



## Introduction

Following the attacks of September 11, 2001, the United States Department of Defense undertook a profound transformation in the use of its Special Operations Forces, with particular emphasis on the Joint Special Operations Command (JSOC). This transformation not only affected operational and strategic capabilities, but also the integration of these forces with governmental and intelligence agencies, NATO, and other international allies. Their doctrine evolved toward missions focused on direct action, reconnaissance, and the elimination of high-value strategic targets, supported by real-time intelligence, large-scale data analysis, and drones<sup>1</sup> (emblematic of this transformation). These systems have since become high-precision tools that enable remote operations, minimize human risk, and offer significantly lower manufacturing and operational costs compared to traditional weapons systems.

Moreover, to ensure their effectiveness in such complex and fragmented environments, the training of these units was adapted accordingly. In terms of organizational structure, specialized joint units with high deployment and rapid-response capabilities were created, backed by a more agile command chain and enhanced joint interoperability. This led to, among other things, a reduction in decision-making time—an especially important factor in facing asymmetric threats.

In the current geopolitical context—marked by a redefinition of the global order, strategic competition, regional instability, asymmetric conflicts, and technological disruption—the rapid proliferation of unmanned systems (UMS) in modern warfare is driving the urgent need for military modernization. Beyond their technological impact, these systems are rapidly transforming the way military operations are conceived and executed, directly influencing capabilities, decision-making processes, and the very nature of conflict.

All of this significantly impacts areas such as military doctrine, organizational structure, and training. Furthermore, due to the demonstrated ability of these systems to reshape

---

<sup>1</sup> In this article, we will use the term “drone”—defined by the Diccionario de la lengua española as an “unmanned aircraft”—to refer to the various types and definitions of unmanned or, where applicable, remotely piloted aerial vehicles, including their systems. Note: It is a widespread trend to use the term drone to refer to all types of unmanned systems, regardless of whether they have the capability to fly or not.

power balances, deterrence strategies, and force projection capabilities, they also influence international relations, as this paper will explore.

This dynamic environment requires highly agile and innovative mechanisms that allow for the rapid, continuous, and effective integration of these systems as their supporting technologies evolve. This necessitates a comprehensive and ongoing process of modernization in the aforementioned areas.

For all these reasons, UMS have become a driving force of military innovation and a catalyst for change in certain geopolitical and geoeconomic dynamics.

This paper has a twofold objective: first, to address the need to promote processes that ensure agile and sustained military innovation over time, aimed at the effective integration of these systems into the Armed Forces to enhance their operational effectiveness; and second, to encourage reflection on the economic and geopolitical implications of these processes.

### **What is military innovation?**

The study of military innovation is one of the most important topics in the field of strategic studies<sup>2</sup>. However, since the term "innovation" can be interpreted in multiple ways depending on the context (whether economic, technological, social ... or military) I think it is appropriate to define its meaning in order to establish a clear conceptual framework that allows the reader to properly understand the scope and implications of innovation in the military field.

According to the Spanish language dictionary, innovation is the "creation or modification of a product, and its introduction into a market." More broadly, innovation is the creation or modification of new ideas, technologies, or processes, and their introduction into different sectors—such as business, technology, or society—with the aim of increasing efficiency and competitiveness.

On the other hand, open innovation<sup>3</sup> is an approach in which, instead of relying exclusively on internal resources, companies, organizations, or individuals collaborate with external actors to develop new ideas, products, or services. It leverages external

---

<sup>2</sup> Horowitz, M. C., & Pindyck, S. (2022). What is a military innovation and why it matters. *Journal of Strategic Studies*, 46(1), 85–114. <https://doi.org/10.1080/01402390.2022.2038572>

<sup>3</sup> CHESBROUGH, Henry: *Open Innovation. The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press, 2003.

knowledge, technologies, and experiences to accelerate development and improve competitiveness.

In our case, in a very summarized way, we can say that it involves the use of resources from the private sector, startups, universities, civil society, etc., to accelerate military development.

The Doctrine for the Employment of the Armed Forces (FAS, from the Spanish Fuerzas Armadas), promulgated on February 27, 2018, defines military innovation as "a change in the way the Armed Forces operate that substantially affects doctrine, training, and often the organizational structure, resulting in a significant increase in effectiveness."

Likewise, Professor Javier Jordán<sup>4</sup> adapted a proposal by Adam Grissom<sup>5</sup> for his work, adding an important nuance to our official definition: "A military innovation [...] is the result of a comprehensive process of change..."

