



*The 18<sup>th</sup> International Scientific Conference*  
**“DEFENSE RESOURCES MANAGEMENT  
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**CURRENT INITIATIVES AND CHALLENGES OF DEFENCE  
RESEARCH & DEVELOPMENT AND INNOVATION**

**BĂLAN Silviu**

Ministry of National Defence, Romania

***Abstract:***

This paper aims to present the current status and challenges of Defence Research & Development and Innovation domain for NATO and EU members, as well as from national perspective, in a world characterized by profound changes due to the crisis generated by the invasion of Ukraine by Russia and increasingly strong competition in the Research and Development and Innovation field. All kind of implications, ranging from lack of raw materials, reduced mobility for researchers, high energy prices, to increased demand for security and defense equipment have been generated by the current situation. Occurring right after the pandemic context, when the need for increasing the budgetary allocations and the cooperation between research entities has already been demonstrated, this new challenge is underlining the need for immediate action to harness and coordinate the research capabilities at European Union and NATO level. In the last years we have witnessed the intense development of China's defense-industrial and technological base. China is gaining access to important dual-use technologies, for example artificial intelligence, augmented reality, robotics and self-driving technologies. It comes as no surprise that the 2017 International Institute for Strategic Studies (IISS) Military Balance argued that “in some capability areas, particularly in the air domain, China appears to be reaching near-parity with the West”.

This very complex spectrum of challenges has to be addressed by the European and NATO Research and Development and Innovation structures in order to achieve their level of ambition and preserve the technological superiority status.

*Key words: R&D; challenges; defense; innovation*

## **1. Introduction: Contemporary R&D and The Security Environment**

### **1.1 Research and Development vs Innovation**

In the last years, just as the international context has been changing rapidly, the scientists' view upon what is research and what is innovation has changed.

This is how on Wikipedia R&D and Innovation are defined:

**R&D** - “*Research and development (R&D), also known in Europe as research and technical (or technological) development (RTD), is a general term for activities in connection with corporate or governmental innovation. Research and development is a component of Innovation and is situated at the front end of the Innovation life cycle. Innovation builds on R&D and includes commercialization phases*”.

**Innovation:** “*Innovation is defined simply as a "new idea, device, or method". However, innovation is often also viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs*”.



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In other words, while the mission of R&D is to turn funding into findings, Innovation is the responsible for turning the findings of R&D into business; R&D is developing relevant solutions to unanswered questions and Innovation is developing applied processes deriving from the solutions.

**International security environment**

In addition to latest security threats, namely the pandemic situation, terrorism and illegal migration, after the invasion of Ukraine by Russia, several dormant regional conflicts appeared to have been reactivated: China & Taiwan, North & South Korea, Greece and Türkiye and Iran and Saudi Arabia. This is a very complex security environment and the technology superiority gains importance as the main deterrent factor. NATO, as a defensive Alliance, is underlining now, more than ever, the importance of high end capabilities that are more efficient and effective. Consequently, this is the main reason for NATO launching new initiatives aimed at supporting and boosting the R&D and innovation sector such as **Defence Innovation Accelerator for the North Atlantic (DIANA)** (developed in a perspective similar to **DARPA**) and **NATO Innovation Fund** (in order to provide the necessary funding).

The conflict between Russia and Ukraine is a conflict that has completely changed the view on foreign policy and the security assumptions worldwide; the main task for the NATO initiatives will be analyzing the lessons acquired from this conflict, shorten the technology development cycle, and turn the lessons acquired into lessons learned.

## **2. NATO and EU Defense R&D and I initiatives**

The NATO Defense R&D and I coordinating authority is NATO Science & Technology Organization (STO) led by Science & Technology Board having its defined mission as „to maintain NATO’s scientific and technological advantage by generating, sharing and utilizing advanced scientific knowledge, technological developments and innovation to support the Alliance’s core tasks”(NATO S&T Strategy). This organization reports to the Committee of National Armaments Directors (CNAD). The organization’ efforts are channeled through its **main panels**: Applied Vehicle Technology, Human Factors and Medicine, Information Systems Technology, System Analysis and Studies, Systems Concepts and Integration, Sensors and Electronics Technology and Modelling and Simulation.

