ANALYSIS

Friedrich Ebert Stiftung

Defence Industry in Central Eastern Europe

The Defence Sector in Central and Eastern Europe – The Hungarian Case

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The Hungarian defence ecosystem has been undergoing a fundamental transformation since 2016, when the comprehensive armed forces development program (originally dubbed "Zrínyi-2026") was initiated. The program constitutes not only a technology upgrade in equipment, but the adoption of suitable modern doctrines and operating procedures, as well as adapting the workforce and service(wo)men's training to the use of the new hardware and software. To underpin this modernisation effort, the national defence technological and industrial base (NDTIB) has also been undergoing a similar upgrade and transformation in its functioning with the aim of creating and/or strengthening certain pillars of the defence industry, which have been weak or non-existent in Hungary since the Cold War. These include the assembly, production and future development of small arms and light weapons, artillery and ammunitions, armoured vehicles, drones, as well as radars, sensors, and related space technologies. The transformation is driven by a strong tie-in to major European arms manufacturers' networks (Rheinmetall, Krauss-Maffei Wegmann, Airbus), and the acquisition (Hirtenberger, Aero Vodochody) or establishment (Lynx, Gidran, ZalaZone) of new defence industrial plants. This paper offers an overview and assessment of the development of the Hungarian defence industry throughout the past decade, outlines the current situation, and identifies prospects and challenges. First, introducing the strategic framework of the comprehensive armed forces development program identifies the place and function of the defence industry in these processes, followed by conceptualising the model of operation. Then, defence industry landscaping shows current capabilities in the field through an overview of the defence industrial ecosystem, specifically the eight defence industrial clusters and the innovation potential currently being developed in Hungary.

The Strategic Framework

The planning and preparation for the development of comprehensive defence capability took place around 2015 in full confidentiality in a "black box" manned by the Chief of Defence Staff, the Ministry of Defence, and the Prime Minister's Office, and transparency has remained limited ever since. The Homeland Defence and Armed Forces Development Programme was formally initiated in 2017 (Decree 1298/2017), later underpinned by a (non-public) Defence Industrial Strategy in 2019. The 2020 National Security Strate-

gy and the 2021 National Military Strategy provide retrospective insights to the development goals at the strategic level.

The first phase of the program, originally launched under the name "Zrínyi-2026," involving military technology developments and defence industry investments, was implemented between 2018 and 2023, with the ultimate goal of achieving the operational capability of a medium rifle brigade earmarked for NATO. This phase saw the start of procurement, including the delivery of military equipment, in several capability development projects of the air force (H145M helicopters, Zlin training aircraft), heavy equipment for the ground forces (Leopard-2A4 tanks for training, PzH 2000 self-propelled howitzers), and the modernisation of individual weapons for infantry soldiers (light arms and handguns, personal equipment). This phase was when the Airbus parts factory was built in Gyula, the small arms assembly and production lines in Kiskunfélegyháza, the Lynx factory in Zalaegerszeg, and the Gidrán assembly division in Kaposvár. This five-year period laid the foundation for the expansion of military production and the partial integration of the German and Hungarian military industries. Furthermore, the Hungarian military industry portfolio expanded with two foreign military companies through acquisition (Hirtenberger Defence Systems and Aero Vodochody).

The second phase of implementation is taking place between 2023 and 2026, when the large military equipment that has been contracted for and not purchased off-the-shelf by the Hungarian Defence Forces (HDF) is being manufactured and delivered. These include Embraer KC-390 military transport aircraft, L-39NG aircraft, Airbus H225M helicopters for the Air Force, and Leopard2-A7+ tanks and Lynxes for the Land Forces. Meanwhile, production is scheduled to begin at all new military companies – in addition to those mentioned above, for example, at the ammunition and explosives factory in Várpalota – first to meet the needs of the HDF, and then (according to plans) for export. Research and development activities are beginning in several technology areas, primarily in the field of combat vehicles, their defence systems, and drone technology, so that the military equipment further developed through innovation will be even more attractive on the international arms market.

The third phase of implementation will begin in 2026 with the process of equipping a second (heavy) brigade earmarked for NATO and achieving its operational capability by 2028 with the delivery of previously ordered military equipment, the training of personnel already in service, and military exercises. 2026 can be considered a milestone not only because it was to be the end point of the original ten-year-long ("Zrínyi") military modernisation plan, but also because by then the privatisation process of key segments of the defence industry will be complete with the creation of a "national champion" 4iG Space and Defence Technologies. Meanwhile, further manufacturing and development opportunities are opening up in the European defence industry as a result of financial, economic, and political incentives from the European Union and NATO. Finally, after 2028, depending on long-term developments, resourcing and requirements of the security environment, further quantitative expansions may take place with the equipment types already in service. This is in line with the Security Action for Europe (SAFE) program and NATO member states' political commitment taken at the Hague Summit to increase defence spending to 3.5 (defence) + 1.5 (security) percent of GDP. The joint European capability, defence industry, and infrastructure development (dual-use and military mobility) projects financed through these funds may play a decisive role. The second half of the 2020s will be a period of "fine-tuning" in terms of operating the new, modern equipment, strengthening cooperation between sub-units within national and international frameworks, and the deepening of interoperability. During this period, defence industry production should already be running smoothly, and innovation should be showing its first results, while research and development in the field of emerging and disruptive technologies should be deepening in allied cooperation, at least in the areas of autonomous systems, cyber defence, and artificial intelligence. Meanwhile, by the end of the 2020s, filling the expanded military structure[1] will pose the greatest human resource challenge facing the HDF.

The Model of Operation

The development of the Hungarian defence industry sector was already one of the seven priority areas in the "Irinyi Plan" of 2016, aimed at supporting innovative economic development. This also suggests that the issue regarding the development of the defence industry had already been decided by 2017, and was considered an integral, systemic part of the comprehensive military modernisation program. The defence procurement process in the previous 25 years mostly consisted of one-off commercial transactions, supplemented at most by limited civilian offset. In contrast, by the 2020s, it had become common practice for defence procurements to be accompanied by some degree of joint component manufacturing and assembly in Hungary (localisation), and even licence-sharing and joint innovation in the case of strategic partnerships. Accordingly, the development of the Hungarian defence industry has sought to build on two functional pillars. The first pillar is the creation of capacities that are worth keeping in national hands because they ensure the continuous supply of primary military technology and materials to the Hungarian Defence Forces. The second pillar, complementing the first, includes the building of capacities that, through the cooperation with international companies, aim at technology transfer and the integration of Hungarian firms into the internation-

1 In 2018, the Hungarian government decided to increase the number of personnel in the HDF to 37,650 (by nearly 8,000 people compared to the previous number), while setting the number of volunteer reservists at 20,000 (compared to the previous goal of 12,000) by 2030 (Decree 25/2018, Decree 36/2016). Their actual number exceeded 11,500 in 2022 (Kálmánfi, 2022).

al defence industry supply chain in certain narrower areas. Thus, they are expected to contribute defence industry exports and revenues to the national defence expenditure.