In contrast, military technological innovation specifically refers to the development and adoption of new technologies, materials, weaponry, and defense systems that enhance military capabilities, with the goal of improving the technical performance of the FAS through advances in science and engineering. However, by itself, it does not encompass the full dimension of the military innovation process<sup>6</sup>. Confusing the two concepts leads to biased interpretations that tend to overvalue the role of technology at the expense of the importance and necessity of the broader processes of change.

In summary, for the purposes of this article, we understand military innovation as a comprehensive process of change in the way the FAS operate to substantially increase their effectiveness—affecting doctrine, training, organizational structure, and occasionally, technology. All of this is driven, in this case, by the need to integrate unmanned systems, robotics, and AI, among other disruptive technologies, into the transformation and modernization procedures of the FAS, especially considering the current geopolitical context marked by increasing strategic competition among powers, ongoing conflicts, and the reconfiguration of alliances.

---

<sup>4</sup> Jordán, Javier (2014). Una introducción al concepto de innovación militar. *Análisis GESI* 6/2014. Pag. 3.

<sup>5</sup> Grissom, A. (2006). The future of military innovation studies. *Journal of Strategic Studies*, 29(5), 905–934. <https://doi.org/10.1080/01402390600901067>. [Consulta: 23/02/2025].

<sup>6</sup> Farrell, Theo G. 2010. "Improving in War: Military Adaptation and the British in Helmand Province, Afghanistan, 2006–2009". *Journal of Strategic Studies* 33 (4): 567-594.

## Unmanned Systems and Military Innovation

The following paragraph provides context for the first objective of this work: "Success no longer goes to the country that first develops a new warfighting technology, but rather to the one that best integrates and adapts it into its way of fighting", and "what will matter most is the speed at which someone recognizes an emerging problem, articulates it in language that others can widely understand, assembles the right team to build a path toward a solution, and delivers that solution to the battlefield."<sup>7</sup>

At the same time, the widespread and increasing use of unmanned systems by both state and non-state actors is already redefining the nature of armed conflict.

In this context, the effective incorporation—often a process that can take years—of unmanned systems into the Armed Forces, which goes far beyond their mere acquisition, urgently requires the activation of comprehensive change processes. These involve deep organizational adaptation and the establishment of new doctrinal and operational frameworks that clearly define the role of unmanned systems.

Furthermore, the accelerated and unrestrained use of unmanned systems is driving the rapid development of technologies, procedures, and counter-strategies. This will lead to a continuous cycle of innovation in military procedures and defense mechanisms, and therefore to further changes in doctrinal frameworks, training, organizational structures, and the development of new systems.

The prior establishment of clear security and ethical protocols would also help facilitate the development of these processes.

Operational and strategic concepts must also be designed and developed to take full advantage of these technologies and to effectively integrate them into the land, maritime, air, cyber, and space domains—both individually and collectively—in order to significantly enhance the strategic and operational capabilities of the Armed Forces.

However, the updating of operational and strategic concepts does not move at the same pace as technological innovation, which often takes a long time to be fully integrated into traditional military structures and mindsets. Overcoming resistance to change is essential.

---

<sup>7</sup> NEWEL, Peter. (April 12, 2018) "Building the hierarchy of innovation in the Defense Department: a plan for action". <https://warontherocks.com/2018/04/building-the-hierarchy-of-innovation-in-the-defense-department-a-plan-for-action/>. [Accessed June 12, 2025].

Promoting a culture of innovation and continuous, cyclical learning is crucial for adopting new technologies and adapting to the speed of technological advancement. This requires leadership that drives change and communicates its benefits effectively.

Military innovation<sup>8</sup> driven by unmanned systems and other disruptive technologies demands sustained political commitment and significant investment in research and development, procurement, and training. This involves long-term funding cycles and appropriate resource allocation.

Moreover, close and ongoing collaboration between the defense industry and the Armed Forces is vital. This includes knowledge sharing, joint development of solutions (between the Armed Forces and industry), coordinated testing, and the establishment of agile frameworks for the development, acquisition, and maintenance of these systems—ensuring they truly address current operational needs.

### **Military Innovation and Its Geopolitical, Economic, and Industrial Dimension**

As we have seen, military innovation driven by the integration of unmanned systems and other disruptive technologies into the Armed Forces goes far beyond a mere technical enhancement of combat capabilities. While that integration is indeed crucial to improving effectiveness in modern warfare, its impact also extends to the economic sphere, international relations, and the strategic projection of power. Therefore, developing, integrating, and controlling these technologies before other states do translates directly into a significant strategic advantage.

