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ARCHITECTURE OF SOVEREIGNTY

Defense Logistics in an Era of the Threat of War

REPORT PARTNERS

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Architecture of Sovereignty

Defense Logistics in an Era of the Threat of War

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Report at a glance

Industrial sovereignty does not mean self-sufficiency, but rather access to products and services, as well as the ability to continue operations.

THE REPORT IN NUMBERS

5
case studies

44
links in the sovereignty matrix

7
unsecured gaps

3–5 years
analysis horizon

THREE GROUPS OF INSTRUMENTS

1

Reporting requirement

the least expensive instrument in the entire catalog and a prerequisite for rational application of all the others

2

Contractual instruments

crisis clauses, requirement for a second supply source, stockpiles, and rights to integration and repair

3

Capital decisions

concerning a narrow group of links in the supply chains for which no access instrument is deemed sufficient

> Final assembly, regarded as a measure of success in the public debate, is precisely the thing we have abundance of and which yields the smallest benefits.

CHAPTER 1

01

Executive Summary

Industrial sovereignty does not mean self-sufficiency, but rather access to products and services as well as the ability to continue operations – manufacturing, repairing, and modifying equipment – even when external support is limited, delayed, or conditional. The crucial question, therefore, does not lie with whether Poland is in full control of the production process for any given product but rather with whether it can continue procurement in the event of a supply disruption? In consequence, the degree of content localization and the location of final assembly facilities do not always reflect the actual levels of sovereignty. When designing defense procurement programs, therefore, it is the resilience of the entire product value chain that must be accounted for, with focus not so much on full self-sufficiency but on the ability to function effectively in crisis situations.

An analysis of the value chain links in five case studies (as of August 2026) leads to a cautiously optimistic conclusion: the scale of the problem is significantly smaller than public debate suggests, but the window of opportunity for implementing the desired changes is becoming increasingly narrow. For example, in the area of large-caliber ammunition, Poland appears to stand strong at both ends of the chain – it has access to resources of its own raw materials and high-energy substances, as well as its own integration systems, command software, and unmanned platform designs – but it is weak in the middle, particularly in propellant chemistry, fuze electronics, and active vehicle protection. Final assembly, regarded as a measure of success in the public debate, is precisely the thing we have abundance of and which yields the smallest benefits.

Several completely unaddressed gaps have been identified, not dozens, and most of them fall within a single technological area. The list of actual investment priorities is therefore

short and internally consistent, and thus feasible within a five-year timeframe – i.e. provided the decisions are taken now, since time required to rebuild these capabilities exceeds two years, and making up for any delays cannot be made up later with increased spending. For most of the remaining links, import dependency is either properly managed or hedged through reserve mechanisms, which allows us to draw a key conclusion for the entire report: the aim is not to eliminate dependencies completely, but to manage them effectively. The appropriate response here is not to localize production, but to establish safeguards in the form of: securing a second qualified source, stockpiles, and the right to integrate and repair.

For anti-drone systems – the fastest-growing segment of procurement – detection and command-and-control systems rely on solutions provided by domestic suppliers and have been proven through deployments. The weapons systems are mostly imported. The most serious bottlenecks are horizontal in nature: the success of several unrelated programs is determined by simultaneous access to the same components. Some links in the chain cannot be reliably assessed today: the supplier is known, but potential alternatives are unknown, and it is precisely their availability that determines the scale of the risk.

Analysis of value chains in the defense sector continues to encounter insular information gaps, resulting in part from the protection of sensitive data or from the deliberate policies of manufacturers. Therefore, from the perspective of the state (particularly the Ministry of National Defense) as the regulator and primary consumer in the defense market, it is crucial to organize information:

1. The reporting requirement is the least expensive instrument in the entire catalog and is a prerequisite for rational application of all the others.

2. The second group consists of contractual instruments: crisis clauses, requirement for a second supply source, stockpiles, and rights to integration and repair. These remain within the purview of the procuring entity and require, above all, changes to document templates rather than new capital expenditures.

3. The most important intervention tool sits with capital decisions concerning a narrow group of links in the supply chains for which no access instrument is deemed sufficient. Paradoxically, even if they must be implemented only upon careful analysis, they require relatively early implementation in order to take effect and shape the supply chains appropriately. At the same time, the list of addressees is of a national level and consists of economy and defense ministries as well as funding institutions, and at the regional level – of cooperation frameworks on the eastern flank. This requires a continuing, working-level cooperation, preceded by intensive consultations and oversight by national governments.

CHAPTER 2

02

Introduction

2.1 Context: from decoupling, through strategic autonomy, to the question of agency

The debate on the sovereignty of the defense industry in Europe in recent years can be divided into several phases. Each resulted in the definition of different goals and acceptable levels of industrial dependence on external partners. The starting point was the U.S. and EU narrative on economic decoupling from China, which began around 2018–2019 in response to the trade war between the United States and China as well as to the COVID-19 pandemic, which exposed the fragility of global supply chains. Decoupling – understood as complete separation of interconnected economies – proved to be both a costly and difficult goal for Europe to achieve, prompting the European Commission to reframe it as a concept of "derisking" (since 2023) – that is, mitigating the risks of excessive concentration of dependencies without severing trade relations[1]. While the European Union maintains a *"derisking, not decoupling"* approach, focusing restrictions on narrowly defined security sectors, U.S. policy has shifted towards a broader decoupling[2]. This distinction has practical significance for the report: Poland and the Eastern Flank, as part of the European Union, operate within the framework of the European logic of de-risking, but at the same time must take into account the fact that their primary security guarantor pursues a decoupling from China policy on a different scale – which, within the three- to five-year timeframe adopted in this report, may generate divergence in expectations regarding the pace of moving away from non-European suppliers in the defense industry's value chain.

1 Jiayi Zhou, Fei Su, Jingdong Yuan, *"De-risking: The EU's and Japan's Approaches to Managing Economic Relations with China,"* SIPRI Policy Paper, Stockholm, February 2024, sipri.org/publications/2024/policy-reports/de-risking-eus-and-japans-approaches-managing-economic-relations-china.

2 U. Galani, *"US-China Decoupling Is Crossing a Rubicon,"* Reuters Breakingviews, April 16, 2025, reuters.com/breakingviews/us-china-decoupling-is-crossing-rubicon-2025-04-16.

At the same time, a separate concept of "strategic autonomy" was being developed within the European Union – the term itself derives from the French strategic thought and military doctrine. For decades it has referred to the ability to conduct military operations independently, without relying on allies. This concept was formally incorporated into European Union policy in June 2016, when it was enshrined as an objective in *the EU Global Strategy on Foreign and Security Policy* – a document that, for the first time, committed the Union to pursuing strategic autonomy, understood as the ability to conduct operations independently or in cooperation with NATO[3]. Since then, the concept has been gradually expanded beyond the military sphere to include trade, energy, and digital policies. In the literature on the subject, strategic autonomy is most often defined as the ability to independently set priorities and make decisions on foreign and security policy matters, along with the institutional, political, and material capacity necessary to implement them. From this three-layered understanding of autonomy – political, institutional, and material – emerges the concept proposed in Chapter 3, defined as "multilevel sovereignty."

The third and most recent stage of the debate – and the starting point for this report – shifts the focus from autonomy to the specific question about agency: who, within the defense industry value chain, makes decisions regarding the design, certification, export, and modernization of weapons, and who merely supplies according to specifications developed by others. The SAFE Regulation of May 2025, establishing the EU's loan instrument of up to 150 billion euros, requires that contractors and subcontractors not be controlled by entities from third countries[4]. The EDIP Regulation goes even further: the cost of components originating from outside of the EU, associated countries, and Ukraine may not exceed 35% of the estimated value of the final product's components – with a temporary, exceptional derogation for the expansion of production capacity for ammunition and missiles[5]. Despite these requirements, however, a non-EU supplier who possess a small component still sometimes happens to achieve a significant advantage and ability to prevent production. In subsection 4.3, this phenomenon is referred to as "hidden bottlenecks": a high, seemingly favorable production localization rate may in practice mask a critical dependence on a single, low-value component without which the entire system cannot be built. This constitutes a significant problem analyzed in Chapter 5: each of the five case studies (ammunition, unmanned systems and C-UAS, land vehicles, repair and maintenance capabilities, radars and sensors) distinguishes between final production (assembly, integration) and control over critical, often small links in the chain – propulsion systems, electronic fuses, nitrocellulose, batteries, or command software architecture.

This is complemented by lessons learned from the course the war in Ukraine has taken to date, which are discussed in Chapter 4. According to the analysis by the Eastern Flank Institute cited in the chapter ([6]), the pace of innovation has become a strategic asset in

3 M. Damen, *"EU Strategic Autonomy 2013–2023: From Concept to Capacity,"* EPRS_BRI(2022)733589, European Parliamentary Research Service, European Parliament, July 2022, europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)733589.

4 Council Regulation (EU) 2025/1106 of May 27, 2025, establishing the Instrument for Enhancing European Security ("SAFE Instrument") through the Strengthening of the European Defense Industry, OJ EU L, 2025/1106, May 28, 2025, EUR-Lex, CELEX: 32025R1106, eur-lex.europa.eu/legal-content/PL/ALL/?uri=CELEX:32025R1106 .

5 Regulation (EU) 2025/2643 of December 16, 2025, establishing the European Defense Industry Program and a framework of measures to ensure the timely availability and supply of defense-related products (EDIP), OJ EU L, 2025/2643, December 29, 2025, EUR-Lex, eur-lex.europa.eu/legal-content/PL/ALL/?uri=CELEX:32025R2643 .

6 *The Drone War–Status as of the End of 2025. Compendium of the Eastern Flank Institute*, Eastern Flank Institute, 2025, in particular pp. 4–5 and the section on the Russian-Ukrainian war: https://wschodniaflanka.pl/nowy-raport-wojna-dronowa-kompendium-instytutu-wschodniej-flanki/.

drone warfare, comparable to the number of brigades or ammunition production. The Ukrainian defense industry has developed a distributed and adaptable production model. It encompasses many independent, decentralized manufacturers, which limits vulnerability to a single strike. It also involves short feedback loops with the battlefield, in which the cycle – time elapsing between the moment user reports a problem to the implementation of modifications – is often measured in weeks. Chapter 4, however, clearly states that this model should not be directly replicated under peacetime conditions of NATO countries – instead, it is advisable to apply the principle of a logistics system resilient to single points of failure, including by dividing production into modules, standardizing interfaces, and establishing alternative production lines among allies. NATO's updated Defense Production Action Plan[7] draws on this logic, highlighting the need to identify critical components, consider "friendshoring," and establish multinational stockpiles of raw materials. The final lesson drawn from the Ukrainian experience concerns hidden bottlenecks in energy, components, and propulsion (Subsection 4.3) and serves as a direct methodological introduction to the analysis of specific links in the value chain in Chapter 5.