A key objective in the development of the Hungarian defence industry – in terms of technology, investment, and production capacity – is to connect with international players, which can also reduce the market entry costs for Hungarian (and co-owned) companies. In addition, international players entering the market with advanced technology can integrate Hungarian companies into production chains and research and development processes, enabling them to achieve a level of technology that otherwise would not be possible through independent development.

To achieve this, it was necessary to position joint ventures as the central players of the 21st-century Hungarian defence industry, in which Hungarian parties are to contribute capital, infrastructure, and favourable operating conditions (relatively cheap and skilled/trainable labour force, government subsidies, and tax breaks), while foreign partners provide cutting-edge technology (hardware and software) ready for mass production, as well as research and development prospects, and internationally recognized brands. The best example of this is the multifaceted cooperation established with Germany's Rheinmetall, which, through its subsidiaries, has become a key player in several areas of the Hungarian defence industry. The existing military companies in the Hungarian defence sector sought to align themselves with these new flagship projects, and where no such companies existed as the field was newly established, new companies had to be established.

In the early years of industrial development, there was no apparent intention to create "national champions" in the Hungarian defence sector which would be key players with a diverse portfolio and a prominent role, such as Polska Grupa Zbrojeniowa (PGZ) in Poland or Czechoslovak Group (CSG) in Czechia. Today, this seems to be changing: by October 2025, the newly established 4iG Space and Defence Technologies Plc. (4iG SDT) has acquired full or partial ownership of six key defence industry companies, and by expanding its own activities and partner network, it has also gained a foothold in the space industry in the fields of satellite manufacturing and satellite communications.[2] These steps made it a leading company in Hungary in five business areas: the space industry, the aviation industry, land systems, the manufacturing of weapons and ammunition, as well as cyber defence and defence digitisation. Thus, 4iG SDT gained the opportunity to become the leading defence company in Hungary and appear as the "national champion," which could also provide a basis for winning higher-tech and larger-volume international manufacturing and development contracts. The defence industry capacity crystallising around 4iG SDT will thus be mixed from an ownership perspective, standing closer to the Czech private ownership model, with a restrained role of state ownership.

Defence Industry Landscaping

In terms of the number of companies engaged in military industrial activities, the Hungarian defence sector has grown by 20% overall in the past ten years: in 2015, 496 companies had a military industry licence, while in 2025, this number rose to 600. Production capacity has expanded at a similar rate (+18%) in recent years: in 2023, 169 companies had a manufacturing licence and, according to their own statements, some manufacturing capacity, while by the fall of 2025, this number had risen to 199. 240 companies had arms import or export licences in 2015, and 318 in 2025 (+32.5%) (BFKH, 2025).[3] In November 2025, 295 Hungarian companies were accredited in the NATO Supplier Information Website database (NBIH, 2025). Based on their size, production, and commercial activities, these companies are predominantly small and medium-sized enterprises, and there are around 60 companies that are connected to international production chains, have a leading technological profile, and/or operate in key areas related to the supply and operation of the Hungarian Defence Forces.

Foreign Trade Balance in Military Technology and Arms Trade

Data on military technology and arms trade can provide further insight into changes in the performance (output) of the Hungarian defence industry. According to the trend emerging from the data provided by the supervising authorities, the value of Hungarian arms exports has increased by a factor of approximately 2.5 since 2010, while the value of imports has increased (on average) fivefold. In the case of imports, this significant change was caused by the delivery of military equipment and materials purchased as part of a comprehensive armed forces development program, which is why we have witnessed significant growth from 2018 onwards and a surge in 2020.[4]

In 2021, foreign trade turnover amounted to approximately EUR 224 million (HUF 80 billion), involving 98 defence companies, or 37% of those licensed at the time. Within this, the value of exports (Figure 1) was EUR 54.42 million (HUF 19.2 billion), of which ammunition and ammunition components accounted for the lion's share (78%),

2 Following several reorganisations and transfers of corporate ownership and supervisory rights, in October 2025, four defence companies were transferred from N7 Holding, which consolidates national defence industry elements, to N7 Defence Clc., in which 4iG SDT holds a 75 percent +1 vote majority stake: Aeroplex Ltd. (aircraft servicing), Arzenál Fegyvergyár Plc. (small arms manufacturing), Colt CZ Hungary Plc. (small arms manufacturing), and Rheinmetall Hungary Munitions Plc. (ammunition production) became part of 4iG SDT. At the same time, through acquisition, 4iG SDT also became the majority stakeholder in Hirtenberger Defence Technologies Ltd. (mortar and ammunition production) and the minority stakeholder in Rheinmetall Hungary Plc. (Lynx infantry fighting vehicles' production and development). Földes, M. (2025)., Ternovácz, Á. (2021).

3 Arms export licences must be renewed regularly (every two years for new applicants and every five years for renewals), and the range of companies involved in arms exports can change dynamically depending on market opportunities.

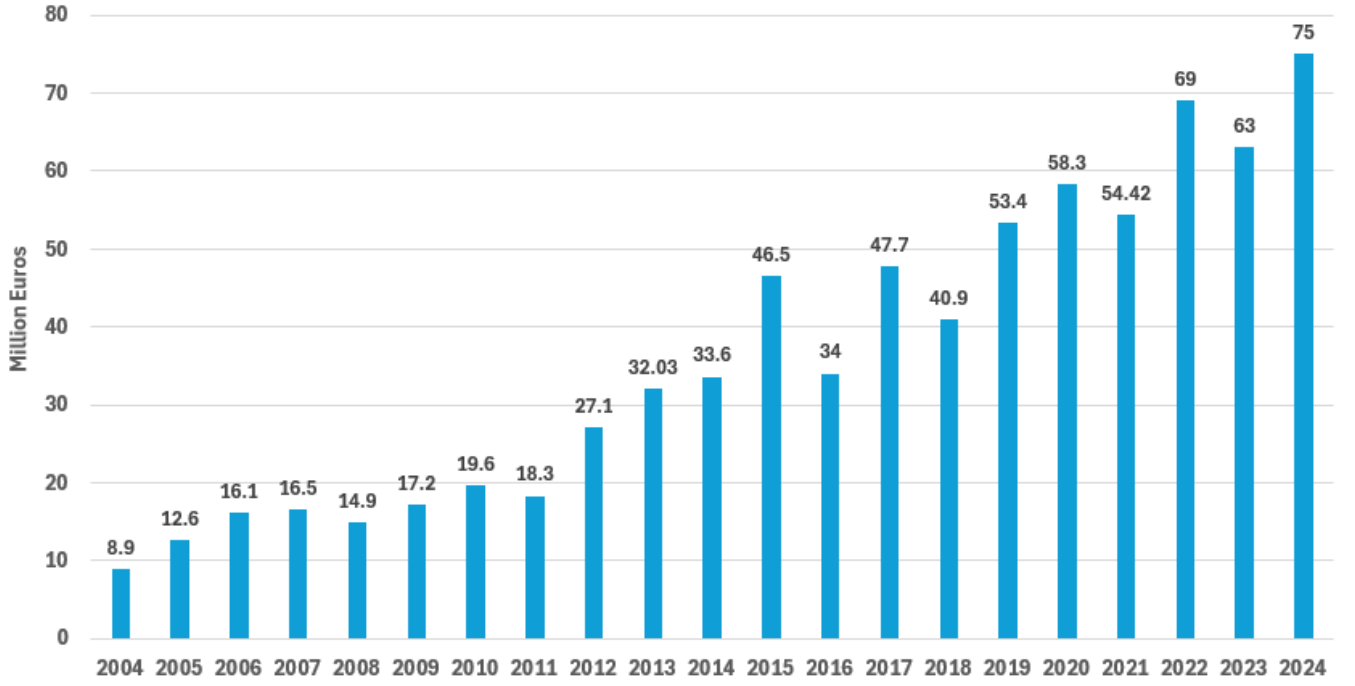
4 Transparency in this field is also somewhat limited in the sense that the latest publicly available data we have is from 2021; meanwhile the supervising authority, the Exports Control and Arms Trade Department at the Government Office in Budapest, was ready to provide further insight to the 2022 data, but more current information is not available. Therefore, this analysis offers an overview of arms trade trends and an assessment for the last two years, 2021–2022 to highlight the characteristics and key elements of arms trade (BFKH, 2021; BFKH 2022).