States that succeed in synchronizing rapid technological innovation with their military innovation processes are better positioned to influence the international arena. In other words, military innovation not only affects tactical or strategic effectiveness, but also has repercussions on the economy<sup>9</sup> and geopolitics.

As demonstrated by data from the war in Ukraine<sup>10</sup>, unmanned systems, by reducing both operational and human costs, offer unprecedented economic efficiency. They enable the

---

<sup>8</sup> Jordán, Javier (2014). ¿Qué factores impulsan la innovación militar? GESI 12/2014.

<sup>9</sup> The use of drones in the war in Ukraine has sparked a booming industry, where the main objective is to reduce production and equipment costs."

Source: LISA News. How the Use of Drones Has Evolved in the War in Ukraine. [Accessed June 14, 2025]. Available at: <https://www.lisanews.org/inteligencia/como-ha-evolucionado-el-uso-de-drones-en-la-guerra-de-ucrania/>

<sup>10</sup> How the drone became Ukraine's war tank: a conversation with Taras Chmut" (March 8, 2025).

Available at: <https://legrandcontinent.eu/es/2025/03/08/como-el-dron-se-convirtio-en-el-tanque-de-guerra-de-ucrania-una-conversacion-con-taras-chmut/> [Accessed June 14, 2025].

execution of complex missions without exposing human lives and with significantly lower logistical demands. Moreover, the development of this industry generates multiplier effects in civilian sectors, creating employment and stimulating research in areas such as aeronautics, artificial intelligence, and cybersecurity.

Additionally, countries that export unmanned systems strengthen their political influence through defense cooperation<sup>11</sup>, technological agreements, and alliances—with the geopolitical and geoeconomic implications that such partnerships entail.

On the other hand, ongoing conflicts show that many states' Armed Forces<sup>12</sup>—though not directly involved—are failing to develop the doctrines, structures, and defense systems needed to counter these new vectors of attack<sup>13</sup> and other emerging threats with sufficient speed and agility.

Another key challenge lies in revising and streamlining current planning, procurement, and acquisition processes. While some European countries have made progress in this regard, their situation contrasts with that of non-state actors and certain states that already operate with agile and flexible acquisition mechanisms. These mechanisms allow them to rapidly adapt and employ commercially available technologies. A notable example is Ukraine, which has transformed its procurement system from a traditional model to one that integrates commercial technologies, thereby reducing acquisition and distribution timelines to just a few months<sup>14</sup>. In contrast, planning and procurement processes in most Western countries still take between 5 and 10 years.

In this esteem, regardless of whether other innovative procedures are applied to significantly reduce planning and acquisition times, it is crucial to "maintain a strong and

---

<sup>11</sup> Defense cooperation is a generic term for the range of activities undertaken by the Department of Defense with its allies and other friendly nations to promote international security. These activities include, among others, security assistance, industrial cooperation, armaments cooperation, foreign military financing, training, cooperative research and development, foreign comparative testing, and host nation support (HNS).

Source: Defense Acquisition University. Defense Cooperation. Available at: <https://www.dau.edu/glossary/defense-cooperation> [Accessed June 14, 2025].

<sup>12</sup> The former Commander-in-Chief of the Ukrainian Armed Forces warned that Europe's model of warfare is outdated. Source: Escenario Mundial. El ex Comandante en jefe de las Fuerzas Armadas de Ucrania advirtió que el modelo de guerra de Europa está desactualizado. Published May 12, 2025. Available at: <https://www.escenariomundial.com/2025/05/12/el-ex-comandante-en-jefe-de-las-fuerzas-armadas-de-ucrania-advirtio-que-el-modelo-de-guerra-de-europa-esta-desactualizado/> [Accessed June 4, 2025].

<sup>13</sup> VV. AA «Countering Small Uncrewed Aerial Systems», Center for Strategic and International Studies (CSIS). Published November 14, 2023. [https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-11/231114\\_Shaikh\\_Countering\\_sUAS.pdf?VersionId=qJtICY3Z071CXLODt8\\_wD5ul9UldmUFj](https://csis-website-prod.s3.amazonaws.com/s3fs-public/2023-11/231114_Shaikh_Countering_sUAS.pdf?VersionId=qJtICY3Z071CXLODt8_wD5ul9UldmUFj) [Accessed June 4, 2025].