It is therefore important that this report goes beyond the question: "Should Europe be self-sufficient?" – which over the past three years has largely been answered in political terms by means of institutional actions – and moves to a more operational and empirical question: "Which specific links in the value chain should remain under national or regional control, and which can be implemented within the framework of deeper allied integration without losing the ability to act independently in a crisis?" The principle applied in this report – already evident in the case study of 155 mm ammunition in subsection 5.1 – is to distinguish between solutions that are already being produced or delivered and those that are still at the development stage under a signed declaration or letter of intent, because – as illustrated by the example of ammunition manufactured by the Czechoslovak Group abroad rather than by PGZ in Poland (example from subsection 5.1.2) – it sometimes happens that goods which are yet to be produced are classified under the "manufactured in Poland" category.

2.2 Why the Eastern Flank: shared threat perception, decision-making formats, industrial complementarity

The choice of NATO's Eastern Flank – rather than the entire European Union or the entire Alliance – as the subject of analysis stems from three premises that set this region apart from the mainstream European debate on strategic autonomy, which has thus far been conducted largely from the perspectives of Paris and Berlin.

The first of these is a shared and uniform perception of threat. The countries on the Eastern Flank – from Estonia and Latvia through Lithuania, Poland, and Slovakia to Romania – consistently define Russia as a direct and existential military threat. The Bucharest Nine (B9) format, which since 2015 has brought together the nine countries of the Eastern Flank, has become the main forum for articulating these shared interests to Brussels and Washington, calling – at successive summits in Bratislava (2023), Riga (2024), and Vilnius (2025) – for increased defense spending,

7 *Updated Defense Production Action Plan*, approved by NATO defense ministers in February 2025, published on June 24, 2025, NATO, nato.int/en/about-us/official-texts-and-resources/official-texts/2025/02/13/updated-defence-production-action-plan – identification of critical production capabilities, components, and materials; the concept of "friendshoring"; and multinational stockpiles of raw materials.

infrastructure modernization, and the development of the region's industrial capabilities[8] [9].

The second factor is the new decision-making frameworks that NATO and the EU have begun to establish specifically for the region. At the NATO summit in Ankara in July 2026, the Eastern Flank Deterrence Initiative (EFDI) and Task Force X were adopted, with the latter focused on enhancing the Flank's defense capabilities using scalable, battle-tested technologies[10]. At the same time, the NATO Front Door for Industry and NATO Engine were launched – platforms facilitating access to procurement opportunities and available production capacity across the Alliance – and in July 2026 NATO itself announced more than $40 billion in allied investments in C-UAS capabilities over five years[11]. For Poland and the region, this translates into institutional recognition of the fact that the modernization of the Eastern Flank requires a separate coordination mechanism – which is one of the arguments for introduction, as outlined in Chapter 8, of a regional benchmark based on the Nordic cooperation model (NORDEFCO), under which smaller countries have been consolidating selected capabilities and conducting joint equipment procurements for decades.

The third premise is the region's industrial complementarity. Poland – with a 2026 defense budget of 200.1 billion PLN, or 4.81% of GDP, and a consolidated state-owned holding company – the Polish Armaments Group – possesses a scale of production for ammunition, artillery systems, and armored vehicles that smaller countries in the region lack[12] [13]. However, as Chapter 5 shows, this scale is internally unevenly distributed: Poland has a strong, proven export position in high-energy materials (Polish company Nitro-Chem supplies the U.S. Army with approx. 90% of TNT[14]) and in the integration of unmanned systems (WB Group), but a weaker one with regard to land vehicle propulsion systems, nitrocellulose, and electronic fuses. The wider region partially compensates for these shortcomings: Romania and Bulgaria contribute their capabilities in large-caliber ammunition and the refurbishment of post-Soviet equipment; the Baltic-Nordic region contributes its expertise in drones and cyber defense; and Slovakia contributes capabilities in the production of wheeled vehicles. This complementarity directly provides for the structure of Chapter 5: five case studies were selected as areas where the region already possesses production capacity or clear potential for specialization in niche markets, including Poland's potential role as a regional MRO hub for U.S. and South Korean equipment (Chapter 5.4) and as an integrator of sensor architecture in light of the risk of "sensor islands" in the region (Chapter 5.5).

8 Ș. Mărgăritescu, *Romania–Poland: Strategic Partnership on NATO's Eastern Flank*, Policy Paper, Aspen Institute Romania, August 2025, aspeninstitute.ro/wp-content/uploads/2025/08/Stefan-Margaritescu_Policy-Paper-Strategic-partnership-on-NATOs-Eastern-Flank-Final-Version-1.pdf .

9 V. Müllner, K. Nečas, *"The Bucharest Nine: Part of NATO's Eastern Flank." An Analysis of Military Investment in Equipment*, "Vojenské rozhledy / Czech Military Review," vol. XXXIII (105), no. 3/2024, pp. 3–26, DOI: 10.3849/2336-2995.33.2024.03.003-026, vojenskerozhledy.cz/pdfs/vor/2024/03/01.pdf .

10 *Strategy for Industry-NATO Cooperation Endorsed by Allied Leaders at the NATO Summit in Ankara*, NATO, July 8, 2026, nato.int/en/about-us/official-texts-and-resources/official-texts/2026/07/08/strategy-for-industry-nato-cooperation.

11 *NATO Launches New Initiatives to Accelerate Defense Industrial Cooperation*, NATO, July 7, 2026, nato.int/en/news-and-events/articles/news/2026/07/07/nato-launches-new-initiatives-to-accelerate-defence-industrial-cooperation.

12 *Polish Government to Increase Funding for PGZ Group and Partnering Companies and Institutes*, Milmag.pl, September 4, 2025, milmag.pl/en/polish-government-to-increase-funding-for-pgz-group-and-partnering-companies-and-institutes/ .

13 *Poland's Wojskowe Zakłady Uzbrojenia Steps Up Investment*, Milmag.pl, March 16, 2026, milmag.pl/en/polands-wojskowe-zaklady-uzbrojenia-ramps-up-investment/ .

14 *Nitro-Chem Signs Contract to Supply TNT to the U.S. Army Worth 1.2 Billion PLN*, PAP Biznes, 2025, https://biznes.pap.pl/wiadomosci/przemysl/nitro-chem-z-umowa-na-dostawe-trotylu-dla-armii-amerykanskiej-o-wartosci-12-0.

PLN 200.1 bn
Poland's 2026 defense budget

4.81%
of GDP

approx. 90%
of TNT supplied to the U.S. Army (Nitro-Chem)

2.3 Research question and the narrowing of the thematic scope

The report's main research question is: which links in the defense industry value chain must Poland and NATO's Eastern Flank come to control independently over the next three to five years in order to maintain the ability to act autonomously in a scenario of limited or conditional external support, and which links can – without losing that capability – remain subject to deeper integration with EU and transatlantic partners? The choice of a three- to five-year timeframe is first related to the design period for the SAFE and EDIP instruments, as well as to the requirements of the national technical modernization plan for the Polish Armed Forces. Second, it corresponds to NATO's planning horizon as defined in the Defense Production Action Plan and the Ankara SYNC strategy[15] [16]. Third, it is the operational horizon for most of the milestones outlined in Chapter 5 – such as the launch (mid-2028) and the attainment of full capacity (early 2029) of the new Eurenco-Mesko modular projectile factory in Pionki, the start of full-scale production of CGR-080 rockets in Gorzów Wielkopolski set for 2030, and PIT-RADWAR reaching full capacity at its new plant in Kobyłka[17]. The very same timeframe determines the structure of the report's findings: Chapter 6 is devoted to cross-cutting themes – the ability to scale up production, available financing sources, personnel, and testing infrastructure – while Chapter 7 synthesizes the results of the sectoral analysis in the form of a sovereignty matrix and a bottleneck risk map.

The narrowing of the report's scope encompasses three dimensions:

The first is a sectoral narrowing: the analysis focuses on the five areas selected for Chapter 5 – ammunition and high-energy materials, unmanned systems and C-UAS, land vehicles, MRO capabilities, and radars, other sensors, and border protection. These are fields in which dependence on non-European or non-regional suppliers is both high and strategically critical. The choice of 155-mm ammunition as the main point of reference in Subsection 5.1 stems from the availability of data, not from the assumption that other calibers (120 mm, mortar ammunition, grenade ammunition, and small-arms ammunition) are analytically less significant – as they all pend on the same raw material bottlenecks and together account for approximately one-third of the total demand for high-energy materials.

The second dimension is geographical: the report considers the countries participating in the B9 format and the Nordic countries to constitute the Eastern Flank to the extent that their industrial capabilities complement those of the Baltic-Black Sea region, with particular emphasis on Poland as the country with the greatest industrial and budgetary potential in the region.

15 *Strategy for Industry-NATO* Cooperation…

16 *Increasing defense industrial production*, NATO, July 8, 2026, nato.int/en/what-we-do/deterrence-and-defence/natos-role-in-defence-industry-production.

17 Author's own data from Chapter 5 of the report.

The third dimension is an analytical focus. Several technological areas were selected for examination as part of case studies. For each element of the value chain (e.g., a specific component or technology), the authors pose four questions: Who has the right to modify the design of components? Is there a production line in Poland or at a trusted partner's facility? Is access to the necessary raw materials and subassemblies ensured? And who decides where the product can be exported to and how it can be used?

2.4 What the report does not cover and why – exclusion criteria

The report does not include a comprehensive analysis of the operational capabilities of the armed forces (doctrine, training, command), focusing exclusively on the industrial dimension and the supply chain. This distinction is important because operational capability and industrial capability are subject to separate decision-making dynamics and separate funding mechanisms.

The report does not cover the naval and aviation sectors (fifth- and sixth-generation combat aircraft), as these segments have a distinct value chain structure with the dominance of a small number of global-scale system manufacturers, and a different rhythm of investment cycles (10–20 years), which extend beyond the three- to five-year horizon adopted in the report. The exception is the elements of these sectors directly related to the modernization of air defense systems, which are covered in subsection 5.5 on radars and detection architecture, including the Wisła and Narew programs as well as integration with the IBCS system.

The report does not address arms export policy in detail as a separate regulatory regime – such as end-user controls, embargoes, or export licenses – but treats these issues merely as one of the factors impacting the decision-making autonomy regarding the use of the system, as assessed within the sovereignty matrix in Chapter 7.

Furthermore, the report does not include countries on the Eastern Flank who fall outside of the B9 format and the Nordic region (e.g., Greece) due to their different threat profiles and industrial structures.