while military software, fire control systems, small-calibre handguns, bombs and rockets, and an even smaller share was accounted for by land vehicles and their components, aircraft, and semi-finished products. The most important export partners in 2021 were the United States, Germany, Switzerland, and Austria – and except for Switzerland, all major export partners were EU and/or NATO allies, while the end users of the export products were to be found in 29 countries. Due to the limited product range and relatively narrow customer base of Hungarian military technology exports, even a single high-value transaction can result in significant volatility in annual figures. According to information from the Government Office in Budapest, these macro characteristics did not change significantly in 2022 in terms of the proportions of export products and the range of partners. Military technology exports reached EUR 69 million in 2022, EUR 63 million in 2023, and EUR 75 million in 2024 (BFKH, 2021; BFKH 2022).

In 2021, the value of military technology imports (Figure 2) was EUR 170 million (HUF 61 billion), 77% of which was government procurement, while civilian hunting and sporting weapons, parts, and ammunition accounted for 5.7% (EUR 9.65 million). The largest import item, worth EUR 71.6 million (42%), was related to ammunition and spare parts for Czech–Hungarian small arms production, civilian firearm imports, and the delivery of ammunition for the Swedish-made Carl Gustaf anti-tank weapons. Aircraft also represented a significant item (EUR 51.4 million, 31.8%): Airbus helicopters were delivered from Germany and spare parts for Mi-8 and Mi-24 helicopters still in service were delivered from Russia. In 2021, the most important import partners were Germany, Sweden, and the Czech Republic, with Russia appearing only temporarily among the suppliers. According to information from the Government Office in Budapest, these macro-characteristics showed a significant change in 2022, reflecting the progress in the armed forces development program. On the one hand, imports amounted to EUR 439 million, which represented an increase by a factor of 2.5 over the previous year. On the other hand, land vehicles accounted for 80% of imports, with Germany (Rheinmetall's Lynx infantry fighting vehicles) and Turkey (Nurol Makona's Ejder Yalcin / Gidrán armoured personnel carriers) being the most important import partners, both of which are allied countries, with record trade values. The second largest item was ammunition and ammunition components (8%), with artillery ammunition purchased for German military equipment (PzH-2000 howitzers) representing the most valuable purchase (BFKH, 2021; BFKH, 2022).

Fig. 1

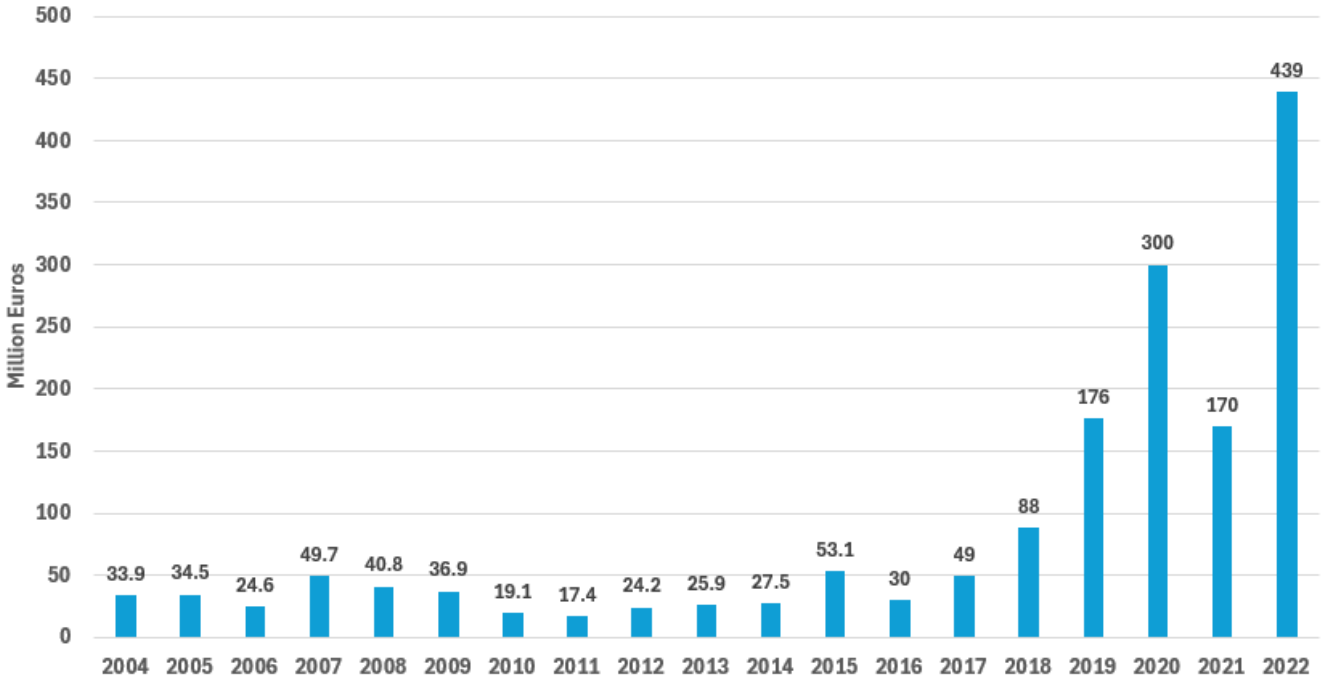
The value of Hungarian military technology and arms exports, 2004–2024.



Source of data: BFKH

The value of Hungarian military technology and arms imports, 2004–2022.