### **NATO initiatives**

#### **Defence Innovation Accelerator for the North Atlantic - DIANA**

On 7th of April 2022, the foreign ministers from the Alliance have approved the Charter of the Defence Innovation Accelerator for the North Atlantic – DIANA. Participation in this initiative is on voluntary bases but, so far, 20 Alliance members have expressed their support and participation in the initiative.

The objective of this programme is to bring at the same table the defence industry, research entities and academia in order to commonly generate dual-use solutions designed to solve security and defence challenges. A special opportunity is offered to the start-up companies that are in dire need for capital, as long as their focus coincides with the nine technology domains defined as priority by NATO: AI, data and computing, autonomy, quantum-enabled technologies, biotechnology and human enhancements, hypersonic technologies, space, novel materials and manufacturing, energy and propulsion.



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Considering the accelerated pace of innovation worldwide, DIANA’s goal is to shorten the technology development cycle, especially regarding software, AI and quantum, in order to maintain Alliance’s technological dominance.

DIANA has one office in Europe (UK) and one in North America. Initially, DIANA will run a network of more than ten accelerator sites and over 50 test centres in innovation hubs across NATO alliance countries, each specialized in one or more high-tech domains. The actual results are expected between 5 to 10 years since DIANA is scheduled to reach initial operating capability (IOC) in 2023 and full operating capability (FOC) by 2025. (NATO website June 2022)

As part of the IOC, two **CHALLENGES** (appeals for projects) will be issued in March 2023 and its expected of them to be focused on AI and quantum computing area.

### **NATO Innovation Fund**

On 30<sup>th</sup> of June 2022, 22 Allied countries launched NATO’s Innovation Fund, the world’s first multi-sovereign venture capital fund. It will invest 1 billion euros in early-stage start-ups and other deep tech funds aligned with its strategic objectives NATO also intends to invest in the funds of venture capital firms that are already investing in technologies the Alliance wants to promote. The Fund will complement NATO’s Defence Innovation Accelerator for the North Atlantic (DIANA) – which will support the development and adaptation of dual-use emerging technologies to critical security and defence challenges. In other words, the Fund will bring to life the best findings and technologies developed with the help of DIANA.

### **EUROPEAN Defense R&D and I context**

The European Defense R&D and I coordinating authority is the European Defence Agency (EDA). The Agency has 15 specific Capability Technology groups (**CapTechs**) to undertake research & technology (R&T) activities in response to agreed defence capability needs: CapTech Technologies, Components and Modules, CapTech Radio Frequency Sensors Technologies, CapTech Electro Optical Sensors Technologies, CapTech Communication Information Systems and Networks, CapTech Materials and Structures, CapTech Missiles and Munitions, CapTech Aerial Systems, CapTech Ground Systems, CapTech Guidance, Navigation and Control, CapTech Naval Systems, CapTech System of Systems, Battlelab, and Modelling & Simulation, CapTech CBRN and Human Factors, CapTech Cyber Research & Technology, CapTech Energy and Environment, Ad Hoc Working Group Space Defence. They also contribute to Agency projects and programmes from wider policy areas with their specific expertise.

### **European Initiatives**

#### **European Defense Fund - EDF**

In the last 20 years, at European level, very few joint armaments projects have been carried on. According to EC data, currently over 80% of funds allocated to defense acquisition and more than 90% of defense research funds is spent at the national level. The lack of cooperation at European level costs between 25 and 100 billion EUR per year.



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In this perspective, the European defense industry is highly fragmented – with one exception: the aerospace industry. The state of affairs creates duplication of defense programs, and therefore duplication of capabilities which means eventually waste of resources. The ultimate goal for EDF, in order to address the current situation, is to provide EU funding for multinational defense research projects.

With the creation of the European Defense Fund, 13 billion EUR will be added for defense technology research and development in the 2021-2027 financial perspective. Out of this amount, over 550 million a year will be spent on research, while the remaining 1200 million on capability development. The funding practices were piloted in two preceding programmes, the Preparatory Action on Defence Research (PADR) and the European Defence Industrial Development Programme (EDIDP).