Finally, the report does not attempt to quantitatively forecast future defense spending or the region's GDP for a period longer than five years, limiting itself to the programming horizon of existing financial instruments and verifiable milestones discussed in Chapter 5. Long-term forecasts (over ten years) are subject to too much political and technological uncertainty to serve as the basis for the operational recommendations contained in Chapter 8, which are addressed to specific institutional audiences identified in Subsection 8.3.

CHAPTER 3

03

Analytical Framework: Multilevel Sovereignty

3.1 Sovereignty as a guaranteed access to products and services

Starting point for the entire report is the rejection of industrial sovereignty as the possession – or lack thereof – of the full, independent capacity to manufacture a given weapons system from scratch to finish, from raw materials to the final product. Such state of complete independence would be difficult to achieve: even the world's most developed industrial economies remain dependent on global supply chains for microelectronics, permanent magnets, and critical raw materials. Instead, this report employs an operational definition, consistent with the RAND Corporation's approach to strategic autonomy, according to which sovereignty is not synonymous with self-sufficiency but rather refers to the ability to operate even when external support is limited, delayed, or conditional[18]. In this sense, two closely related but distinct components are key: access to the products and services needed in the event of a crisis, and operational continuity – that is, the ability to maintain and restore that access over time, rather than only at the single point in time when a contract is concluded.

This distinction reflects the practice observed during the research conducted for this report. Ukraine's experience, described in Chapter 4, showed that during a protracted conflict the advantage lies not with the possession of a single product with the best parameters, but with the possession of a system capable of continuously replacing losses, repairing, modifying, and scaling production. Similarly, in the subsection on land vehicles, the example of the Borsuk infantry fighting vehicle shows that even a platform designed and fully integrated domestically remains dependent on a foreign powertrain. Therefore,

18 Lucia Retter et al., *European Strategic Autonomy in Defense. Transatlantic Visions and Implications for NATO, U.S., and EU Relations*, RAND Europe, 2021, https://www.rand.org/pubs/research_reports/RRA1319-1.html; see also B. Lippert, N. von Ondarza, V. Perthes (eds.), *European Strategic Autonomy: Actors, Issues, Conflicts of Interests*, SWP Research Paper 2019/RP 04, March 2019, swp-berlin.org/publications/products/research_papers/2019RP04_lpt_orz_prt_web.pdf.

instead of asking (in the context of measuring the degree of sovereignty) whether Poland designed this product, one should be asking whether Poland can continue to produce, repair, and modify Borsuk in the event of supply chain disruptions. The Rosomak, which has been manufactured in Poland under license from the Finnish company Patria for over 20 years, is in this sense more closely aligned with the definition of sovereignty adopted in the report – the December 2025 license agreement extends manufacturing rights through 2034, and modernization and maintenance rights through 2064, ensuring freedom to modify, export, and implement solutions in the event of supply chain emergencies.

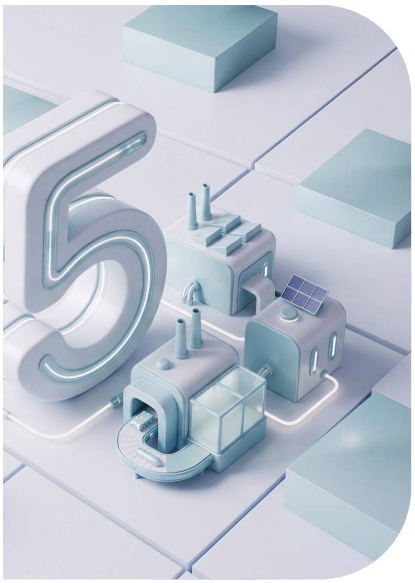
This approach results in a departure from the parameters most commonly associated with manufacturing sovereignty – the nominal percentage of "Polonization"/"local content" (the share of domestic production in a given product) or the location of production. As the analysis of high-energy materials in subsection 5.1 shows, a high localization rate can mask a critical dependence on a single component of small value – such as an electronic igniter or nitrocellulose – that the final product depends on, regardless of where the final assembly takes place. In Chapter 7 of the report, this distinction is formalized, and two separate questions are posed for each element of the value chain. The first is about the "appropriate decision-making level": where should a decision regarding a given capability be made to ensure guaranteed access – nationally, regionally, within the EU, within NATO, or with a trusted global partner. The second concerns the "actual level," i.e., where this decision is currently made in practice. The analysis conducted in this chapter shows that, for the 34 analyzed links in the value chain, import dependency is already properly managed or secured by a reserve mechanism.

34 analyzed links in the value chain: import dependency is already properly managed or secured by a reserve mechanism

3.2 Five levels of organization of capabilities: national, subregional (Eastern Flank), European, NATO/allied, and global partners

3.2.1 Levels of industrial capability organization

If sovereignty does not mean independent production of all components (by the state), it is necessary to come with a tool allowing to determine the organizational-regional level where any given capability should be located. The report identifies five such levels, ordered from the most local to the most dispersed: national, subregional (NATO's Eastern Flank), European, allied (NATO), and global partners – which includes selected partners outside the Alliance, such as South Korea and Japan. Existence of political influence at that level is prerequisite for inclusion of this level in the classification: levels where Poland has and will have no influence on decisions made (e.g., purely market-driven global supply chains without any political instrument) are not treated as a separate organizational category but as a structural dependency, described later in this subsection.



The national level applies to these capabilities where the decision regarding production, modification, or export must remain in Poland – this applies primarily to command software architecture, the integration of sensors and effectors, and rights to platform documentation, the loss of which would entail structural dependence on a foreign OEM, as described in subsection 5.3.2 with regard to propulsion systems.

The subregional level – NATO's Eastern Flank – is appropriate where the scale of demand from a single country in the region is insufficient to justify its own production line, but the total regional demand does justify such a scale. An example is the regional dimension of C-UAS described in subsection 5.2.4, in which countries bordering Russia and Belarus and experiencing drone airspace violations provide a natural base for joint test ranges, the exchange of threat signature libraries, and shared component inventories.

At the European level, the report refers to three specific initiatives aimed at building the EU's industrial independence: the Critical Raw Materials Act (CRMA)[19], EDIP[20], and SAFE[21]. The CRMA, effective as of May 2024, sets non-binding targets for the European Union for 2030. According to these targets, the EU's extraction capacity should allow the EU to source at least 10% of its annual consumption of strategic raw materials, reach the processing capacity of at least 40%, and recycling capacity of at least 25%. At the same time, any single third country's participation in the annual consumption of any given strategic raw material at any specific stage of processing is capped at 65%. As of August 2026, these targets remain unchanged; however, their achievement requires significant acceleration of investment and diversification efforts. On December 3, 2025, the European Commission adopted the ReSourceEU Action Plan, aimed at accelerating the implementation of the CRMA through the establishment in 2026 of a strategic oversight center, a joint procurement mechanism (the Raw Materials Mechanism, operational as of March 2026), and a pilot program for building up stocks of critical raw materials[22] [23]. The SAFE and EDIP regulations cover this level from the perspective of financing and requirements on the origin of components in end products.

The alliance (NATO) level pertains to capabilities requiring Alliance-wide interoperability, and it is at this level that common logistical standards are established – for example, number of days' worth of ammunition reserves a country should maintain to conduct operations of a specific intensity. The updated Defense Production Action Plan (February–June 2025) and the SYNC strategy adopted in Ankara in July 2026 explicitly

19 Regulation (EU) 2024/1252 of the European Parliament and of the Council of April 11, 2024, establishing a framework for ensuring a secure and sustainable supply of critical raw materials and amending Regulations (EU) No. 168/2013, (EU) 2018/858, (EU) 2018/1724, and (EU) 2019/1020 (hereinafter: the CRMA Regulation), OJ EU L, 2024/1252, May 3, 2024, EUR-Lex, CELEX: 32024R1252, eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX:32024R1252 .

20 Regulation (EU) 2025/2643 of December 16, 2025, establishing the European Defense Industry Program and a framework of measures to ensure the timely availability and supply of defense-related products (EDIP), OJ EU L, 2025/2643, December 29, 2025, EUR-Lex, eur-lex.europa.eu/legal-content/PL/ALL/?uri=CELEX:32025R2643 .

21 Council Regulation (EU) 2025/1106 of May 27, 2025, establishing the Instrument for Enhancing European Security ("SAFE Instrument") through the Strengthening of the European Defense Industry, OJ EU L, 2025/1106, May 28, 2025, EUR-Lex, CELEX: 32025R1106, eur-lex.europa.eu/legal-content/PL/ALL/?uri=CELEX:32025R1106 .

22 European Commission, *Questions and Answers on the RESourceEU Action Plan*, Brussels, December 3, 2025, ec.europa.eu/commission/presscorner/api/files/document/print/en/qanda_25_2886/QANDA_25_2886_EN.pdf .

23 European Parliament, Legislative Timeline | Critical Raw Materials Centre, updated June 20, 2026, europarl.europa.eu/legislative-train/theme-a-new-plan-for-europe-s-sustainable-prosperity-and-competitiveness/file-critical-raw-materials-centre.

identify critical production capabilities, components, and materials as subjects of allied rather than merely national coordination.

The global partners level corresponds to relationships such as the WB Group's cooperation with Hanwha Aerospace on the CGR-080 program – in which a specialized component comes from a trusted partner outside the Alliance, while the platform and integration remain under the control of a Polish entity, which, as noted in subsection 5.2.2, is not evidence of a program's weakness but rather an example of an appropriate level of capability organization.

DIAGRAM **Five levels of capability organization**



Beyond this five-level organizational structure, however, there is a separate category: structural dependencies – that is, those links in the value chain over which none of the five levels – not even the European or Alliance levels – currently has any political influence within the three- to five-year timeframe adopted in this report. Three such dependencies are particularly significant for the defense industry of Poland and the region.

The first concerns critical raw materials as defined by the CRMA (34 materials), for which dependence on China remains structural: according to Special Report No. 04/2026 of the European Court of Auditors dated February 2, 2026, China controls 97% of the EU's magnesium imports, 71% of gallium, and 69–79% of specific critical rare earth minerals essential for the production of permanent magnets; and for 4 of the 26 materials assessed (lithium, magnesium, gallium, and rare earth elements), the concentration of supply at the processing stage already exceeds the EU's 65% limit for the share of any single third country, as established in the CRMA for 2030.[24].

The second concerns permanent magnets containing rare earth elements – thus no longer just the raw material, but a ready-to-go component without which no electric motors, control surface actuators, missile guidance systems, radars, or drone propulsion systems can be built and replacing it with another solution usually entails the redesign of the entire subassembly. The European Union imports approximately 16,000–18,000 metric tons of permanent magnets containing rare earth elements annually, of which the vast majority – estimated at 85% to

24 European Court of Auditors, *Critical Raw Materials for the Energy Transition – Not a Rock-Solid Policy*, Special Report 04/2026, Publications Office of the European Union, Luxembourg, February 2, 2026, eca.europa.eu/ECAPublications/SR-2026-04/SR-2026-04_EN.pdf.

