

## ASPECTS REGARDING THE USE OF ARTIFICIAL INTELLIGENCE IN IMPROVING DEFENSE RESOURCE MANAGEMENT

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**Abstract:** *Regarding the society evolution dominated by a high-level technology, we consider this article a constructive approach. The aim of the paper is to highlight a few activities/places/spots in which competences of humans/soldiers interfere with different elements of the artificial intelligence. We deem that the technological progress in the past few years has been impressive. Nowadays, thousands of activities that were mostly or exclusively executed by people can be done faster and often with greater precision using digital systems. In this instance and considering the achievement of functional compatibility between Romanian Army and forces from NATO as being a priority, the development of the technology based on artificial intelligence is vital within the defense resource management.*

**Keywords:** *artificial intelligence; resources; NATO; technology.*

### Introduction

The presence and importance of technology for the harmonious development of society has become a benchmark of sustainable economic growth; artificial intelligence (AI) becomes an increasingly well-known concept as a key technology for the future of mankind. The uncertainty of the ecosystem of society demands rapid adaptation to change and the current technological progress opens up access to untapped opportunities. Nowadays, AI technology is all over the world. Furthermore, different industries have already made significant progress. The benefits of AI implementation at the strategic and operational level have demonstrated a significant increase in terms of resource efficiency. In addition, the costs of the logistical process decreased considerably due to real-time data analysis and prediction outcome of AI.

Obviously, the current pandemic forces public and private institutions to face a complex range of issues such as: resource and organizational structure management, budget deficit, effective strategic planning and, above all, adaptability to agile changes within the external context. Today, the focus shifts to organizations that understand the role of technological progress and apply its principles in their infrastructure, understanding the competitive advantages of this approach. There is no doubt that an integrated strategy is needed in adopting new technologies, in particular with reference to intelligent software. This means raising awareness of global movements and, consequently, preparing their human capital to this end, thus establishing a state of balance in the flow of an organization that ensures survival and acquisition of useful know-how.

As the SARS-COV-2 pandemic has once again highlighted the fact that the world is more unpredictable than ever, the North Atlantic Alliance is aiming, through its new strategy named NATO 2030 to maintain a high standard regarding adaptation to security requirements of the international environment. Moreover, the organization encourages other member nations to develop new capabilities based on artificial intelligence<sup>1</sup>.

### Methodology

In a context characterised by an unprecedented dynamism, where moments of uncertainty are frequent realities, nations need to put together their forces and become increasingly aware of

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<sup>1</sup> Jens Stoltenberg, *NATO secretary general: Our alliance must remain strong militarily and politically across the globe*, accessed on 11.01.2021, URL: <https://www.defensenews.com/outlook/2021/01/11/nato-secretary-general-our-alliance-must-remain-strong-militarily-and-politically-across-the-globe/>

the need for coherent strategic thinking. Moreover, they have to realise that by using this approach, they will be able to quickly and effectively adapt to unpredictable changes within the socio-economic environment. Therefore, we can consider NATO 2030 as an imperative for the development of military capabilities. Through this scientific approach, we have set out to identify, on a one-off basis, relevant activities in the area of defence resource management where the contribution of artificial intelligence could generate substantial improvements. Moreover, it is known that the major powers are already implementing AI technologies, both at a centralized system level and in relation to defence equipment and ammunition.

The article was designed using methods that collect non-reactive data such as personal observation and the study of „traces” (both documents and other forms of information storage). It is also based on a review of essential works developed by experts in the field of artificial intelligence and certain categories of defence resources. Current articles were used to complete the overall picture and the experience of authors, both within the military organization and in civil entrepreneurship, has enabled a multidisciplinary approach to the subject addressed.

### **Defence resources**

Today’s society is characterized by a visible rush of resources. Awareness of the importance of many of these resources, as well as the fact that some are non-renewable, and the desire to have a significant regional or even global share of one category or another of resources, is engaging numerous states in a continued race for obtaining them. A significant difference between two states is given by the manner in which a country is able to exploit the opportunities offered by the supply chain, in order to overcome difficult situations or how quickly they can adapt.

In our country, the need to not waste existing resources, but to efficiently use them, through a unified use and even to identify new ones, in an integrated system, though the support of all available instruments. This forces us to focus our attention on threats, risks and vulnerabilities within the national security and defense. Furthermore, the attention must be focused on international security commitments made by our country, as well as on the categories of resources allocated to reduce or eliminate security destabilizing factors.