Fig. 2



Source of data: BFKH

In the early 2020s, as far as can be ascertained from open sources, the value of military technology exports is showing slow growth, which is justified by the limited range of products currently available. The Hungarian government is making increased efforts to expand this by acquiring marketable and well-known companies, production capacities, and technological expertise (Aero Vodochody, Hirtenberger Defence Systems), by joining production chains through the purchase of licences (CZ, Colt), and by establishing joint ventures with partners that already have established access to international markets (Rheinmetall, Nurol Makina). The latter may represent a significant expansion of "national" production capacities, but in the short term they must still meet the HDF force's modernisation needs, meaning that procurement and co-production costs will also appear in the import balance. In the medium- and long term (by the end of the 2020s), an operational manufacturing base with relatively stable production capacity could be established which would also be capable of producing for international markets. Accordingly, the slow growth in exports is likely to continue in the next years, with more substantial progress from the end of the decade. Meanwhile, the value of imports will continue to fluctuate dynamically on an annual basis, depending on the pace of deliveries for the armed forces development program. The foreign trade balance for military technology is expected to become less negative, as a significant portion of the procurement contracts concluded since 2018 have already been fulfilled, and few new agreements have been signed since 2022.

This may change with the possible involvement of European Union defence industry development funds. Hungary has indicated a bid of EUR 16.2 billion in the Security Action for Europe (SAFE) program.[5] The Hungarian national plan was submitted on November 30, 2025; this actually includes project proposals valued at a total of 17.4 billion euros to add extra planning overhead and make sure that all allocations would be covered even if some projects are not accepted by the Commission (Kormany, 2025). However, details have not been publicly disclosed, as the European Commission plans to make its funding decision in Q1 2026. Currently we can only formulate provisions about its possible content based on background information and existing defence industry capacities. Land combat vehicle manufacturing and development (with German and Italian partners), drone and aircraft development (with French, Is-

5 The SAFE program is a joint EU loan, which is significantly more favourable than Hungarian national loan conditions and provides long-term funding until 2049. Therefore, after initial political opposition, the Hungarian government announced the third largest demand among EU member states in July 2025. The specific content will be submitted by the member states to the European Commission on November 30, where the assessment is expected to take place by early 2026. It is important to note that the European Commission, which distributes the funds, has set several priorities for programs to be financed from SAFE resources, which are not particularly favourable to the Hungarian defence industry. On the one hand, priority is given to programs supporting Ukraine's military capabilities, from which Hungary opts out for political reasons. On the other hand, the funds can also be used for dual-use (civilian-military) developments, provided that they enhance the resilience of Member States and the EU, such as critical infrastructure protection or military mobility development projects. A further perspective condition is that the long-term elements of the projects (research and development, manufacturing) must be implemented in multinational cooperation, which requires Hungarian defence companies to be able to closely cooperate with international partners.

raeli, and German partners), and the development of communication, sensor, reconnaissance, and surveillance systems are examples of areas where the Hungarian defence industry might seek cooperation with international partners. The scale of the funding could secure the further development of two or three Hungarian defence industry clusters and the key companies operating within them for years to come, which could help them produce marketable export products by the end of the decade. Of course, this will also require solving the bottleneck problems of domestic manufacturing capacity (labour, supply chain, raw materials), as well as international licensing agreements with partners.

The Functional Map of Hungarian Defence Industry: Clusters

The Hungarian defence industry was initially centred around six clusters, which have increased to eight by 2025:[6]

1. Small arms and light weapons;
2. Ammunitions and explosives;
3. Land (combat) vehicles;
4. Aviation technology and drones;
5. Surveillance and air defence;
6. Command and control, communications, reconnaissance, intelligence and monitoring systems;
7. Space technology; and
8. Simulation and training.

1) Small arms and light weapons

Although small arms and light weapons manufacturing in Hungary was formerly state-owned (examples include Fegyver és Gépgyár Corp., i.e., "FÉG", founded in Budapest in 1891, whose last legal successor, FÉGARMY Fegyvergyártó Ltd. went bankrupt in 2004), this state ownership ceased to exist in the 21st century. Private arms manufacturing only covered limited products, such as the Hungarian-designed Gepárd weapon family, currently manufactured by SERO Ltd., including for example sniper rifles, also used by the Hungarian Defence Forces.

In the 2020s, Kiskunfélegyháza has become a cluster centre for small arms and light weapons manufacturing. Arzenál Fegyvergyár Clc. manufactures firearms (P-07, P-09 pistols, Scorpion Evo III submachine guns, CZ BREN 2 assault rifles for the HDF and Hungarian law enforcement agencies), and the new Gestamen firearms series can be produced there. The German Unique Alpine AG TPG-3 A4 sniper rifle, AR-10 and AR-15 machine guns are also manufactured locally; and an agreement has been reached with the Belgian FN Herstal company on the local production of Browning firearms (Snoj, 2020). The region is an excellent example of how a cluster can connect domestic customers (the HDF and law enforcement agencies), investors, the suitably trained workforce, and the education and innovation ecosystem. As a result of these developments, Diana Fegyverzettechnikai Technikum és Kollégium (Diana Weapons Technology Technical College and Boarding School) expanded its infrastructure and training programs in secondary education, while in higher education, Neumann János University in Kecskemét launched a weapons engineering program, followed by the establishment of the National Weapons Manufacturing Education Centre.

In addition, Dynamit Nobel Defence and Arzenál Clc. will cooperate to manufacture reactive armour elements and components for anti-tank missiles in Vecsés from 2026. According to reports, initially only components will be manufactured, but the ultimate goal is to create a Hungarian product variant manufactured entirely in Hungary within a few years. Since the German–Israeli parent company also manufactures reactive armour components for tanks and infantry fighting vehicles, it would be a logical next step for DND's ERA system to appear on the Hungarian-manufactured Lynx vehicles as well (Portfolio, 2020).

These projects show the fundamental role of inviting foreign companies to Hungary to establish joint ventures, purchase licences, and acquire foreign manufacturing capacities, while Hungarian capacities remain in the background – presumably due to quality and manufacturing constraints and the niche nature of the products (as they target a narrow customer base).

2) Ammunitions and explosives

Re-establishing the production of ammunitions and explosives in Hungary serves the purpose of making the HDF self-sufficient regarding basic military supplies in order to replace dependence on foreign suppliers. For this reason, Rheinmetall Hungary Munitions Clc. is building a large-calibre ammunition factory in Várpalota, where 30, 120, and 155 mm calibre artillery ammunition will be manufactured for Lynx infantry fighting vehicles and Leopard-2 tanks, as well as an explosives factory where hexogen/RDX explosives will be produced. The production of large-calibre ammunition was scheduled to start in 2024, and explosives production in 2026. There have also been suggestions that Hirtenberger Defence Systems' mortar grenade production capacity could also be relocated here, although this is less justified from a financial point of view. Hirtenberger, which became Hungarian-owned in 2019, has an international production and sales portfolio in the field of artillery equipment. To supplement the production of artillery ammunition in Várpalota, 7.62 mm and 12.7 mm machine gun ammunition (for Lynx and Gidrán vehicles) are manufactured at the former MFS ammunition factory in Sirok, which is

6 Compared to 2019, when the first Defense Industrial Strategy was adopted in Hungary, the new areas are simulation and training, and space technology.

now owned by Beretta Group (Szabó, 2020).