98%[25], depending on the methodology – comes from China, while only about 1,000 metric tons are produced within the EU[26].

The third category consists of semiconductors and mass-market optoelectronics, for which – as will be discussed in subsection 5.2.3 – full European sovereignty is difficult to achieve due to the structural weakness of the European chip industry in the face of pressure from China and the United States.

The threat posed by these dependencies is not merely theoretical. On July 24, 2026, the Chinese Ministry of Commerce placed 14 entities from the European Union under export controls for dual-use products – including the German company Rheinmetall, the Polish detector manufacturer VIGO Photonics, Wrocław University of Technology, and the Czech military vehicle manufacturer Tatra Trucks. The list covered the entire military segment of the supply chain: permanent magnets, advanced materials, complex semiconductors, infrared detectors, drones, military vehicles, and weapons integration[27]. These restrictions were introduced even though some of China's earlier export restrictions from October 2025 had been temporarily suspended until November 10, 2026 – which shows that even a temporary easing of China's export policy does not eliminate structural risks[28].

3.2.2 Operational consequences: inventories, substitution, and monitoring of dependencies

Since structural dependencies cannot be eliminated within a three- to five-year timeframe, mitigating and managing risks remains an appropriate response to the situation. The report outlines three specific operational instruments, consistent with the methodology applied in the sovereignty matrix in Chapter 7. The first of them is stockpiling. From an administrative standpoint this is the simplest solution but the most expensive to maintain. The size of stockpiles should be measured not by monetary value, but by time – the number of months – for which any given stockpile would be enough to cover the facility's normal production rate; that is, how long the product could continue to be dispensed from the warehouse if supplies of raw materials or input components were cut off. This measure, unlike monetary value, directly answers the question: how much time does the military have in order to find an alternative supplier or to find a substitute before the stock is depleted? The Days of Supply (DOS) indicator is used[29] for ammunition – it's a fundamental unit of NATO logistics planning – to denote the number of days of operations at a specified intensity which the stockpile can cover. Historically, it was assumed that ammunition had to last for 30 days (Cold War era logistics planning).

25 Estimates of China's share of EU imports of permanent magnets vary depending on the methodology: data limited to direct imports under a single Harmonized System (HS) code indicate 85–88%, while analyses that also account for the re-export of magnets of Chinese origin by other EU countries cite figures closer to 98%. Cf. Seraph, *"Europe has the deposits. China has the industry*, 2026, seraph.com/articles/europe-has-the-deposits-china-has-the-industry/ , compared with European Parliamentary Research Service, EPRS_ATA(2025)779220, 2025.

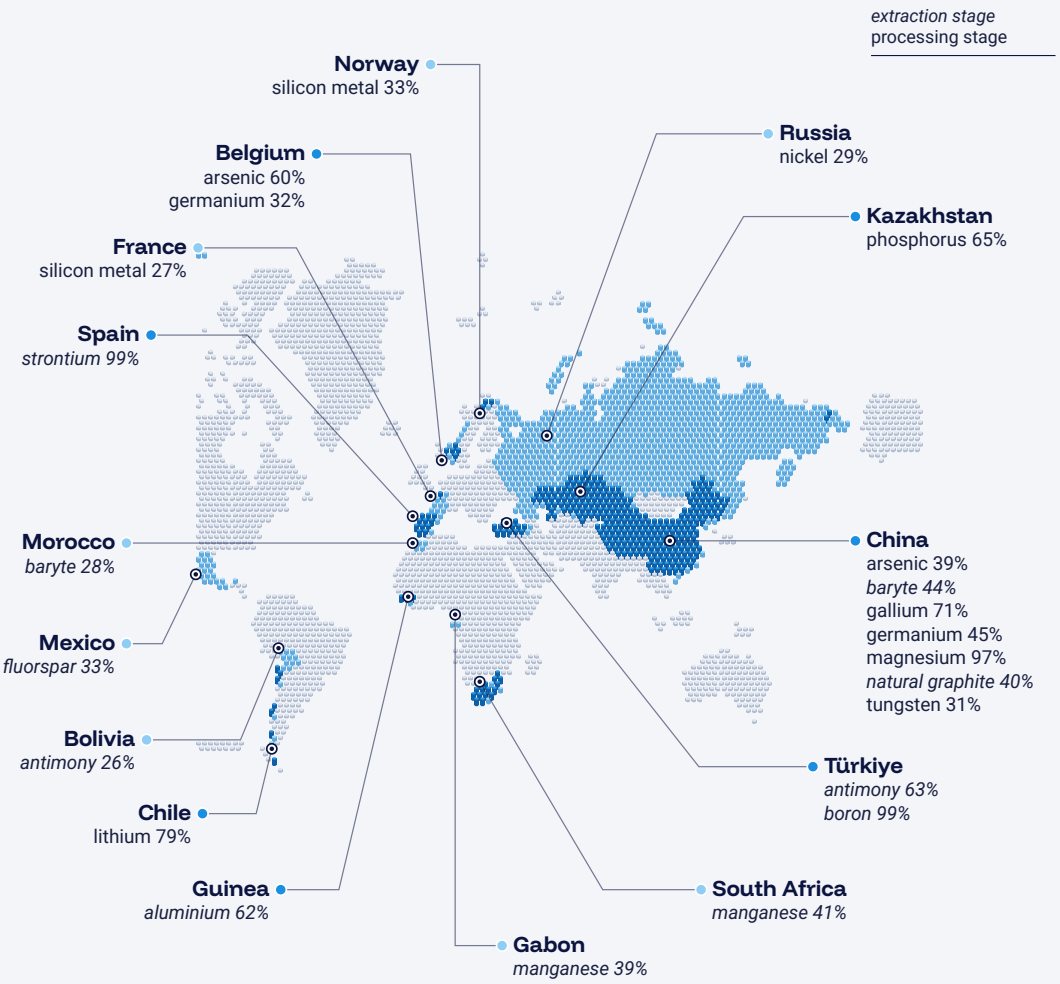
26 V. Rizos, E. Righetti, A. Kassab, *"Developing a supply chain for recycled rare earth permanent magnets in the EU: challenges and opportunities*," CEPS, December 7, 2022, p. 7, circulareconomy.europa.eu/platform/sites/default/files/2023-01/Developing%20a%20supply%20chain%20for%20recycled%20rare%20earth%20permanent%20magnets%20in%20the%20EU.pdf .

27 *China adds 14 EU entities to export control list over Russia-related sanctions*, Reuters, July 24, 2026, reuters.com/business/aerospace-defense/china-adds-14-eu-entities-export-control-list-over-russia-related-sanctions-2026-07-24/.

28 *China Formalizes Suspension of Rare Earth Restrictions After Trade Truce*, Bloomberg, November 7, 2025, bloomberg.com/news/articles/2025-11-07/china-formalizes-rare-earth-curbs-suspension-after-trade-truce.

29 *The Sustainability Statement includes the Days of Supply (DOS) to be maintained in theater*, in: *NATO Logistics Handbook*, NATO, 2012, nato.int/nato_static_fl2014/assets/pdf/pdf_2016_03/20160303_2012-logistics_hndbk-en.pdf.

FIGURE 1 **Main suppliers of selected critical raw materials to the EU**



Note: the figure shows the main EU suppliers for 18 out of 26 critical raw materials that are important for the energy transition, for which more than 25% of EU supply (2016–2020) is concentrated in one country. Italics indicate the extraction stage, roman type the processing stage.
Source: European Court of Auditors, based on European Commission information; *Critical Raw Materials for the Energy Transition – Not a Rock-Solid Policy*, European Court of Auditors, Special Report 04/2026, Publications Office of the European Union, Luxembourg, February 2, 2026, eca.europa.eu/ECAPublications/SR-2026-04/SR-2026-04_EN.pdf; © 2025 Mapbox © OpenStreetMap.

However, as Gen. Alexus Grynkewich explicitly stated in July 2026, the experience of modern conflicts requires extending this period, because a 30-day stockpile, previously considered sufficient, no longer ensures combat readiness and the ability to replenish losses[30].

The second instrument is adequate substitution, that is, the maintenance of at least two qualified sources for procuring any given component, with at least one of them coming from an allied or partner nation – a principle repeatedly emphasized in the case studies in Chapter 5, including with regard to batteries and electric drives in unmanned systems (Subsection 5.2.3) as well as land vehicle powertrains (Subsection 5.3.2).

30 *Grynkewich on NATO's defense industry: we need more than just capacity building*, PAP, July 7, 2026, pap.pl/aktualnosci/grynkewich-o-przemysle-zbrojnym-nato-potrzebujemy-nie-tylko-budowania-zdolnosci.

The third instrument is dependency monitoring – that is, regularly checking, for each element of the value chain, whether a safeguard exists in case the primary supplier fails: a second qualified supplier, inventory, or the right to perform repairs independently. This is exactly the same logic that is referred to in Chapter 7 as the distinction between a secured gap (when such a safeguard exists) and an unsecured gap (when it does not). However, this tool has a clear limitation: for the three elements analyzed in Chapter 7, it is impossible to answer the question of whether any safeguard exists for any of them, because the necessary data is not publicly available.

3.2.3 Allied commitments regarding logistics and industrial policy

The five-tier structure for capabilities organization does not operate in isolation from the commitments that Poland and the countries of the region have already undertaken within NATO and the European Union. As previously mentioned, the updated Defense Production Action Plan commits allied nations to take steps to strengthen sovereignty in the area of production capabilities – the national and subregional levels cannot be planned in isolation from this commitment but should be consistent with it, so that national decisions on stockpiles and substitution reinforce, rather than duplicate, alliance mechanisms[31]. Friendshoring, understood as a strategy for building supply chains among trusted allies rather than going for the lowest bidder, is a principle that – as demonstrated by the WB Group's relationships with Hanwha Aerospace[32] and Hexagon[33] – Poland is already applying.

Similarly at the European level: the implementation schedule for Strategic Projects under the CRMA (60 projects selected in the first round in 2025, with the second round closing in January 2026 and over 160 new applications) creates a framework within which Polish investments – such as those into the magnet recycling capacity – should be positioned as part of the EU mechanism rather than solely as part of national industrial policy[34]. The tension that the report notes but does not resolve at this point concerns the pace: the timelines for the CRMA (2030 targets) and EDIP (a budget of 1.5 billion euros by the end of 2027) are not fully synchronized with the more urgent three- to five-year horizon adopted in this report[35].