Romania is known as a medium country (seventh in size) within the European Union. It does not have the ambition or resources to take on the role of the sole actor involved in ensuring state security. Instead, Romania relies on its allies and partner – states within the international community. In this context, our country will be capable to maintain a favorable climate of security. Moreover, it will represent a value for its partners in achieving major international or regional goals. This added value comes both from the resources our country has and from “developing niche capabilities that are interesting for our allies and partners”<sup>2</sup>.

In this context, the NATO 2030 Strategy strengthens the importance of developing such capabilities. Moreover, the Strategy highlights the fact that these capabilities should be based on the integration of artificial intelligence.

It is known that the strategic partnership is a representative tool in developing its own capabilities using resources, common expertise and experience in different areas. Regarding defense resources, the exploitation of the international security position allows reciprocal access to resources, capabilities, experience, expertise of technological transfers (arms and military technology) and the development of the transfer of know-how in the field of organization, management, learning and training personnel. Even if NATO is one of the most relevant political-military alliances in the world, it has limited resources that require rigorous management. As a member of this Alliance, Romania strengthens its position in the Alliance by building on capabilities and contributions in international exercises and operations.

Efficient use of resources means ensuring the responsiveness of specialized structures. In this context, defense resource management must use, in an integrated and coherent manner,

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<sup>2</sup> Iulian Chifu, *Gândire strategică*, Editura Institutului de Științe Politice și Relații Internaționale, București, 2013, p. 45.

existing and identified resources in order to maintain, support or generate new capabilities designated to accomplish the security tasks. Climate change, economic instability or different types of problems regarding resources requires implementing a constructive approach in managing all categories of resources. In particular, conceiving and planning the implementation of such a strategy is a vital tool for national defense planning.

### **Artificial intelligence**

The society of the future is set to be built on a few focused pillars. The development of technology – a central pillar of future development will be the headpiece of coming decades. Innovations, the design of increasingly performing systems or value-integrated will deliver value for future generations. Moreover, Jamie Susskind mentioned in his paper<sup>3</sup> that all these changes are moving towards the emergence of a world of *digital life*. The author defines “*digital life a dense overcrowded system that unites people, powerful machines and abundant data in a network of great complexity and fineness*”<sup>4</sup>. However, the concept of artificial intelligence is not quite new within the scientific world. AI was first introduced at the Dartmouth conference in 1955 by the computer technician and professor John McCarthy. His first paper represents a baseline and defines AI as “*the science and engineering of intelligent car manufacturing*”. His article led to the development of the Lisbon programming language in 1958 which was based on the radical idea of calculations using symbolic expressions rather than numbers, which helped to create an entire industry based on the artificial intelligence we know today.

The field of artificial intelligence is a recent segment. It was initiated in the middle of the 20<sup>th</sup> century and has developed at a very fast pace.

The main idea of AI technology is based on a system that has the ability to simulate human intelligence and to react or make decisions, depending on the information received from the external environment or on data already entered into the computing system. In order to understand artificial intelligence, you should associate AI with human intelligence. Furthermore, AI is a software conceived to simulate how our brain works. Unlike the human mind, where connections are made at the neuronal level by receiving a stimulus from sensors (such as eyes or ears) or acquired through the perception of experience, artificial intelligence correlates the data available from the computer technician, another external software system of sensors and an algorithm developed by interpretation.

The human brain has connections based on a neuronal level. The human body sensors (such as eyes or ears) receive information. Moreover, a person gets information through the perception of experience. On the other side, artificial intelligence correlates available data with external sensors using algorithms developed to perform. One of the advantages of using artificial intelligence is to create functions that can work intelligently together and, also independently.

As mentioned above, artificial intelligence uses input data obtained either through manually entered databases, by centralizing/collecting data from different sensors or simply from the external environment. The aim is to obtain predictions for automation of overly complex or routine activities that would involve high costs and be time consuming.

When we talk about artificial intelligence we generally refer to “*systems capable of performing tasks that, in the past, were carried out with the help of people’s cognitive and creative processes*”<sup>5</sup>. If we want to further explain this field, we can say that the level of performance based on intelligent systems is present and easily visible. In most cases, because of our imaginative process, we tend to associate artificial intelligence with a humanoid robot. Yet, AI is actually a software program built with the ability to learn and quickly adapt to the external environment.

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<sup>3</sup> Jamie Susskind, *Politica viitorului. Tehnologia digitală și societatea*, Editura Corint Future, București, 2019, p. 43.

<sup>4</sup> *Ibidem*.

<sup>5</sup> *Ibidem*, p. 44.

Nowadays, AI technology is increasingly used: from GPS systems that generate predictions to estimate the time to an established destination, to intelligent robots with which, for instance, the medical world can perform complex operations or identify treatments more easily using the AI's identified patterns – a process that would normally take many years for scientists due to the amount of data that is globally available.

