-Gate.pdf>, accessed on 10.08.2020.

The role of education in the specialized knowledge of CI

Starting from the content and significance of one of the most cited definitions given in the pioneering period of knowledge management – KM (the process of capturing, distributing, and effectively using knowledge), we believe specialized education will play an essential role in the transition to a stage of KMCI maturity, also in terms of its significance in the field of security and defense. Currently, the national offer is mainly focused on the training of liaison officers. It is auspicious to consider the design of master and even bachelor degree programs in the educational offer of military academies, supported by the establishment of specialized departments (e.g. - Protection of critical ground infrastructures), as educational structures, dedicated to this issue. The targeted schooling segment can be both military and civilian and the instructional approach (topics, practice, etc.) can be subsumed to a public-private partnership. In this way, the number of specialists in the field of CI will certainly increase, both quantitatively and qualitatively, with benefits for the whole society.

It is obvious, as demonstrated by actions in the area of contemporary good practices of the manifestation of hybrid warfare, that with CI knowledge, things are much more complicated, especially on the background of military action. Can military decision-makers and implicitly planners take into account the consequences of the lack of protection provided to critical infrastructures as a result of the deployment and employment of forces (land, air, naval, joint, etc.) in a timely and true manner? Must the response come from knowledge, as a means of mediating between security and defense (as phenomena, states and processes) and be related to the reality of the current operational environment? The discussion also pivots on the differentiation regarding the place given to knowledge about specific issues of critical infrastructure protection, namely, either in the domain of military sciences or in the field of national intelligence and security (as regulated doctoral fields in Romania). We base this conclusion on the following argument: if we consider strictly the functionality of these infrastructures, its place would be in the latter; if we refer to the preparation and development of military intervention, in general and in particular, to the defense of such an objective, in the context of a hostile action (terrorist attack), CI knowledge should be located in the former. The interdisciplinary character of the two fields mentioned and the complexity of the CI protection approaches determine a complementary use of references from the two categories, in both military theory and practice.

Conclusions

For the national CI system, the customization by military specialists of the software elements (common values, competencies, behavior, personnel) of a tool with wide applicability in the field of organizational redesign (McKinsey 7-S model) leads to the fulfillment of the operationalization condition of adequate knowledge within military organizations, related to the objectives of interest in the design of military actions. We consider certain inevitable difficulties specific to knowledge, as they are already sufficiently mentioned in the specialized literature. Such an example is provided by Constantin Brătianu: *“Knowledge management is an integral part of organizational management, being the link between operational and strategic management. Knowledge management is a more difficult field to understand because knowledge is an intangible entity that we conceptualize with the help of metaphors. This also entails a certain limitation of their understanding given the quality of the metaphors used and the cultural matrix in which a certain thought emerged.”*¹²

¹² Constantin Brătianu, https://www.researchgate.net/publication/306866415_Managementul_cunostintelor_Concepte_fundamentale, accessed on 17.01.2021.

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