3.3 Instruments of sovereignty: stockpiles, licenses, crisis clauses, co-production, and technology transfer

Subsections 3.1 and 3.2 addressed the question: who should control the production of specific components – the state, the region, the European Union, NATO, or a trusted global partner? This subsection answers another question: how can this control be ensured in practice – what instruments can be used to achieve it? Below five such tools are described: stockpiles, licenses, crisis clauses, co-production, and technology transfer.

31 NATO, *Updated Defense Production Action Plan*.

32 *The Establishment of Hanwha WB Advanced System*, WB GROUP, September 2, 2025, wbgroup.pl/en/aktualnosci/the-establishment-of-hanwha-wb-advanced-system/.

33 *WB GROUP and Hexagon Sign Memorandum of Cooperation*, WB GROUP, May 27, 2026, wbgroup.pl/en/aktualnosci/wb-group-and-hexagon-sign-memorandum-of-cooperation/.

34 European Commission, cited in: *Critical Raw Materials Act: Strategic projects gain momentum in second funding call*, January 19, 2026, ieu-monitoring.com/editorial/critical-raw-materials-act-strategic-projects-gain-momentum-in-second-funding-call/874564 .

35 *European Commission Unveils Work Program and Funding Breakdown for the EDIP Program for 2026 and 2027*, Agence Europe, March 30, 2026, agenceurope.eu/en/bulletin/article/13839/13/european-commission-unveils-work-programme-and-breakdown-of-funding-for-edip-programme-for-2026-and-2027 .

As noted above, stockpiles should be estimated in “days of supply” rather than in monetary terms. The analysis conducted in subsection 5.1.1 illustrates the scale of the problem in the Polish context: the estimated current stockpile of 155 mm ammunition in Poland remains significantly below 200,000 rounds, while the Polish Armed Forces plan to build a stockpile of at least one million rounds – which means a gap to be closed amounts to at least 800,000 rounds[36] [37]. Stockpiles are an appropriate tool primarily for mass-produced, rapidly consumed products with a relatively short shelf life. Their weakness is that they do not build lasting production capacity: stockpiles used in a conflict must be replenished, and their replenishment depends on the same limited production chain that previously – as the example of 155 mm ammunition shows – was unable to deliver sufficient amounts. In other words: stockpiles buy time, but they do not solve the problem of limited production capacity, which is the main reason for the need to build up stockpiles.

Licenses are the appropriate instrument where full acquisition of intellectual property is impossible or uneconomical, but the long-term nature of production and service rights yields a result similar to sovereignty without its formal attribute. The reference point here is the Rosomak–Patria model, described in subsection 5.3.3. More than 20 years of cooperation have reduced the risk that the Polish manufacturer would serve as a mere “assembly plant” waiting for approvals and parts from abroad, even though formal ownership of the vehicle’s architecture remains with the licensor. A similar model of gradual “Polonization” is evident in the Legwan program – appendixes signed in 2025 between Rosomak and KIA extended production rights and provided for the gradual transfer of component production to Poland[38]. The methodological conclusion drawn from these cases, as formulated in subsection 5.3.3, is that the most effective way to build sovereignty in the field of military vehicles is to run it in stages. A licensing agreement should, from the outset, specify measurable milestones regarding the transfer of specific capabilities: component production, system integration, design modifications, repairs and overhauls, and management of technical documentation. Such criteria are more reliable than a general and vague percentage of “Polonization” that is difficult to verify.

Crisis clauses are an instrument that complements any licensing or co-production agreement, and their purpose is to ensure access, priority in supply, and the ability to increase production volume in situations where the standard mode of cooperation with a foreign partner is disrupted. The Ukrainian experience, described in subsection 4.1, provides a concrete model here: the licensed production of FPV systems at a state-owned enterprise based on a private manufacturer’s technology demonstrates that the state does not need to acquire intellectual property rights if it has secured, in advance, agreed-upon rights to launch an additional production line at a second contractor’s facility for times of crisis. The Rosomak–Patria agreement of December 2025 contains analogous provisions for emergency situations in the supply chain, which makes it – in addition to its licensing aspect – an example of an implemented crisis clause. It is worth noting that

36 *The WB Group will produce 155 mm ammunition. Successful tests*, Rzeczpospolita, December 11, 2025, radar.rp.pl/modernizacja-sil-zbrojnych/art43488651-grupa-wb-bedzie-produkowac-amunicje-155-mm-sukces-testow .

37 Estimates of the target level of wartime stockpiles vary depending on the source: while the Ministry of National Defense and industry representatives (WB Group) cite “at least one million rounds” as the minimum, industry sources regarding new production investments (Niewiadów Group) indicate a need for a wartime stockpile in the range of 1–3 million rounds, suggesting that the actual shortfall may be greater than the 800,000 rounds assumed in this report. See: *Launch of 155 mm artillery ammunition production in Niewiadów*, WP Tech, May 13, 2026, tech.wp.pl/uruchomienie-produkcji-amunicji-artyleryjskiej-155-mm-w-niewiadowie-jeszcze-w-tym-roku-zaklad-bedzie-dostarczac-180-tys-sztuk-rocznie,7285385981085728a .

38 Signing of annexes to the contract with KIA for the delivery of Legwan 4x4 vehicles, Rosomak S.A., August 27, 2025, rosomaksa.pl/aktualnosci/podpisanie-aneksow-do-umowy-z-kia-na-dostawe-pojazdow-legwan-4x4.

a crisis clause is only valuable when it is clear exactly what it covers: priority access to finished, complete assemblies or to individual components needed for their production in Poland. Therefore, the recommendation from Chapter 8 – to distinguish final assembly from the actual production of subassemblies in contracts for large land-based platforms and to report them separately – is, in practice, a quality test for such clauses: without this distinction, it is impossible to verify whether the crisis guarantee actually covers the level where the real risk is located, or whether it is merely a provision on paper, useless in the event of being cut off from a foreign supplier.

Co-production is an appropriate instrument at the subregional and allied levels, when the scale of demand from a single country does not justify building a production line, but the total regional demand does justify that scale. The Homar-K system – version of the Korean K239 Chunmoo rocket launchers adapted to Poland's needs – is an example of such co-production on two levels: the integration and assembly of the launchers onto a Polish Jelcz 8x8 chassis with the Topaz fire control system (WB Electronics) take place at Huta Stalowa Wola, while production of the CGR-080 rocket ammunition itself is set to begin at a new factory in Gorzów Wielkopolski, currently under construction by a joint venture between WB Electronics and the Korean company Hanwha Aerospace[39]. This model requires coordination between the Ministry of National Defense, Huta Stalowa Wola, WB Electronics, and the Korean technology partner. Its effectiveness – as demonstrated by the example of the co-production of 155 mm ammunition in subsection 5.1.2 – depends on whether the declared domestic content is verifiable in practice, rather than merely written into the framework agreement.

Technology transfer is an instrument that encompasses the transfer of technical documentation, patents, training, and manufacturing *know-how* – not a mere right to assemble or manufacture under license. Its value is greatest when it accompanies the procurement of foreign armaments and allows for long-term strengthening of the domestic industry, rather than just a one-off contract closure. An example in this category, described in subsection 5.1.2, is the project to localize the CGR-080 missiles in line with the September 2025 agreement between the WB Group and Hanwha Aerospace. This marks the first instance of transferring such advanced long-range guided missile technology to the domestic industry, with a factory under construction in Gorzów Wielkopolski since July 2026.



There exists no single, universal instrument – choosing the right one depends on the answers to two questions already formulated in subsections 3.1 and 3.2: what level should a given capability be organized at? and how long would it take to restore it if supplies were disrupted? If something could be restored quickly, in less than six months – stockpiling would be the appropriate safeguard. If restoration takes between six months and two years, and there are several allied suppliers on the market, the appropriate solution would be to have a second, alternative supplier and crisis clauses in the contract. However, if – as in the case of nitrocellulose or propulsion systems described in Chapter 7– restoration would take more than two years and require the construction of an entirely new industrial capacity – the solution should be joint production coupled with technology

39 *More Homar drones in Poland*, Defence24, November 18, 2025, defence24.pl/przemysl/kolejne-homary-w-polsce.

transfer implemented in phases, with specific interim deadlines, rather than covered by a single investment decision spanning many years without appropriate updates. In other words, the choice of instrument should depend on how long it will take to rebuild a given capacity – not on how much money happens to be available in the budget for a given year.

> **[…] the aim is not to eliminate dependencies completely, but to manage them effectively.**

CHAPTER 4

04

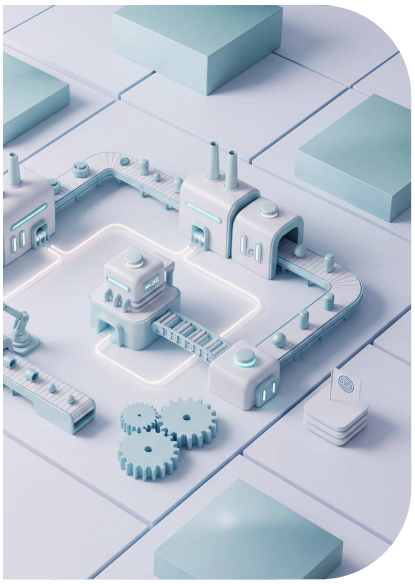
Lessons from Ukraine

The Russian invasion of Ukraine is a particularly valuable case study in war logistics. While it is impossible to transfer that war economy model to a NATO country in peacetime directly, the conflict has revealed the difference between formal possession of capabilities and ability to sustain them over years of intense operations. In a protracted war, the advantage lies not with the possession of a single product with the best parameters, but with a system capable of continuously replacing losses, repairing and modifying products, and scaling up production. These conclusions align with an analysis by the Eastern Flank Institute (IWF), which indicates that in drone warfare, the pace of innovation has become a strategic asset, comparable to the number of brigades or ammunition production[40].

This fact presents Poland and the countries on the Eastern Flank with a significant logistical dilemma. It is no longer enough to ensure domestic production of a specific weapons system. It is necessary to analyze whether, in a crisis, it can still be manufactured, repaired, and modified without access to a single specific foreign supplier, and whether – and if so, what – alternatives exist for key components. Questions also arise regarding documentation and licensing rights that enable rapid reconfiguration, as well as the industry's access to personnel, energy, tools, and testing infrastructure under crisis conditions. Another important aspect is the ability to rapidly absorb information from the battlefield and translate it into new technical specifications and production runs. In this sense, Ukraine serves above all as a test of resilience for the entire value chain, reminding us of its fundamental role – a lesson European nations last learned on such a scale during World War II.

40 *Drone War – Status as of the End of 2025. Compendium by the Eastern Flank Institute*, specifically pp. 4–5 and the section on the Russian-Ukrainian war.