The existence of technologies which can facilitate translations from one language to another in a short period of time or recognize human faces and different voices are just two examples of the need for using intelligent systems in the widest range of activities. For instance, chatbots are present in shopping platforms of different companies. They are able to take over shopping orders (pizza, daily food, etc) and turn them into firm orders ready to be delivered to the recipient.<sup>6</sup>

Aforementioned artificial intelligence has already revolutionized the world, the way we perceive things and people around us, being present in all areas worldwide: from the hotel services industry, education, entertainment, online trade to manufacturers of intelligent devices in aeronautics, aerospace, automotive, etc. The central question which remains stable in the field is whether these systems will replace us, or they will ultimately lead us. For the moment, the deployment of AI technologies is forcing people to refocus on other jobs or acquire new sets of skills and not to replace them. This is because AI technology needs to be implemented and run by people. The retraining of future generations must be based on building more robust systems in order to accomplish all the tasks we need, without collapsing, functioning poorly or being pirated. When developing the aforementioned program, defining functionalities and limits are key aspects in respect to human rights, values and ethics.

On the other hand, the concept of AI concerns the largest scientists, entrepreneurs and leaders, due to the competitive power of the software program and also the power of making autonomous decisions. In this context, Elon Musk, Tesla's CEO, stressed that "*AI is a fundamental risk to the existence of human civilization*"<sup>7</sup>. In a press release, Russian President Vladimir Putin said that the nation leading in AI "will be the leader of the world"<sup>8</sup>. The fear of scientists regarding AI stems from the fact that a program has the ability to learn much faster than man. Moreover, the intelligence of a machine will surpass human intelligence. Due to this, companies, such as Tesla, are testing the human-machine communication concept by implanting CIP into the human body, so that humanity can keep up with the development of technology. However, the greatest risk in terms of artificial intelligence is not the fact that the program will start making its own decisions and gather control, but about software design errors made by human operators in its development – whether on purpose or not.

How will AI affect warfare, the justice system, jobs, society, and even human nature? How can we keep AI beneficial? The legal framework could be the answer to the previous questions. In the end, it is man who develops technology and who will be in charge with deciding the direction it will take. Moreover, in which cases will human rationale be preferred in decision-making? AI is still a concept belonging to humans. This paradigm should be approached with the idea of using AI in order to increase prosperity through automation, without impacting people in a negative manner.

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<sup>6</sup> Cory Edwards, *Why and how chatbots will dominate social media*, accessed on 08.01.2021, URL: [https://techcrunch.com/2016/07/20/why-and-how-chatbots-will-dominate-social-media/?guce\\_%20referrer=aHR0cHM6Ly93d3cuZ29vZ2xILnJvLw&guce\\_referrer\\_sig=AQAAAGh9ZA2MeH97KZ0BwAj-nF0DK8msbfPvTB60g3-8681p4xdfjR-&gucounter=2](https://techcrunch.com/2016/07/20/why-and-how-chatbots-will-dominate-social-media/?guce_%20referrer=aHR0cHM6Ly93d3cuZ29vZ2xILnJvLw&guce_referrer_sig=AQAAAGh9ZA2MeH97KZ0BwAj-nF0DK8msbfPvTB60g3-8681p4xdfjR-&gucounter=2)

<sup>7</sup> Matt D'Angelo, *AI fundamental risk to the existence of human civilization*, accessed on 16.01.2021, URL <https://www.teslarati.com/elon-musk-ai-fundamental-risk-existence-human-civilization/>

<sup>8</sup> James Vincet, *Putin says the nation that leads in AI 'will be the ruler of the world*, accessed on 16.01.2021, URL: <https://www.theverge.com/2017/9/4/16251226/russia-ai-putin-rule-the-world>

### **Optimizing management of the defence resources by using artificial intelligence**

Regarding the actors directly involved in resource management, the idea that „mobilization” is behind the provision of the best possible material and human resources in order to achieve military objectives, taking into account their level of involvement in orderly actions or missions, is well established. We would say that defence resources are not limited to people and materials. Regarding the legal framework around the mobilization process, we consider important to highlight a few activities in which AI can prove a consistent input.

AI is a fast-growing technology adopted in many global industries. Research evidence has shown that AI improves performance and productivity in an organization by automating processes and activities that require human intervention. We are talking about a significant time decrease to accomplish activities. Moreover, the data base used is a significant one and the input has come from various sources.