The results for the first call for projects(2021) have been announced on 22nd of July 2022: 61 defence R&D projects have been selected and will receive 1,2 billion EUR in grants, the main domains of research being: Air Combat, Air & Missile Defence, Information Superiority, Cyber, Digital transformation, Disruptive technologies, Energy and Environment, Ground Combat, Materials and components, Defence innovation, CBRN, Naval Combat, Force protection and mobility, Sensors and Space.

#### **Hub for EU Defence Innovation - HEDI**

Defence Ministers from European Defence Agency members, on 17th of May 2022, at the Agency’s ministerial Steering Board, have approved the establishment of a Hub for EU Defence Innovation (HEDI) within EDA. This comes after the Strategic Compass for Security and Defence, approved in March, called for the creation of such a Hub in 2022.

HEDI will act as a platform to stimulate, facilitate and support cooperation on defence innovation among Member States while ensuring synergies with related European Commission activities, notably the EU defence innovation scheme, and coherence of output with NATO innovation initiatives such as the Defence Innovation Accelerator for the North Atlantic (DIANA).

The implementation of HEDI is designed as a three steps process:

**Step 1: inspiring and promoting innovation at EU level.** HEDI will contribute to creating a ‘common picture’ of defence innovation in Europe. For this purpose, it will organise stakeholder groups and workshops and set up and manage networks of defence innovation organisations and researchers who will be invited to exchange views on these topics once or twice a year.

**Step 2: facilitating innovation across Member States and EU institutions.** This second phase will see HEDI drive activities such as the upgrade of the existing EDA Defence Innovation Prize (increase in the number of prizes awarded and of domains covered), the funding of proof-of-concept of innovative ideas, the organisation of European Defence Innovation Shows, the launch in cooperation with partners of so-called Innovation Challenges (a specific R&T methodology targeting short cycles of development from proof-of-principle to minimum viable product), as well as specific actions to support the uptake of innovation ideas/concepts towards capability development.





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**Step 3: making of HEDI an EU-wide platform for cooperative design and experimentation embedded in the EU capability development process.** The activities to be undertaken will be decided by Member States at a later stage.

### **3. R&D AND I FRAMEWORK AT NATIONAL LEVEL**

The Romanian R&D and I system has a complex structure, organised over several levels and involving a large range of institutions and R&I performers.

First layer is represented by the Parliament and its respective dedicated Comissions in Senate and Chamber of Deputies. After that, the Prime-Minister is supervizing the National Council for Science, Technology and Innovation Policy. Within the Government, there are 3 main players, Ministry of Research, Innovation and Digitization coordinating the National Research Institutes, Ministry of Education coordinating the higher education institutions and Romanian Academy coordinating the institutes of the Romanian Academy. In addition, several other ministries, MoND included, coordinate its own R&D facilities, according to their needs.

The Romanian R&D and I is operating in the environment described by the *National Research Strategy, Innovation and Smart Specialization 2022-2027*, adopted in July 2022 and the *National Research Development and Innovation Plan 2022-2027*, adopted in September 2022. The 10 programs (areas of interest) defined by the Plan are: ideas; HR; performing research organizations, core, research infrastructures, challenges, partnerships for innovation; European and international cooperation; research in areas of strategic interest; science and society. This Plan is budgeted for approximately 12 billion Euros for the whole period, with the closure of the programs until the 2030 horizon. In comparison with previous budgetary allocations it seems like a strong commitment; however, this is a political engagement and it could be subject to changes.

As already mentioned, the Romanian Ministry of National Defence includes its own R&D facilities: Military Equipment and Technology Agency (**METRA**) that coordinates five Centers for Research and Innovation specialized in different fields: Information Technology and Communications, Armament Systems, CBRN protection and Ecology, Flight Testing and Naval Forces. In addition, several Defence Research Projects have been carried out together with specialized researchers from the Military Technical Academy and the National Defence University. The coordinating authority for the R&D domain in the military is the Romanian General Directorate for Armaments.