4.1 Decentralized and adaptable production



The first lesson concerns scaling up production and combining it with its decentralization. During the war, Ukraine has built an industry whose capacity significantly exceeded what could be financed solely from its own budget. In 2025, the value of the Ukrainian defense sector's potential production was estimated by the country's Ministry of Defense at $35 billion, while foreign financing for production in Ukraine reached $6.1 billion, including approximately $1.8 billion under the so-called "Danish model" and over $4.3 billion through direct purchases by partners from Ukrainian manufacturers[41]. Another significant factor is the local capacity to maintain foreign equipment acquired through donations – it is difficult to make an estimate in absolute terms; however, discussions with Ukrainian officials indicate that at least some simple components are manufactured locally due to lack of easy access to original parts and replacements. The significance of this model goes beyond the mere transfer of funds. The partner finances production where the necessary expertise exists and where the product can be validated most quickly by the user, while the combatant state retains its technological base, jobs, and the ability to further adapt the equipment. From the perspective of the Eastern Flank, this is an argument for treating the co-production and financing of selected products or components at an ally's facility as an instrument of subregional sovereignty.

If Poland cannot control the entire value chain, it should at least have the ability to launch production in an allied or partner country under an agreement that guarantees access during a crisis, priority in deliveries, and the ability to increase production volume.

The second factor is the number of entities and the potential for new manufacturers to enter the market. According to data from the Ukrainian Ministry of Defense, the number of specialized defense companies has risen from fewer than ten in 2022 to approximately 1,500 in 2026. Nearly one-third of them focus on unmanned systems. Drone production has risen from several thousand in 2022 to approximately 4 million in 2025, with plans to exceed 7 million in 2026.[42].

It does not follow, however, that during peacetime a country should be directly replicating the Ukrainian model of hundreds of improvised workshops. Rather, another principle applies: the resilience of a logistics system increases when the industry does not pend on single points of failure, such as a production facility or service provider. For fast-moving consumer goods, it is therefore desirable to maintain several qualified sources, divide production into modules that can be relocated, standardize interfaces, and prepare alternative production lines in dual-use enterprises. In the case of heavy and more complex platforms, the room for maneuver decreases, but a similar effect can be achieved by distributing repairs, parts production, and refurbishment capabilities across several centers.

41 *The Ministry of Defense Secured Over $6 Billion for Ukraine's Defense Industry in 2025*, Ministry of Defense of Ukraine, 2026, https://mod.gov.ua/en/news/the-ministry-of-defence-secured-over-6-billion-for-ukraine-s-defense-industry-in-2025.

42 *Combat experience and technological adaptability: Ukraine's contribution to shaping new defense standards*, Ministry of Defense of Ukraine, 2026, https://mod.gov.ua/en/news/combat-experience-and-technological-adaptability-ukraine-s-contribution-to-shaping-new-defense-standards.

Licensing and mobilizing existing capacity are also important. In Ukraine, there have been instances, among others, that a licensed FPV production based on technology from a private manufacturer[43] was launched at a state-owned enterprise. There have also been cases where the opposite occurred. Such a mechanism is also of interest to Poland: the state does not need to take over intellectual property if it has pre-agreed emergency rights to launch an additional production line with another contractor. NATO allies, taking advantage of their non involvement in a regular armed conflict, can use their time and resources to establish transparent rules for the mechanism described.

4.2 Feedback loops with the battlefield

The second lesson concerns the organization of communication between the military at the tactical level and the defense industry. In Ukraine, technological innovations emerge within an exceptionally short cycle: the user reports a problem, the manufacturer modifies the solution, the product is retested in a real combat environment, and information about its effectiveness is fed back to the manufacturer and the Ministry of Defense. In the case of unmanned systems or electronic warfare, this cycle is often measured in weeks rather than years. In 2025, the Ukrainian Ministry of Defense approved for use over 1,300 new models of weapons and equipment, including more than 550 unmanned systems[44].

Some of these are offered to individual units through a special marketplace platform, which relieves the burden on the Ministry of Defense's regular procurement system by delegating decision-making to tactical-level commanders. Digital procurement tools have become part of this innovation cycle. Data from combat systems influences product ratings and order volumes. In the first five months of 2026, 485,000 drones and other pieces of equipment were delivered through the platform, and the average time from order to delivery of an available product was nine days[45].

As mentioned, in peacetime, it is neither possible nor advisable to replicate all the simplifications adopted in wartime. However, it is possible to create a safe equivalent: permanent experimental units, annual or quarterly comparative testing series, multi-year framework agreements with a share of volume reserved for subsequent product versions, digital defect reporting, and a formal procedure for rapid updates to software, sensors, communications, and effectors. Particularly in drones, WRE, C-UAS, and software, freezing configuration for several years is the functional equivalent of losing capability.

It is also important for the defense industry to shift its certification philosophy, which in most NATO countries was developed during peacetime and has become overburdened with bureaucratic requirements. The goal should be to certify the general principles of how a product or service functions, rather than every single modification. Otherwise, the testing system becomes a bottleneck that slows down operations. The lesson from Ukraine is not about an absolute "lack of standards," but rather about shifting focus from one-time product qualification to continuous validation, with a greater role for the end user.

43 *The Ministry of Defense has launched its own production of FPV drones*, Ministry of Defense of Ukraine, 2025, https://mod.gov.ua/en/news/the-ministry-of-defence-has-launched-its-own-production-of-fpv-drones.

44 *In 2025, the Ministry of Defense authorized over 1,300 new models of weapons and military equipment for operational use*, Ministry of Defense of Ukraine, 2026, https://mod.gov.ua/en/news/in-2025-ministry-of-defence-authorized-over-1-300-new-weapons-and-military-equipment-models-for-operational-use.

45 *95% of the drones procured for the Defense Forces are Ukrainian-made*, Ministry of Defense of Ukraine, 2026, https://mod.gov.ua/en/news/95-of-drones-procured-for-the-defence-forces-are-ukrainian-made.

4.3 Hidden bottlenecks: energy, components, drivetrains

The war in Ukraine has also shown that the value chain extends far beyond the assembly hall's walls. Production can be halted by a number of factors: lack of power supply, lack of a single driver, wheel bearing, optoelectronic circuit, explosive, battery, or lack of access to code and cryptographic keys. In heavy-duty systems, drive units, gearboxes, and specialized power units serve a similar function. High level *of local content* – measured as the value and degree of local production – can therefore potentially mask dependance on a single, low-value component whose absence means the final product cannot be manufactured.



For this reason, a sovereignty map should identify not only a component's origin but also the timeframe for its replacement, as well as indicate potential alternative suppliers. An imported component for which there are several suppliers from allied nations and a qualified substitute should be treated differently from a system supplied exclusively by a single manufacturer, without the right to repair and without a stockpile for a mobilization period. Energy constitutes a separate category. The dispersion of facilities does not increase resilience if they all depend on the same vulnerable power grid, communications infrastructure, or supply of raw materials. Selected defense facilities therefore require stand-alone solutions, backup power sources, fuel reserves, and priority in restoration of supplies. In practice, this is part of industrial and energy policy that requires active cooperation between the Department of Defense and other ministries. The issue is not limited solely to the defense of critical infrastructure facilities but requires their active participation, for example, in the design and expansion of power grids.

CHAPTER 5

05

Areas – case studies

5.1 Ammunition and high-energy materials

The following section begins with a discussion of overall demand, proceeds to an analysis of current and planned production capabilities for complete munitions, and concludes with a detailed assessment of the individual components of this process. This structure allows us first to determine the scale of the problem and then to identify the parts of the chain where Poland has real agency, and where Poland remains dependent on foreign partners or its own plans that are still to be implemented.

At the outset it may be worth explaining why so much attention is being paid to the 155 mm caliber, given that high-energy propellants are a bottleneck for mortar, tank, grenade launcher, small-arms, and aerial bomb ammunition as well. The 155 mm caliber is the NATO standard for barrel artillery, and many EU and NATO support programs (EDIRPA, ASAP, the Czech supply initiative for Ukraine) have been built around it; consequently, data available for 155 mm is the most comprehensive, and many regard it as a flagship indicator of success. Also other calibers rely on the same supply chain, but less frequently raised separately in the public debate. This has analytical implications: some of the figures advertised as "155 mm" actually also include 120 mm, which boosts the perceived progress in the flagship caliber, as demonstrated later in this subsection. 155 mm ammunition is the product of several distinct industrial sectors: chemistry, the propellant industry, metallurgy/forging, reloading, and fuse electronics. Analysis of this segment is systematically distorted in the Polish public debate by the fact that press releases, letters of intent, and "target" timelines are often cited as if they described the current state of affairs. In each point analyzed below, we strive to make a precise distinction between what has already been achieved and confirmed by deliveries, and what remains a declaration, letter of intent, target timeline, or agreement without production having yet been launched – because this is a prerequisite for a fair assessment of Poland's performance in this segment.

5.1.1 Needs and capability potential

Poland plans to procure a total of 884 Krab and K9 howitzers. With a unit fire of 40 rounds for the Krab and 48 for the K9, a single deployment of the howitzers alone requires over 35,000 rounds (though this figure does not include the ammunition carried by ammunition vehicles). A battlefield reference point: during the most intense phases of the war, Ukraine consumed up to 14,000 rounds per day (though PGZ Vice President Arkadiusz Bąk disputes these figures as overstated), and currently, after drones have taken over some of the strike missions, consumption has dropped to 2,000–4,000 per day. Even the lower limit of this range, extrapolated to a year, far exceeds Poland's production capacity. The historical reference point is equally telling: between 2016 and 2022, the Polish industry supplied a total of approximately 48,000 155-mm rounds[46].

Estimates of the Polish Army's 155-mm ammunition needs should be interpreted through the lens of the NATO standard, which is functional rather than quantitative: The Alliance does not specify the required stockpile in units, but rather in the aforementioned "Days of Supply" – that is, the number of days of operations at a specific intensity for which a country is expected to maintain a stockpile. If one considers the consumption rates observed in Ukraine, the stockpiles of some countries would be depleted in a matter of days, and replenishing them would take years. Polish estimates are a national transposition of this functional standard onto the size of its own artillery fleet and therefore take the form of two thresholds that must be distinguished from one another. The minimum threshold, referred to as the "essential minimum" of stockpiles, is estimated by military experts at at least one million units[47]. The higher threshold reaches as many as three million

46 Ł. Michalik, *"Polish Ammunition Production: The Problem with Gunpowder and Polish TNT for NATO,"* WP Tech, July 28, 2026, https://tech.wp.pl/polska-produkcja-amunicji-problem-z-prochem-i-polski-trotyl-dla-nato,7312338708732256a.