Within the Army, AI plays an important and crucial role. Countries such as Russia, China or the USA, as well as others, have taken significant steps toward AI implementation in the defence sector.<sup>9</sup> For example, the USA develops applications using AI in military domains such as: logistics, cyber operations, intelligence, command and control, etc. The development of smart missiles, drones or armed robots which, using certain parameters, have the ability to locate and destroy nearby targets without significant human involvement, could lead to an opponent’s surprise or to the provision of leadership on the battlefield.

A recent event, in which the use of drones was key in the actions being carried out is the conflict between Armenia and Azerbaijan in the area of Nagorno-Karabakh at the end of 2020. During the 44 days of conflict, drones provided a huge advantage to the Azeri by destroying tanks, artillery and anti-air defence systems. That fact was clear evidence of how combat fields can be dominated by intelligent technology systems.<sup>10</sup>

We consider that one of the most important resources within an organization, both military and civil, is time. Furthermore, the established objectives are to be achieved as quickly and accurately as possible. In this context, we have identified some activities that could be significantly improved by using one of the fields composing artificial intelligence – *automatic learning*. Referring to this as a series of algorithms (instructions) capable of recognizing patterns, generating models, performing tasks and processing significant amounts of data, Pedro Domingos wrote in his book “*The master algorithm*” (2015) that „*automatic learning algorithms can acquire both knowledge and skills*”<sup>11</sup> giving computers the competence „*to be programmed on its own*”<sup>12</sup>.

At the same time, these automatic learning algorithms are built in three distinct ways: by “*supervised learning*” – human intervention to achieve desired results, by “*unsupervised learning*” – the computer is given data and identifies the patterns by itself, “*learning through strengthening*” – the computer receives feedback on the quality of the results generated and the system is able to self-operated.<sup>13</sup>

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<sup>9</sup> Forrest E. Morgan, Benjamin Boudreaux, Andrew J. Lohn, Mark Ashby, Christian Curriden, Kelly Klima, Derek Grossman, *Military applications of Artificial Intelligence*, accessed on 08.01.2021, URL: [https://www.rand.org/pubs/research\\_reports/RR3139-1.html](https://www.rand.org/pubs/research_reports/RR3139-1.html)

<sup>10</sup> Jonh While, *Nagorno Karabkah drones in the conflict between Azerbaikan and Aremenia*, accessed on 08.01.2021, URL: [https://www.washingtonpost.com/world/europe/nagorno-karabkah-drones-azerbaijan-aremenia/2020/11/11/441bcbd2-193d-11eb-8bda-814ca56e138b\\_story.html](https://www.washingtonpost.com/world/europe/nagorno-karabkah-drones-azerbaijan-aremenia/2020/11/11/441bcbd2-193d-11eb-8bda-814ca56e138b_story.html)

<sup>11</sup> Pedro Domingos, *The Master Algorithm. How the quest for the ultimate learning machine will remark our world*, Basic Books, New York, 2015, p. 8.

<sup>12</sup> *Ibidem*, p. XI.

<sup>13</sup> Benone Andronic, Gheorghe Minculete, *Abordări relaționale ale sprijinului logistic al Diviziei de Infanterie în operația de apărare*, Universitatea Națională de Apărare „Carol I”, București, 2019, p. 50.

Regarding the fact that personal and professional life will be inseparable from technology because of its increasing presence in daily activities, we consider that it is necessary to analyse the possibility of implementing intelligent systems in the human resources component within integrated management of defence resources. Furthermore, the role of AI within resource management will be to provide real options to the involvement of humans in activities.

Supply and resupply should be seen as an essential component of operational logistics. It must ensure the optimum quantity and quality of the fighting forces, in the right place and at the right time. Moreover, it should support all the fighting forces with all required categories of material goods. Transposing this activity in commercial terms, logistics supplies the products required by the “customers” and the client is represented by the combatant forces. Through their efforts, “suppliers” aim to gain the trust and loyalty of their customers by providing the required products in a timely manner.

As a rule, in a military operation, the needs for supporting the warrior forces are identified in stages, in two different phases. First of all, the original supply provides the quantities of material needed to build up the stock of troops and established CDOS. Secondly, resupply is represented by steps required to ensure the quality of needed material to maintain stocks at the initial level, taking into account the materials that are destroyed, contaminated, lost etc.