3) Land (combat) vehicles

After the Cold War, the Hungarian defence industry only had the expertise, industrial capacity, and technology to perform maintenance, repairs, and minor (non-structural) modernisation upgrades for land systems. As in other clusters, Hungarian companies were unable to manufacture complete weapon systems or significant subsystems. The Soviet/Russian-made legacy tanks (T55, T72) and combat vehicles (BMP-1, PSZH D944, BTR-80/80A) were maintained by HM Currus Clc. until they were withdrawn from service, which also highlights the technological limitations of the company. Similarly, Hungarian military vehicle manufacturing, organized around Rába Clc., only supplied smaller segments of the HDF's vehicle fleet.

These remaining capacities, limited in both quality and quantity, could not form the basis for the development of land vehicles in the 2020s. Accordingly, the cluster is currently built around newly established industrial collaborations that provide access to the most advanced technology according to international standards. The new agreements were linked to the modernisation of the HDF in cooperation with major German (Rheinmetall, Kraus-Maffei Wegmann) and Turkish (Nurol Makina) companies, the procurement of large weapon systems (Lynx, Leopard-2, and Ejder Jalcin/Gidrán), and the establishment of assembly and partial manufacturing in Hungary (Zalaegerszeg, Kaposvár, Győr).

Land combat vehicle manufacturing is based on two pillars. First, Rheinmetall Hungary assembles Lynx combat vehicles in Zalaegerszeg, with Hungarian suppliers also involved in certain components, while the nearby ZalaZone off-road vehicle test track supports testing and quality assurance (also for other vehicles). It is important to note that when the German-Hungarian agreement was signed, Lynx was not yet considered a fully mature product, had not been adopted by any armed forces (not even the Bundeswehr), and had no combat experience. The Lynx's future options include further development of its turret armament, for example, the adaptation of the Israeli Rafael's Trophy active protection system (Világi, 2021). The development of autonomous combat vehicles can also rely on the capabilities of the ZalaZone track in for example, Rheinmetall's Mission Master XT (Trautmann, 2020; Huszák, 2021).

The other pillar is the production of the Gidrán armoured tactical vehicle which is manufactured by Nurol Makina Hungary Ltd., Gidrán Páncélozott Járművek Ltd., and Rába Jármű Ltd. based on the Turkish vehicle Ejder Yalçın. While the first 42 pieces were assembled in Kaposvár from 2021, today Győr is the primary location for the entire production, while Kaposvár is where the auxiliary systems are installed. The goal is to manufacture a fleet of 400-450 vehicles for the HDF, which will include ten different variants. Among other developments, these include the adaptation of Rheinmetall's next-generation 35-millimeter air defence system, the Oerlikon Skyranger, which is a combination of a 30-millimeter automatic machine gun, guided missiles, and a high-energy (20 KW) laser (Defensehere, 2022); and the integration of the Hero drone family's loitering munitions, jointly manufactured by Rheinmetall and UVision (Hungary Today, 2023).

In terms of forward-looking arrangements, an agreement has been signed regarding the development cooperation of Rheinmetall's fourth-generation tank, the KF-51 Panther, which will be a complex weapon system equipped with a 130 mm tank gun, active protection systems, artificial intelligence-supported targeting equipment and numerous related sensors, as well as drones connected to the system. Based on the Leopard 2 tank chassis, the Panther will feature a new, more advanced turret and auxiliary systems. Some elements of its development are also taking place in Italy, and in the future, the program will primarily target purchases by countries that already use Leopard tanks and wish to replace them with more modern equipment.

4) Aviation technology and drones

In the field of traditional aviation technology, previously the HDF only had the capacity to operate, maintain, and perform limited repairs on Soviet/Russian aircraft (An-26, MiG-29) and helicopters (Mi-8, Mi-17, Mi-24) for decades, but major repairs to the airframe and engines were carried out in Russia or in Ukraine. In the case of the leased JAS 39 Gripen multi-role aircraft, which represent a generational and technological change and will remain in service until at least 2036, and the Airbus helicopters that arrived in the 2020s, maintenance capacity was developed in Kecskemét and Szolnok respectively, based on a similar logic. Embraer, the manufacturer of the KC-390 military transport aircraft to be delivered by 2026, has agreed with Aeroplex Közép-európai Légijármű Műszaki Központ Ltd. that the company, which has experience in aircraft maintenance, will become the official service centre for the KC-390 aircraft ordered by the HDF. Embraer, which is a Brazilian company, also announced the opening of a research and development centre. As part of its comprehensive military development program, Airbus Helicopters has established a factory in Gyula, where it manufactures parts of the power transmission systems for all Airbus helicopter types and provides special surface treatment for them (Sasvári, 2022). The Czech company Aero Vodochody is also part of the aviation portfolio, where, in addition to the HDF L-39 procurement, further orders were also announced: the Senegalese Air Force, a Portuguese company, and an American company will purchase a total of 26 L-39NGs from the manufacturer (Dajkó, 2021).

Skylark I reconnaissance drones have been part of the HDF arsenal since 2008 (due to the stabilisation operations in Afghanistan), and this capability was expanded by Skylark I LEX and Skylark III reconnaissance drones from 2022. Hungarian drone development initially began in connection with the Ministry of Defence (MoD EI Clc.) with the Bora and Ikran models, followed by the Meteor 3MA target drone (an aerial target for military exercises), but these were unable to make a breakthrough to the international market. The next level of development was civilian, with

the engineering of the jet-powered ProTAR drone (by Rotors&Cams), which is also a target aircraft. A significant procurement followed in 2022, namely, the Hero-30 loitering ammunition jointly manufactured by German Rheinmetall and Israeli UVision, which was already tested in a military exercise in 2025. In 2023, there was also talk about the Rheinmetall–UVision cooperation being expanded with Hungarian manufacturing capacity in the future (Hungary Today, 2023). Although neither party made an official announcement, both the procurement and the production would make it realistic to extend the cooperation to additional, longer-range and more destructive elements of the Hero drone family, possibly in conjunction with its integration into the KF-51 Panther tank, as mentioned earlier.

Based on our current knowledge, independent Hungarian R&D in this field appear to face technological limitations – airframes and propulsion systems are available, but products equipped with complex sensors or strike capabilities are missing. Given the extremely rapid development of this field, newly established small and medium-sized enterprises focusing on this area, with a strong financial background such as 4iG Space and Defence Technologies, will be able to overcome these limitations through technology transfer secured in international cooperation. In addition to the production of the Hero loitering ammunition, this cluster could also be linked to any potential development of unmanned aerial vehicles with Israeli or Turkish partners in the future, possibly in conjunction with the development of autonomous control capabilities and drone swarms.