47 *"Poland Without Weapons." The Essential Minimum Ammunition Stockpiles Are Lacking*, WNP, June 17, 2024, https://www.wnp.pl/bezpieczenstwo/polska-bez-broni-brakuje-niezbednego-minimum-zapasow-amunicji,845973.html.

units[48]. This range is not the result of methodological discrepancies but of different assumptions regarding the intensity and duration of a hypothetical conflict, as the required volume is a function of the number of gun barrels. Compared to current stockpiles (estimated at just under 200,000), this indicates a gap of at least 800,000 units, and at the higher threshold – nearly 3 million.

It should also be noted that the same raw materials supply chain supports a much broader range of products than just artillery ammunition. According to Coherent Market Insights, the 155 mm segment is expected to dominate the artillery shell market in 2026, reaching a 63% value share. The 155 mm caliber therefore dominates the TNT demand due to the weight of the charge and the scale of orders, but other categories – which together account for about one-third of total demand – face the same raw material bottlenecks. This is worth keeping in mind for any analysis of "ammunition sovereignty" focused on a single caliber[49].

5.1.2 Production capacity – current status and forecasts

- **PGZ**

The PGZ-Amunicja consortium (established on April 28, 2023; comprising Mesko, Dezamet, Nitro-Chem, Gamrat, and Belma) is currently the only entity actually supplying the Polish Army with complete sets of 155 mm ammunition (projectile, fuse, propellant charge set, and primer combined). The volumes were as follows: in 2023 – 10,000 units; in 2024 – 18,000 units; in 2025 – approx. 20,000 units [50].

The model presented by PGZ in July 2025 and intended for implementation assumes organizing production across two so-called "factories," with each of them being not a single plant but rather a network of cooperating facilities where individual companies in the ammunition sector complement one another to produce the final product in the form of complete 155 mm caliber ammunition. The institutional framework of this arrangement consists of MESKO, Zakłady Chemiczne "Nitro-Chem," Zakłady Metalowe "Dezamet," Zakład Produkcji Specjalnej "Gamrat," and Bydgoskie Zakłady Elektromechaniczne "Belma," organized into two groups:

- The first group (conventionally referred to as "Ammunition Factory No. 1") carries out the production of projectiles using current technology with existing partners, with the aim to significantly increase production capacity – to approximately 100,000 units per year – and gradually boost the domestic content in the supply chain; it consists of: the Mesko plant in Kraśnik (projectile bodies), Nitro-Chem in Bydgoszcz, Gamrat in Jasło, and Dezamet in Nowa Dęba.

- The second group ("Ammunition Factory No. 2") is to manufacture next-generation projectiles based on acquired foreign technologies – intended for the Krab and K9 self-propelled howitzers – with an initial capacity of approximately 80,000 units per year; its core is the new Dezamet plant, supported by Nitro-Chem, Gamrat, and existing capacity in Nowa Dęba; its technological foundation is cooperation with the British

48 *"We do not manufacture ammunition in Poland; we assemble it from imported components,"* Radio Kielce, January 22, 2024, https://radiokielce.pl/1148724/nie-produkujemy-w-polsce-amunicji/.

49 Artillery Shells Market Size and Forecast – 2026–2033, Coherent Market Insights, March 30, 2026, https://www.coherentmarketinsights.com/industry-reports/artillery-shells-market.

50 T. Kwasek, *Polish Defense Group Presents National Ammunition Plan*, Military Portal, July 9, 2025, https://portalmilitarny.pl/analizy-i-komentarze/polska-grupa-zbrojeniowa-zaprezentowala-narodowy-plan-amunicyjny/.

DIAGRAM **Organization of 155 mm ammunition production at PGZ**



company BAE Systems[51], formalized, among other things, by a framework agreement dated September 12, 2025.

The expansion of production capacity is supported by funding from the Capital Investment Fund granted in July 2025: Dezamet – 1.358 billion PLN, Mesko – 887.2 million PLN, Nitro-Chem – 113.3 million PLN, Gamrat – 66.17 million PLN – for a total of approximately 2.42 billion PLN. The minister in charge of state assets at the time declared a target of 150,000–180,000 large-caliber projectiles per year. It is important to take note of a methodological caveat that is easy to overlook: the often-cited "PGZ program target of 150 –180,000 units per year" comes from the agreement of July 2, 2025, and refers to total large-caliber production (155 mm + 120 mm), not the 155 mm caliber alone. According to the agreement, the plan assumes 20,000 units in 2025, 50,000 in 2026, and 80,000 in 2027, while the final figure in the range of 150,000–180,000 depends on the ratio between 155 mm and 120 mm – with the potential to produce up to 70,000 units per year of mortar ammunition alone and 120-mm tank rounds[52]. In other words, the actual volume of 155-mm ammunition specifically could be significantly lower than the headline figure of 150,000–180,000 suggests if a significant portion of production capacity is shifted to 120 mm.

This capacity expansion is primarily driven by two major contracts with the Ministry of National Defense. On December 22, 2023, the Armaments Agency signed

51 A separate matter is Dezamet's acquisition of a license and certification for RO32 and RO40 projectile technology from BAE Systems. This constitutes a separate line of cooperation with the company, in addition to the technology transfer agreement from October 2025 and the letter of intent between Nitro-Chem and BAE Systems regarding explosives in the United Kingdom. These are three distinct agreements with the same partner, concerning different subjects and different PGZ subsidiaries.

52 M. Niechciał, *"Over Two Billion Zlotys for the Production of 155 mm and 120 mm Ammunition,"* ZBiAM, July 3, 2025, https://zbiam.pl/ponad-dwa-miliardy-zlotych-na-produkcje-amunicji-155-mm-i-120-mm/

an implementation agreement with PGZ-Amunicja for 281,000 units of 155 mm ammunition worth 10,659 million PLN, with deliveries scheduled for 2024–2029[53]. On May 30, 2026, another contract – under the SAFE instrument – was signed in Nowa Dęba for several hundred thousand sets worth over 13.5 billion PLN net, with a settlement deadline by the end of 2030.[54].

However, these figures should be viewed with some caution regarding the timeline and the extent to which production is being localized. A journalistic investigation revealed that when confronted with questions on the actual increase in production capacity, the actual volume of ammunition produced, and any contractual penalties for delays, PGZ stated that this information is "protected" and cannot be disclosed. According to WP's sources, most of the rounds delivered to the Polish Army by PGZ to date were in fact manufactured at plants in Slovakia, controlled by the Czech Czechoslovak Group (CSG), rather than in Poland; even the reloading and painting of the units were outsourced to foreign facilities. At the time of that journalistic report, the construction of at least one of the key ammunition projects had not been even launched despite the completion scheduled for 2024. PGZ postponed the completion date to the end of 2026[55]. A few months later (in December 2025), PGZ confirmed another delay in the construction of the 155 mm ammunition factory, explaining that it was necessary to obtain approval from the Ministry of State Assets to collaborate with BAE Systems[56]. The CEO of PGZ himself admitted in an interview in April 2026 that "some of the critical opinions about the group turned out to be accurate"[57].

WB Group / Polska Amunicja

In parallel with the state-run PGZ program, the private WB Group is developing its own independent path into the 155 mm artillery ammunition market through the company Polska Amunicja (owned by WPT Holding, in which WB Electronics holds a 51% stake, with the remaining shares owned by Ponar Wadowice). It should be noted that in April 2026, Polska Amunicja withdrew from the Armaments Agency's procurement process for 155 mm ammunition under the SAFE program, citing a "significant change in legal and business conditions," unacceptable terms for the delivery of Modular Charge Systems, and their expert opinion that WITU (the Polish Military Institute of Armament Technology)'s certification process (which takes at least two years) is incompatible with the SAFE program's deadlines[58]. However, the company is not halting development of its own 155 mm ammunition technology. It operates an active ammunition plant (WB IM – though details on its production capacity are hard to get), where prototype 155 mm shells have already been produced in the following versions: high-explosive fragmentation and high-explosive fragmentation with a gas generator. The project is currently in the testing

53 K. Wilewski, *"Record-breaking ammunition contract,"* Polska Zbrojna, December 22, 2023, https://polska-zbrojna.pl/home/articleshow/40927?t=Rekordowy-kontrakt-amunicyjny.

54 W. Kozioł, *Over 13.5 billion PLN under the SAFE program for hundreds of thousands of 155-mm shells*, Defence24, May 30, 2026, https://defence24.pl/przemysl/ponad-135-mld-zl-w-ramach-safe-na-setki-tysiecy-pociskow-155-mm.

55 S. Ruszkiewicz, *Problems with 155 mm ammunition. What about production? "A bottomless pit,"* Wirtualna Polska, August 9, 2025, https://wiadomosci.wp.pl/problemy-z-amunicja-155-mm-co-z-produkcja-studnia-bez-dna-7186695073504000a.

56 P. Myszor, *"Jelcz Is Climbing Out of the Slump and Announces a Sharp Increase in Military Vehicle Production,"* WNP, December 4, 2025, https://www.wnp.pl/przemysl/jelcz-wychodzi-z-dolka-i-zapowiada-skokowy-wzrost-produkcji-samochodow-dla-wojska,1010817.html.

57 R. Szulc, M. Kordek, *PGZ Wants to Invest, Needs One Billion Zlotys. Polish 155 mm Ammunition Is a Priority*, Stefa Obrony, April 17, 2026, https://strefaobrony.pl/pgz-chce-zainwestowac-potrzebuje-miliarda-zlotych-polska-amunicja-155-mm-to-priorytet/ar/c15p2-28911099.

58 B. Wypartowicz, *Polska Amunicja Withdraws from Talks on Participation in SAFE. We Know the Reasons*, Defence24, April 10, 2026, https://defence24.pl/przemysl/polska-amunicja-rezygnuje-z-rozmow-o-udziale-w-safe-znamy-powody.

phase, conducted on combat systems rather than in lab conditions: according to company representatives, foreign test firings at a short range of 17 km yielded satisfactory results. A distinctive feature of this model is its supply chain structure, which remains partially dependent on partners: the shells are to be manufactured by external entities, the fuses are to come from an external supplier, and the propellant charges from two European manufacturers. The reloading is, however, to be carried out domestically, and a domestically developed gas generator has already been tested in the laboratory. The schedule calls for the production of 1,500 projectiles for testing and certification, followed by a first batch of 5,000–10,000 units still in 2026, and in 2027 serial production is to be launched, with volume increasing over time and a target ranging from 50,000 to as many as nearly 100,000 units per year. The primary recipients are to be the Polish Armed Forces and at least one foreign customer, with whom, as the company has stated, an agreement has already been reached[59].