<sup>14</sup> Bondar, Kateryna. «How Ukraine Rebuilt Its Military Acquisition System Around Commercial Technology». CSIS. Publicado el 13 de enero de 2025. [https://csis-website-prod.s3.amazonaws.com/s3fs-public/2025-01/250113\\_Bondar\\_Ukraine\\_Acquisition.pdf?VersionId=O4NwclUMH5YcqZeFA3tPOAPB\\_ww02L\\_Z](https://csis-website-prod.s3.amazonaws.com/s3fs-public/2025-01/250113_Bondar_Ukraine_Acquisition.pdf?VersionId=O4NwclUMH5YcqZeFA3tPOAPB_ww02L_Z) [Accessed June 3, 2025].

solid defense technological and industrial base," while also complementing it "with an open innovation system that looks beyond it," in order to "meet the challenge posed by emerging technologies."<sup>15</sup>

As previously mentioned, the proper integration of these technologies into the Armed Forces not only provides key elements for power projection<sup>16</sup> and deterrence capabilities, but also enhances a state's capacity to influence the dynamics of global alliances and rivalries. That is, it ensures relevance in the international arena—where superiority is no longer determined solely by economic capacity, but by adaptability and innovation speed.

Regarding the economic implications, it is important to note that the drone industry—both military and civilian—is undergoing rapid growth, creating new business opportunities, technological innovation, and employment. "The global military drone market was valued at USD 14.14 billion in 2023 and is expected to grow [...] to USD 47.16 billion by 2032."<sup>17</sup>

17

On the other hand, current geopolitical uncertainties do not foster economic support for innovation. As highlighted in the introduction of the Strategic Outlook 2024 (PE 2024, p. 11) by the Spanish Institute for Strategic Studies: "...the rise in geopolitical risk is slowing innovation." "A 1% increase in geopolitical risk reduces the number of patents registered by companies the following year by 0.18%, the financial value of approved patents by 0.24%, and their scientific value by 0.08%."<sup>18</sup> Given the expected increase in geopolitical risk in 2025, this trend may further hinder innovation—something Europe, and Spain in particular, should not overlook within the scope of their respective responsibilities.

The link between military power and "the political objectives to be achieved through military operations, and the lives of those who participate in them, largely depends on the actual capability of the armed forces. And that capability is based on the adequacy of their doctrine, organizational structure, training, and equipment to the strategic, operational, and tactical environment. An ever-changing environment, marked by uncertainty, which

---

<sup>15</sup> DÍAZ TORIBIO, José. «La innovación abierta una alternativa para adaptarse a un cambio tecnológico continuo y potencialmente disruptivo». Publicado en diciembre 2024.  
[https://armada.defensa.gob.es/archivo/rgm/2024/12/rgmdic2024\\_Parte08.pdf](https://armada.defensa.gob.es/archivo/rgm/2024/12/rgmdic2024_Parte08.pdf). Pág. 1090. [Accessed June 3, 2025].

<sup>16</sup> Joseph S. Nye, Jr., *The Future of Power*, Nueva York, Public Affairs, 2011, 300 pp.

<sup>17</sup> <https://www.fortunebusinessinsights.com/es/military-drone-market-102181>. [Accessed June 14, 2025].

<sup>18</sup> Research: When Geopolitical Risk Rises, Innovation Stalls.

Harvard Business Review, March 3, 2022. Available at: <https://hbr.org/2022/03/research-when-geopolitical-risk-rises-innovation-stalls> [Accessed in 2024].

therefore demands an attitude receptive to innovation”<sup>19</sup>—clearly illustrates that this relationship and attitude cannot be understood without recognizing the decisive role military innovation plays as a driver of modernization.

Thus, those who lead comprehensive military innovation processes will also lead the new architecture of global power.

This modernization<sup>20</sup> must not be confined to the military sphere alone; it must also involve other sectors where the promotion of strategic alliances with private industry, research institutions, universities, and the technology industry<sup>21</sup> are essential to ensure that innovation translates into real competitive advantages in defense.

Decision-making in the innovation process must be agile and supported by a legal and regulatory framework that allows the integration of new technologies without bureaucratic obstacles. This includes, among other things, updating regulations related to the use of AI in conflict, data protection, and cybersecurity.

Likewise, close coordination between industry and the Armed Forces is essential to ensure the fast, ongoing, and collaborative integration of technological developments into military applications<sup>22</sup>.

To enable these changes, it is necessary to foster a culture of innovation both inside and outside the Armed Forces (a broader defense culture), while addressing a set of challenges that must be overcome to ensure success. These include the need to foster unity among key stakeholders—military personnel, industry, political decision-makers—avoiding interference from internal opponents (organizational resistance<sup>23</sup>), and mitigating the influence of external actors (other powers, adversarial groups).