5) Surveillance and air defence

Traditionally, the Hungarian Defence Forces have performed airspace surveillance and air defence tasks relying on Soviet/Russian military technology, both in terms of radar systems (P-37, PRV–17 and SZT–68U radars) and air defence missiles (2K12 KUB), for which the domestic technology base, service and repair capacities were provided by MoD EI Clc. The modern elements of airspace surveillance capabilities that were still missing in the 2010s were solved by the purchase of IAI ELTA ELM-2084 multifunctional, phase-controlled radars. Their final assembly and system integration is carried out by Rheinmetall Canada in Nyírtelek. The ELTA ELM-2084 functions not only as an airspace surveillance radar but also as a ground-based fire control radar, thus fulfilling multiple roles in the HDF. In the 2020s, Rheinmetall Canada's local radar plant may be linked to the development of sensors and small aircraft or drones, but overall, it represents limited capacity and a specialized profile.

After the turn of the millennium, air defence was supplemented with Mistral short-range surface-to-air missiles, which were upgraded in 2017 with the purchase of a more modern missile version. In 2025, the obsolete KUBs have been withdrawn from service and replaced by the Norwegian-American (Kongsberg-Raytheon) NASAMS medium-range air defence missile system. The command-and-control link between the radars and air defence will be established by the Surface-to-Air Missile Operations Centre (SAMOC) purchased from Airbus Defence & Space. The operation, maintenance, and modernisation of these systems will largely be the responsibility of a few specialised Hungarian defence companies in cooperation with the manufacturers (Szűcs, 2023).

6) Command and control, communications, reconnaissance, intelligence and monitoring systems

The tasks derived from the comprehensive military modernisation and defence industry development are communications technology, command and control, and cyber defence. Even before the establishment of 4iG Space and Defence Technologies Clc. with a specifically defence-oriented profile, the parent company, 4iG Clc. had already been the leading information and communications technology company on the Hungarian market in the 2010s. The new company, established in 2022, is a joint venture between Rheinmetall AG (51% majority ownership), 4iG Ltd. (39%), and MoD EI Clc. (10%), whose core task is to support the digitisation of the Hungarian Defence Forces (Növekedés, 2022). Rheinmetall's participation in the joint venture should not be interpreted merely as a capital investment, but as fulfilling a fundamental role for system integration: the interconnected and coordinated operation of numerous 21st-century military devices and the command, control, and communication systems that connect them, as well as the reconnaissance and surveillance systems, which are fundamental elements of modern network-centric warfare in terms of both hardware and software.

Today, these functions are performed by Rheinmetall Electronics Hungary Kft., which provides digital and software services to the Hungarian Defence Forces in the areas of command, control, communications, computers and intelligence (C4I), as well as test systems, simulators, and training equipment.

7) Space technology

Space and satellite technology is being developed in Hungary as a completely new technological segment, with access to the technology currently being provided primarily through cooperation with Israel. In this specialized field, 4iG Space and Defence Technologies Clc. is the dominant player, with a portfolio that includes space and satellite development, Earth observation data processing, and defence digitisation (in addition to drone manufacturing and counter-drone defence). A key government objective is to build and launch (expectedly in cooperation with U.S. private companies) eight satellites in geostationary orbit (HUGEO) and eight in low Earth orbit (HULEO) by 2032, and then to operate them in a systematic manner. To this end, 4iG purchased 20% of the Israeli company Spacecom in 2022, with an option to purchase an additional 31% over the next three years. The reason for this was that in the 1980s the International Telecommunication Union (ITU) allocated a geostationary orbit segment to Hungary, which was leased by Spacecom between 2004 and 2024, after which the Hungarian government transferred it to Carpathiasat Clc. for the next 20 years. The aim of the investment and development was to place Hungary's first satellite, suitable for

commercial, governmental, and scientific research tasks, into orbit around Earth and then operate it in the long term. The construction of eight additional satellites orbiting in low Earth orbit is planned to be carried out at the Martonvásár factory (Remtech) of Remred Space Technologies, also founded by 4iG in 2024.

The possibility of expanding space technology cooperation was explored by 4iG Space and Defence and Axiom Space in 2025 in the form of a framework agreement built around a USD 100 million investment and a five-year cooperation plan. The agreement includes potential cooperation between the two companies on the first European Orbital Data Centre (ODC) program, research into low Earth orbit satellite technologies, and 4iG SDT's connection to Axiom Space's global space industry marketplace (4iG, 2025).

8) Simulation and training

The development of training in a modern simulation (Virtual Reality, Augmented Reality) software environment became necessary because the new military equipment and systems created strong training demands and these also increase cost-effectiveness. From the tactical training of individual riflemen to company and battalion-level training and the training of operators, pilots, and even mechanics of the new weapon systems, numerous programs are running in the HDF, mostly as a result of joint development by small Hungarian companies and foreign manufacturing partners. Hungary is the lead coordinator of the EUROSIM PESCO project, which strengthens tactical training and the sharing of experience with simulation.

Key Stakeholders in Hungary and Breakout Areas

Within the eight clusters assessed above, there are a number of companies that play determining roles or provide fundamental services for the Hungarian Defence Forces and are planned to be developed into Tier-2 and Tier-1 companies in the wider framework of EDTIB with meaningful arms export profiles. Table 1 summarises these, based on a resultant vector of two criteria: access to cutting-edge technology (through transfer from foreign partners) and primary production/service profile for the Hungarian Defence Forces. There are three focal points of these clusters and companies: armoured vehicle production, space telecommunications and networked sensor (C4ISR), and aviation (light aircraft, drones and counter-drone systems). By 2025 the central actors in the Hungarian defence sector are 4iG Space and Defence and N7 Holding, both closely connected to the telecommunication national champion 4iG.

Table 1

Defence firms active in Hungary with a determining role or fundamental profile

Company name	Main products/services	Ownership	Primary partners
Aero Vodochody	Light aircraft (reconnaissance/attack)	Mixed: Hungarian-Czech (HSC Aerojet Zrt. 80%, Omnipol a.s. 20%)	Hungarian Defence Forces / Foreign trade partners
Carpathia Sat Zrt.	Geostationary satellite technology, telecommunications, reconnaissance	Hungarian (4iG 51%, Antenna Hungária Zrt. 44%, New Space Industries Zrt. 5%)	4iG
Gidrán Páncélozott Járművek Kft.	Manufacturing the Gidrán armoured vehicles	Hungarian (Nurol Makina Hungary Kft., Rába Járműgyártó Kft.)	Rába Zrt.
HDT Védelmi Ipari Kft. (former Hirtenberger Defense Systems)	Mortars and light artillery	Hungarian 4iG Space and Defense Technologies	Hungarian Defence Forces / Foreign trade partners
Hungaro DigiTel Távközlési Kft.	Wired, wireless and satellite telecommunications, ground-based servicing for satellite technology	Hungarian (4iG 75%)	4iG
Nurol Makina Hungary Kft.	Manufacturing the Gidrán armoured vehicles	Turkish	Rába Zrt.