Understanding the importance of providing all the materials needed to conduct a military operation, at the right time and place, two main methods of resupply were doctrinal theories: “push – for materials required to be supplied regarding the regular rate of consumptions and pull – for materials required to be supplied at irregular intervals based on requests”<sup>14</sup>. Considering the complex operational environment defined by a large spectrum of techniques and where the unexpected becomes a constant, we deem it necessary that a third way of supplying forces with materials to be considered. The “directed”<sup>15</sup> approach is a viable alternative and is designed in order to supply the fighting forces in unforeseeable circumstances. Moreover, the resupply is based on the real need regarding the fluctuant consumption. All the activities shape a “pro-active”<sup>16</sup> resupply system. While digital systems are not vital in the first two methods of resupply, this third way requires a high degree of digitalization. Firstly, all the parties involved demand to interconnect in a predefined network. Secondly, all data must be collected and centralized. The decision structures must have access to all the information. When we talk about data we refer to at least a few pieces of information that would facilitate analysis and identification of the best way of resupply: standard of consumption, stocks, missions assigned, technique designated for missions, factors which could influence the performance of the tasks entrusted etc. Moreover, implementing a smart system in order to measure the fuel used by the vehicles and interconnecting it with the decision point would facilitate the resupply of fuel. The transfer of data can be done by satellite system and the implemented technology would lead to the integration of all the structures into a network. This will significantly facilitate the process of decision making. Real-time information and the designated developed algorithms can automatically calculate the needs for resupply. Moreover, the analyses based on a large spectrum of information positively influence the decision. Furthermore, human involvement will be reduced; the resupply process will be predictable. All in all, the entire process will be more efficient and the involved resources will be tailored to the necessities.

A key activity within supply/resupply process indeed essential to successful military operations is the effective transport of goods, ammunition, weapons and troops. Generally speaking, AI integration within military transportation can reduce both costs and operational human effort. This means the possibility of relocating human resources to other activities. The integration of the entire transport fleet (land, sea and air) can also make it easy to detect

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<sup>14</sup> Art. 518, alin. 3 din *Doctrina logisticii întrunite a Armatei României*, București, 2020.

<sup>15</sup> Benone Andronic, Gheorghe Minculete, *Abordări relaționale ale sprijinului logistic al Diviziei de Infanterie în operația de apărare*, Universitatea Națională de Apărare „Carol I”, București, 2019, p. 74.

<sup>16</sup> *Ibidem*.

malfunctions such as: unjustifiable high costs, disproportionate loads, noncompliance with the deadlines. Moreover, it contributes to prevent different by generating helpful predictions based on known data.

Regarding medical support in military operations, a number of *medtech*-type devices have been developed worldwide, capturing vital patient data by providing real-time diagnosis. In an operational area, AI should be integrated by implementing devices such as *medtech*, but also with robotic surgical systems or soil platforms to provide remote surgical assistance and evacuation activities. In difficult conditions, by using the available data, systems equipped with AI can retrieve medical history records of soldiers and help with complex and much faster diagnosis.

Any system is vulnerable to piracy. Both databases containing military records and information regarding the allocation of human resources to different structures represent easy targets for piracy. Unauthorized access to information with a lower or a higher degree of classification and the possible damage of military systems are considered to be known vulnerabilities in the Army. Programs based on AI are capable to develop tools in order to protect networks, computers, programs, and any unauthorized access autonomously. It should be noted that artificial intelligence helps to correlate, remove and aggregate information from different data sets in a short time. This advanced analysis allows soldiers to recognize patterns and achieve in a much easier way, multi-source correlation in order to adapt the optimal range of action.

### **Conclusions**

In the current context, it is vital to plan and implement a strategy based on the development and implementation of a planning algorithm using automatic learning. A system capable of dynamically assigning geographically shared resources while taking into consideration constraints and risks is undoubtedly an advantage of an agile ally. Moreover, this system helps to have the same direction such as global strategy. The interdependence between the organization and its environment is inherent. The AI will develop planning and the use of resources in an efficient manner. Moreover, it will maximize the active capacity of the resources.

Therefore, we can conclude that this article highlights the fact that the use of artificial intelligence can generate a number of benefits within resource management. Practically:

- Artificial intelligence uses, selects, groups, correlates a significant amount of data in a relatively short period;
- The use of AI will significantly reduce the time devoted to certain activities;
- It also reduces the logistical footprint.

The implementing of AI technology reduces the involvement of human resource in the processes of managing material resources and therefore lowers the errors made by employees. Furthermore, the software has the ability to generate pre-defined products (structures intended to carry out a certain task or a designated mission) using information such as: possibilities, legal framework, factual limits or enablers.

We would say that it is mandatory for Army to prepare and to specialise soldiers in order to obtain capabilities in the AI field as well as to train human resources around the new technology.

The alignment of the Romanian Army to the NATO's standards involves ensuring the technological compatibility between military equipment and the demanded skills.

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