---

<sup>19</sup> Jordán, Javier (2014). Una introducción al concepto de innovación militar. *Análisis GESI*, 6/2014 p. 1.

<sup>20</sup> Colom Piella, Guillem. Sobre innovaciones militares disruptivas. *Revista General de Marina* diciembre 2023. [https://armada.defensa.gob.es/archivo/rgm/2023/12/RGMDiciembre2023\\_Parte04.pdf](https://armada.defensa.gob.es/archivo/rgm/2023/12/RGMDiciembre2023_Parte04.pdf). [Accessed May 28, 2025].

<sup>21</sup> Information on the functions of the Ministry of Defence and its public bodies, affiliated or subordinate. Government of Spain – Transparency Portal. Available at: [https://transparencia.gob.es/transparencia/transparencia\\_Home/index/PublicidadActiva/OrganizacionYEmpleo/Funciones/Historico/Funciones-XIV-Legislatura/Funciones-MDEF.html](https://transparencia.gob.es/transparencia/transparencia_Home/index/PublicidadActiva/OrganizacionYEmpleo/Funciones/Historico/Funciones-XIV-Legislatura/Funciones-MDEF.html) [Accessed June 8, 2025].

<sup>22</sup> Defence Drone Strategy. The UK’s Approach to Defence Uncrewed Systems. [https://assets.publishing.service.gov.uk/media/65d724022197b201e57fa708/Defence\\_Drone\\_Strategy\\_-\\_the\\_UK\\_s\\_approach\\_to\\_Defence\\_Uncrewed\\_Systems.pdf](https://assets.publishing.service.gov.uk/media/65d724022197b201e57fa708/Defence_Drone_Strategy_-_the_UK_s_approach_to_Defence_Uncrewed_Systems.pdf). [Accessed May 28, 2025].

<sup>23</sup> Cebollero Martínez, Conrado. “Writing to Think: Military Doctrine as a Driver of Innovation”. IEEE Opinion Paper 21/2019. Spanish Institute for Strategic Studies (IEEE). Available at: [Insert IEEE or BIE3 URL] [Accessed February 23, 2025].

All of this must be accompanied by increased investment in the preparedness of the Armed Forces; in R&D and technological innovation in fields such as AI, robotics, and cybersecurity; in the modernization and digitalization of command-and-control systems suited to the new demands posed by unmanned systems; in strengthening cyber defense and electronic warfare capabilities; and in public-private collaboration.

## **Conclusions**

In a context of accelerated change, the emergence of unmanned systems in modern warfare is driving the modernization of the Armed Forces. Beyond their technological impact, these systems are rapidly transforming the way military operations are conceived and conducted at all levels. As such, they have a significant effect on areas such as doctrine, force preparation, and organizational structure.

States whose Armed Forces manage to adapt their procedures more swiftly and overcome institutional inertia to foster rapid and continuous military innovation will gain greater freedom of action and execution capacity in their defense policy. Furthermore, they will benefit from enhanced deterrent capabilities and a decisive advantage in shaping global power balances.

The gap between the pace of technological innovation and the speed of institutional adaptation represents a critical risk. To mitigate it, it is essential to promote a culture—both within and beyond the Armed Forces—focused on military innovation and supported by leadership capable of guiding, persuading, and instructing with a transformative vision.

The momentum of innovation in military technology must be grounded in a strategic vision that prioritizes projects with long-term impact, in order to avoid short-lived technological trends lacking operational relevance. Likewise, continuous assessment mechanisms must be established to reallocate resources as new needs or risks emerge, ensuring that transformation evolves in a coherent and sustainable manner rather than remaining a collection of isolated technical initiatives.

From an economic perspective, the military technological revolution can drive industrial growth and economic modernization, but it requires a consistent and meaningful reorientation of public spending.

Establishing clear and forward-looking security and ethical protocols from the outset of all military technological innovation processes is not only essential, but also a cornerstone

to avoid the development or acquisition of technologies that cannot be fully utilized. This directly influences the planning and implementation of coherent military innovation.

Finally, although there is some controversy regarding the role of unmanned systems—particularly drones—since some analysts argue that their role thus far has been complementary rather than substitutive of traditional forces, this work maintains that it is crucial to urgently launch military innovation processes. These should include doctrinal revision, updated training, and the resulting organizational restructuring, in order to anticipate the disruptive potential and transformative impact embodied by these technologies and the ones underpinning them—especially artificial intelligence and advanced robotics.

*Luis F. Rey Arroyo.\**  
Colonel, General Staff, Ret.  
Army of Spain