Company name	Main products/services	Ownership	Primary partners
N7 Defence Holding	A conglomerate holding ownership and management rights to 9 companies with production profiles in helicopter propulsion system parts; ammunition, and explosives; armoured vehicles; small and light arms	Hungarian (4iG 75%)	Aeroplex Kft., Airbus Helicopters Hungary Kft., Rheinmetall Hungary Munitions Zrt., Rheinmetall Hungary Zrt., Hirtenberger Kft., SATYPS PSP Hungary Zrt., Dynamics Nobel Defence Zrt., Arzenál Fegyvergyár Zrt., Colt CZ Hungary Zrt.
Pro Patria Electronics Kft.	Passive radar technology, sensors	Hungarian	Gidrán Páncélozott Járművek Kft.
REMRED Space Technologies Ltd.	Space technology	Hungarian (4iG 45%)	Remtech
Rheinmetall Electronics Hungary Kft.	Digital and software services, C4ISR, testing and simulations, training	Mixed (Rheinmetall 51%, N7 Defence Zrt. 49%)	N7 Defence Zrt.
Rheinmetall Hungary Munitions Zrt.	Ammunition production	Mixed (Rheinmetall 51%, N7 Defence Zrt. 49%)	N7 Defence Zrt.
Rheinmetall Hungary Zrt.	Wheeled and tracked armoured vehicles (KF41 Lynx, KF51 Panther)	Mixed (Rheinmetall 51%, N7 Defence Zrt. 49%)	N7 Defence Zrt.
Rohde & Schwarz Hungária Kft.	Radio communications (VHF-UHF)	German HQ, Hungarian subsidiary	Hungarian Defence Forces
SAAB	JAS-39 Gripen multirole aircraft	Swedish	Hungarian Defence Forces
Spacecom	Broadband satellite services	Mixed Israeli, 4iG 20-51%	4iG
4iG Space and Defence Technologies	A conglomerate holding ownership and management rights to 6 companies. Activities organized in 5 branches: space, aviation, land systems, weapons and ammunition, cyber and defence digitalisation	Hungarian	Rotors & Cams Zrt., RAC Antidrone Zrt., Hungaro DigiTel Kft., Spacecom Ltd., CarpathiaSat Zrt., REMRED Zrt.

Currently the production capacities of most companies are still in the process of being established, upgraded or expanded to fulfil the force's modernisation orders of the HDF throughout the 2020s. This is the main reason why a meaningful revenue profile for these companies cannot be established for the moment. In the second half of the decade, mostly beyond 2028, there will be windows of opportunity opening for them, with further financing and technological boosts mostly from the SAFE funds and to a lesser extent from new national acquisitions (i.e., HIMARS long-range precision rocket artillery from the U.S.). As mentioned earlier, land combat vehicle manufacturing and development (with German and Italian partners), drone and aircraft development (with French, Israeli, and German partners), and the development of communication, sensor, reconnaissance, and surveillance systems integrated into

low earth satellite space technology are the areas where the Hungarian defence industry can engage deeply with international partners. However, as most capacities are newly established (built in the 2020s literally from scratch), their own respective production chains and wider industrial and service ecosystem must be developed and consolidated first, before they could join European production and value chains. In this regard, developments in the next three years will be crucial and will decide about the success (sustainability, marketability and profitability) of Hungarian arms industry, its products and services.

Research, Development and Innovation Potential

The common elements of the manufacturing, research and development, and innovation collaborations outlined in the eight cluster areas are: the presence of international partners in Hungary; technology transfer; and meeting the technology demand of the HDF for the short- to mid-term, followed by production for the international market in the long term. To ensure that products meet the ever-changing requirements of warfare and integrate developing technologies, Hungarian defence industry players also seek to engage in research, development, and innovation. The government also provides support for this, as well as some coordination through the Defence Innovation Research Institute. The defence industry capacities developed in the 2020s, which are being created in cooperation with German, Turkish, etc. companies, in most cases also include R&D&I activities that go beyond joint production.

The international pillar of defence industry development is represented by international companies with investments and commercial partnerships, as well as NATO and EU innovation programs that support multinational development, such as NATO's Defence Innovation Accelerator for the North Atlantic (DIANA) and the European Defence Fund (EDF), as well as Permanent Structured Cooperation (PESCO) multinational capability development projects. NATO DIANA, established in 2022, initially certified two Hungarian test centres in Kaposvár and Zalaegerszeg, and since 2024 there are nine DIANA-accredited institutions in Hungary. The new ones were established by the University of Pécs, University of Óbuda (two centers), BHE Bonn Hungary Electronics Ltd., Alverad Technology Focus Ltd., ITSec Area Ltd., and Nokia Bell Labs. Promising connections are being forged with at least four of the eight emerging and disruptive technologies' fields identified by NATO as key development areas: big data, artificial intelligence, autonomous devices, and quantum computing (Honvedelem.hu, 2024).

In the summer of 2022, EDF awarded funding to six multinational research projects involving Hungarian participation for the development of artificial intelligence, 5G communications, satellite technology, sensors, and drone technology, which are as follows (with the names of the foreign companies leading the collaboration and the Hungarian companies participating in it, as well as the field of research):

→ 5G COMPAD (Saab – Swedish – and BHE Bonn Hungary Electronics Ltd.) – development of military 5G communication systems for peacekeeping operations;

→ EuroHAPS (Thales – French – and C3S Elektronikai Fejlesztő Ltd.) – ground observation satellite technology;

→ FaRADAI (Ethniko Kentro Erevnas Kai Technologikis Anaptyxis – Greek – and Certh Számítástechnikai es Automatizálási Kutatóintézet) – the role of artificial intelligence in surveillance;

→ iFURTHER (Hellenic Aerospace Industry SA – Greek – and BHE Bonn Hungary Electronics Ltd.) – beyond line-of-sight sensor development;

→ NOMAD (Equipos Móviles de Campana Arpa, S.A.S. – Spain – and F4STER–FUTURE 4 Co.) – energy storage and supply for mobile military command posts; and

→ ALTISS (Magellium S.A.S. – France – and SAGAX Communications Ltd.) – use of drone swarms in force protection (European Commission, 2022a, b).

However, among the 54 multinational projects supported by the next EDF project cycle, in 2023, only one involved a Hungarian company: the Defence Innovation Research Institute participates in the CALIPSO project, which aims to develop an environmentally friendly propulsion system, together with 34 partner institutions from 14 EU member states (European Commission, 2023). From this, we can conclude that both the number of Hungarian companies and research centres that can participate in international-level projects is very limited, and there are only a few areas where Hungarian defence industry players can act innovatively. These limitations are expected to somewhat diminish as defence industry capacities expand, but they will not disappear, as Hungarian companies are only able to take on a leading or initiating role in exceptional cases. In the case of PESCO, which is also EU-funded, Hungary plays a leading role in only one project (EUROSIM) and participates in eight others (Nádudvari, Etl, Bereczky, 2020).

Assessment and Outlook

As developing the Hungarian defence industry started in the mid-2010s, practically building on a handful of Tier-3 companies without access to advanced technology, production know-how, investments and international markets, the meaningful developments of the past decade must be assessed carefully. Development efforts – in terms of technology, investment, and production capacity – have been centred around the key objective of connecting with the international defence industry both in terms of major players and production chains, building from lower levels upwards. International players entering the field with advanced technology can integrate Hungarian companies into production chains and research and development processes, enabling them to achieve a level of technology that otherwise they would not be able to reach through independent develop-

ment. This can also reduce the market entry costs for Hungarian (and co-owned) companies.