Annually, METRA is generating a R&D Sectorial Plan that includes defence projects of importance for the Services. In addition to the R&D Sectorial Plan, METRA is taking part in multinational cooperation Defence R&D projects within the framework of Permanent Structured Cooperation (PESCO), European Defence Industrial Development Programme (EDIDP) and European Defence Fund (EDF).

Researchers from METRA also have a significant role in connecting to the international defence R&D trends; they represent Romanian MoND in all the NATO Science and Technology Organization panels and in EDA CapTechs. Together with the specialists from the Services, they also act as national representatives in the NATO Armament Groups organized at CNAD level.

As a result of synergy of efforts at National Level, at the present time, Romania is rejoining the european research community, taking part part in several multinational cooperation Defence R&D



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Projects: 3 projects in PADR framework, 14 projects in EDIDP framework, 14 projects in EDF framework and 20 projects in PESCO framework.

#### **4. Defence R&D And I Challenges At Alliance And National Level - Conclusion**

The challenges for Defence R&D and I domain are really vast and quite different at European and NATO level compared to the national level. For a better comprehensibility and accountability, I have grouped them in main categories and presented them on main impact areas.

##### **At alliance/ EU Level**

- **Regarding the scientific community and activities:**
  - Russia is not the most important scientific player on the global stage – however is pretty specialized in fields such as energy and natural sciences; even though the Alliance doesn't rely on cooperation with Russia, ending scientific collaborations with Russian scientists may affect EU scientific activities;
  - Because of the invasion, many scientists and entrepreneurs in the field have been forced to migrate and therefore close their research facilities/ businesses;
  - Regardless of traditional cooperation, the R&D community has to put aside its differences of opinions (regarding the share of benefits) and concentrate on the common well –being;
- **Regarding the economy and supply chains:**
  - Economic uncertainties inevitably can discourage investments;
  - Energy prices have run very high in comparison to the initially estimated budgets for ongoing R&D projects;
  - The closure of key Ukrainian companies, together with trade sanctions imposed on Russia, may significantly affect technology supply chains, including the semiconductor industry, impacting key sectors such as automotive and electronics;
  - The increased energy prices will affect the capacity of implementing environmental friendly initiatives such as the European Green Deal (EU) and NATO Green Defence;
- **Regarding the funding for R&D domain:**
  - On one hand, the budgets directed for R&D and I domain will certainly increase; however, it is not yet certain this increase will cover for all the increasing costs related to energy and establishing alternate supply chains for strategic materials.

##### **At national level:**

- **Regarding the lack of coordination of the key stakeholders at national level:**
  - In order to deliver the needed results, R&D and I policy has to overcome the sectorial approach by linking directly to strategic areas like health, energy, digitalization, industry and defence industry just to name some of them;
  - There is a stringent need for clarification upon the national correlation mechanisms between stakeholders;
  - There is a great need of funding predictability and feed-back course correction mechanisms;
- **Regarding the European and international cooperation:**
  - Lack of experience in participating in international cooperation projects;



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- Lack of clear legal provisions and sufficient Governmental support;
- Lack of national funded bilateral projects;

## 5. Conclusion:

Even if Romania is part of NATO and EU, the challenges faced by the R&D and I community are of a totally different nature. The goal for NATO and EU is to preserve the status of technological superiority; the goal of R&D and I in Romania is to rise from the status of emerging innovator (2021) to that of moderate innovator, according to the European Innovation Scoreboard (*National Research Strategy, Innovation and Smart Specialization 2022-2027*). The R&D funding reflect the same discrepancy: between 2014 and 2019, total governmental allocations for R&D in Romania varied between 319.7 million Euro (2014) and 475.9 million Euro (2016), which represents about 0.5% of total general government expenditure, compared to 1.4% at the EU27 level.

After 30 years of ever decreasing R&D funding, Romania has started to invest in R&D again. Unfortunately, sometimes even with all funding available, the lack of relevant specialists and specialized infrastructure can render any effort futile. Let's hope that, by becoming part of NATO and European R&D initiatives, Romanian specialists will get access to necessary technologies and infrastructure and will be able to compensate for the lack of investments in this important field of activity.

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