This model of operation relies on the localisation of production and added research and development cooperation, which goes beyond the old-school procurement model and traditional offset arrangements. This change was made possible by the comprehensive armed forces development program that created high-value and long-term demand for the defence industry, making foreign producers interested in teaming up with Hungarian partners or establishing local subsidiaries through joint ventures.

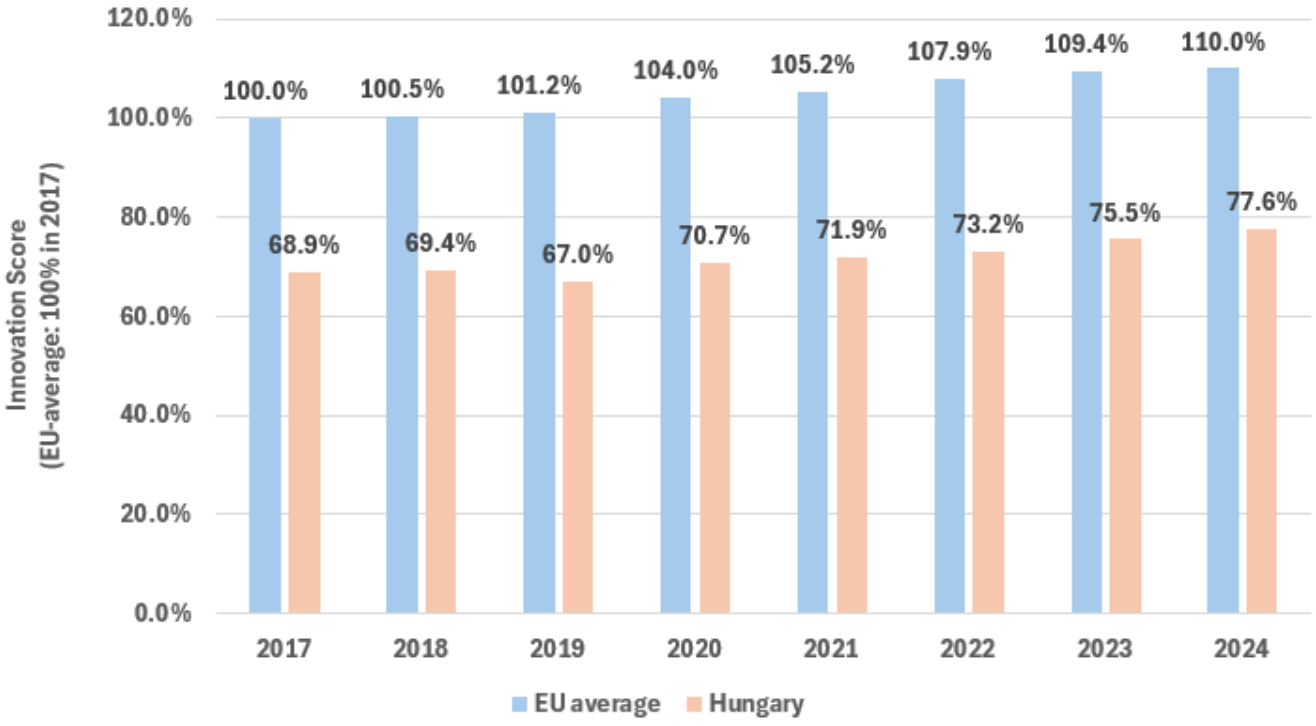
Defence industry landscaping has shown that the defence industrial ecosystem, built around eight functional clusters, is only gradually developing, though it is fragmented and largely driven by the armed forces modernisation priorities of the Hungarian Defence Forces. It nurtures technological and production potential in several areas but is currently still in transformation. This means that the consolidation of Hungarian defence industrial capacities in production, repair and maintenance of new technologies, and even more in research and development, can be expected by the end of the 2020s at the earliest, if some core challenges are to be addressed successfully (Csiki Varga, 2024). These challenges include financing, enhancing innovation capacities, providing adequate workforce, building a functioning and then sustainable defence industrial supply chain and wider ecosystem, and gaining entry to the international arms market.

Financing for the short- to mid-term is mostly provided by government orders covering the procurement of the HDF's major weapons systems at least until 2028. But for all other newly built industrial capacities within the eight clusters and beyond, further financing is necessary. As constraints on public and private financing via European banks, enforced by ESG rules, are strong, ensuring investment in the Hungarian defence sector is facing strong barriers. Government spending on defence modernisation (further acquisitions), repair and maintenance, research and development, as well as subsidies for partners depend largely on the general economic performance of the country, which has been modest in recent years, narrowly avoiding recession. This would make the role of venture capital ever more important, but in Hungary the risk-averse financial culture, the immature development of the defence sector, and the limited availability of venture funds also make this form of financing challenging.

Another challenge is Hungary's modest performance as an innovator. The European Innovation Scoreboard records the overall innovative performance of Hungary across all sectors, indexed to the EU. The data show that even though there has been an improvement in innovation enablers since 2017, this did not even keep pace with the EU average, keeping Hungary in the group of "emerging innovators" among the EU-27, in which is placed at around the 21st place. Human resources, venture capital expenditures, R&D expenditures, innovative SMEs, and intellectual assets (patents, design) are lagging far behind the EU average (European Commission, 2025).

Fig. 3

European Innovation Scoreboard records, 2017–2024, showing the Hungarian performance indexed to the EU-average.



Source of data: European Commission, 2025

Shortcomings in a skilled and educated workforce – both to traditional defence companies and innovative tech firms, such as start-ups and SMEs in the supply chain – with an innovative edge are known deficiencies for the moment. To provide for such human capital, tighter and deeper cooperation programs with institutions of higher education, innovation hubs and research centres have been initiated, but it takes years to yield these cooperations, while the defence sector will face tough competition with other industrial and advanced tech sectors as well.

As a comprehensive framework, a functioning and later sustainable defence industrial supply chain and wider defence ecosystem – comprising defence companies, tech companies, SMEs, start-ups, civilian, dual-use and military research and innovation hubs, financial institutions, military planning and management, as well as political coordination bodies, etc. – must underpin the efforts of developing Hungarian industry, with efficient links to the international defence environment, such as in NATO and the European Union. In 2025, some of these are rudimentary, while others are at a more advanced stage, but further significant improvement is necessary. On the one hand, this is because the national defence industry will not survive without these, while on the other hand, credible prospects for profitable arms exports might only appear by the end of the 2020s, if the above-mentioned elements and processes meet with success.

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Imprint

Published by
Friedrich-Ebert-Stiftung e.V.
Godesberger Allee 149
53175 Bonn
info@fes.de

Publishing Department
Department for International Cooperation /
European Union and North America Department

Content Responsibility and Editing
Dr. Ernst Hillebrand, Director FES Budapest

Contact
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Image Credits
P. 1: Moleng24/Tymofii

January 2026

ISBN 978-3-98628-814-3

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