- **Niewiadów-PGM**

The third domestic pathway to 155 mm ammunition production – alongside PGZ and the WB Group – is a project by the Niewiadów S.A. Group (part of Niewiadów Polska Grupa Militarna S.A.) and the Fidera investment fund. The declared target capacity is up to 180,000 sets of 155 mm ammunition per year. The 155 mm project is part of the company's broader portfolio, which also includes a factory producing medium-caliber (40 mm) ammunition under license from Singapore (approx. 70 million PLN, with a target output of 480,000 units per year). The company also has its own testing and ballistics facilities, including a firing range with a 155-mm caliber ballistics test stand. At the heart of the project is the construction of a 155-mm ammunition manufacturing plant in Niewiadów, as part of an investment program worth over 250 million PLN. Their company – Elaboracja Niewiadów – is currently accepting the delivery of modern production lines for the screw extrusion filling of ammunition. Niewiadów itself is building its own model of industrial cooperation around this plant, known as the Niewiadów Ammunition Ring – a supply chain comprising partners from Poland and other European countries, designed to ensure the stability of production capacity and the security of component supplies. On February 10, 2026, a framework agreement was signed with Northrop Grumman Polska to produce over 180,000 units of ammunition annually in Poland[60]. The project was expanded to include cooperation with KNDS: the first agreement was concluded in March 2026, and on June 18, 2026, at Eurosatory, a strategic agreement was signed with KNDS Ammo France for the production of complete 155-mm caliber ammunition sets[61]. The project, known as the Niewiadów Ammunition Ring, brings together numerous partners – this extensive network of agreements, like all announcements of serial production in this segment, requires confirmation through actual deliveries after the end of 2026.

59 M. Szopa, *WB Enters the Artillery Ammunition Market*, Defence24, December 11, 2025, https://defence24.pl/przemysl/wb-bedzie-produkowac-amunicje-artyleryjska.

60 T. Wachowski, *Northrop Grumman and Elaboracja Niewiadów Strengthen Artillery Ammunition Production and Commercialization Capabilities in Europe*, ZBiAM, February 11, 2026, https://zbiam.pl/northrop-grumman-oraz-elaboracja-niewiadow-wzmacniaja-zdolnosci-produkcji-i-komercjalizacji-amunicji-artyleryjskiej-w-europie/.

61 M. Wąsiołek-Bartusik, *"Ammunition Production to Begin in Poland. Niewiadów Bets on French Technology,"* Polski Przemysł, 2026, https://polskiprzemysl.com.pl/produkcja-amunicji-w-polsce-umowa-knds/.

Rocket artillery

Aside from the 155 mm barrel-fired ammunition, the second major ammunition program concerns rocket artillery. Polish rocket artillery currently has a diverse arsenal: the domestically produced 122 mm Feniks rocket, manufactured by Mesko for the WR-40 Langusta launcher and ultimately adapted for the Homar-K as well (PGZ is also developing the capabilities of the rocket fuel production plant in Jasło[62]), as well as the CGR-080 rockets (239 mm caliber, range 30–80 km) and the larger CTM-290 (range approx. 290 km) purchased from South Korea for the K239 Chunmoo/Homar-K[63] launchers. The biggest step toward domestic rocket production, however, is the project to localize the CGR-080: on September 5, 2025, the WB Group and Hanwha Aerospace signed a document at the International Defense Industry Fair finalizing preparations for the construction of a factory in Poland to manufacture these missiles. This marks the first instance of such an advanced long-range guided missile technology transfer to the domestic industry. At the end of December 2025, the third implementation agreement for the Homar-K program, worth approximately 14 billion PLN gross, was signed with the consortium leader – the joint venture Hanwha WB Advanced System (WB Electronics + Hanwha Aerospace, with no other entities involved); missile production is scheduled to begin in 2030, with the first deliveries to the Polish Army to take place that same year; production of launch containers is set to begin as early as 2026. The factory is being built on a 116-hectare site in Gorzów Wielkopolski (an investment of approximately 1.7–2 billion PLN); Earthworks began in July 2026, with a planned construction period of approximately 18 months. Thus, alongside the missile body production line in Kraśnik, this is one of the few projects in this segment where the announcement has already progressed to actual construction work[64].

Mines

Anti-tank mines is the most advanced area. It is based on Bydgoskie Zakłady Elektromechaniczne "Belma," a PGZ Group company and the sole domestic manufacturer of drop-deployment systems and MN-123 mines, which are deployed, among other ways, from Baobab-K mine-laying vehicles. The scale of this program has already been confirmed by contracts: following an order in June 2023 for 24 Baobab-K vehicles worth approximately 510 million PLN (with deliveries scheduled for 2026–2028) and a supplementary agreement with Huta Stalowa Wola in December 2025 for the tracked Baobab-G variant, the contract concluded on April 29, 2026, marked a significant milestone in terms of volume. Under this contract, Belma will supply over 70,000 ISM mine cassettes, which – given five mines per cassette – translates into the delivery of over 350,000 MN-123 mines with a total gross value of approximately 3.4 billion PLN[65]. The capacity expansion is supported by over 311 million PLN in funding from the Capital Investment Fund under the Eastern Shield program. The second tier involves the recently launched production of anti-personnel mines, the resumption of which became possible

62 P. Miedziński, *"The Key to Polish Missile Autonomy: Modern Non-Destructive Testing Center Opens in Gamrat,"* Defense Portal, May 25, 2026, https://portalobronny.se.pl/przemysl-zbrojeniowy/klucz-do-polskiej-autonomii-rakietowej-nowoczesne-centrum-badan-nieniszczacych-w-gamracie-otwarte-aa-M453-XjTK-2LYX.html.

63 M. Kutarba, *"Korean Rockets Will Extend the Range of Polish Artillery,"* Rzeczpospolita, September 5, 2025, https://radar.rp.pl/mspo/art42962101-koreanskie-rakiety-zwieksza-zasieg-polskiej-artylerii.

64 S. Biliński, *"Poland Will Produce Its Own Rockets! A Contract Worth Billions,"* Forsal.pl, December 30, 2025, https://forsal.pl/kraj/bezpieczenstwo/aktualnosci/10611070,polska-bedzie-produkowac-wlasne-rakiety-kontrakt-wart-miliardy.html.

65 P. Miedziński, "*A Billion-Worth Contract for Anti-Personnel Mines for the Polish Army. BELMA Wins the Contract*," Defense Portal, April 29, 2026, https://portalobronny.se.pl/polityka-obronna/miliardowy-kontrakt-na-miny-narzutowe-dla-wojska-polskiego-belma-z-kontraktem-aa-dhf4-6opd-tBmZ.html.

after Poland's formal withdrawal from the Ottawa Convention on February 20, 2026, following a six-month notice period initiated by a law passed in mid-2025[66]. There are two entities primarily responsible for production in this segment: Belma, whose CEO has declared readiness to manufacture anti-personnel mines for Poland and the Baltic States, and Zakłady Sprzętu Precyzyjnego Niewiadów, which was the first to make a formal decision to resume production, and in 2026 entered into an agreement with Wifama to jointly offer directional, pressure-activated, and pull-type mines to the Polish Armaments Agency. The third, qualitatively distinct layer consists of "smart" systems involving human in the decision-making loop, the flagship example of which is Jarzębina-S: developed by the Military Institute of Engineering Technology in collaboration with Belma and MindMade, funded by the SAFE program, and already in production; it combines explosive charges and fragmentation grenades with cameras, as well as thermal imaging sensors, seismic sensors, and battlefield radars[67].

- **Regional context**

Compared to the rest of the region, Poland is lagging behind. It is estimated that it is at least a year behind other European ammunition investments[68]. Given Poland's declared timelines, it is significant that some regional investments in 155 mm ammunition production have already moved from the construction phase to the manufacturing phase. The most advanced is Germany's Rheinmetall, whose flagship Werk Niedersachsen plant in Unterlüß – opened on August 27, 2025, after just over a dozen months of construction – began test production as early as the second quarter of 2025. The plan assumes the production starts at approximately 25,000 rounds in 2025, is increased to 140,000 in 2026, and reaches as many as 350,000 annually starting in 2027. Such output is set to make it the largest ammunition factory in Europe[69]. In July 2026, Rheinmetall delivered 155 mm ammunition to Ukraine for the first time directly from its plant in Unterlüß: a batch of several thousand rounds of the latest RH1412 type; the remainder of the order is scheduled to be fulfilled by the end of 2026[70]. At the same time, the company is building or launching production facilities outside Germany: a €300 million factory in Bejsagole, Lithuania, which is scheduled to begin operations in the second half of 2026 and is ultimately expected to produce several tens of thousands of rounds per year[71].

5.1.3 Value chain

- **Chemical precursors**

Grupa Azoty produces concentrated nitric acid and nitroses domestically (in Tarnów and Puławy) of a quality high enough that even Germany's Rheinmetall purchases them for its own nitrocellulose

66 Along with Poland, Finland and the Baltic states also participated; see *"Modern Mine Warfare,"* Eastern Flank Institute, 2026, https://wschodniaflanka.pl/wspolczesna-wojna-minowa-raport-iwf/.

67 M. Moneta, *"Jarzębina and New Antipersonnel Mines,"* Polska Zbrojna, July 1, 2026, https://polska-zbrojna.pl/home/articleshow/46673?t=Jarzebina-i-nowe-miny-przeciwpiechotne.

68 M. Miłosz, *"Are We Heading Toward an Oversupply of 155-mm Ammunition?"*, Rzeczpospolita, November 10, 2026, https://radar.rp.pl/modernizacja-sil-zbrojnych/art43303941-czy-czeka-nas-nadpodaz-amunicji-kalibru-155-mm.

69 *Rheinmetall Opens Europe's Largest Artillery Ammunition Plant in Germany*, Defence Matters, August 27, 2025, https://defencematters.eu/rheinmetall-opens-europes-largest-artillery-ammunition-plant-in-germany/.

70 A. Kiński, *"Rheinmetall Delivers 155-mm Ammunition from the Werk Niedersachsen Plant for the First Time,"* ZBiAM, July 15, 2026, https://zbiam.pl/rheinmetall-po-raz-pierwszy-dostarczyl-amunicje-155-mm-z-zakladow-werk-niedersachsen/.

71 *Construction of the "Rheinmetall" factory officially begins in Bejsagole*, LRT, November 4, 2025, https://www.lrt.lt/pl/wiadomosci/1261/2735052/w-bejsagole-oficjalnie-rozpoczyna-sie-budowa-fabryki-koncernu-rheinmetall.



production[72]. This constitutes a real, functioning raw material base.

High-energy materials

Nitro-Chem in Bydgoszcz is currently the only large operational TNT factory in the European Union and the largest producer of this material in NATO, covering approximately 90% of the U.S. military's TNT needs[73]. This is the only part of the supply chain where Poland has a verified, ongoing commercial advantage – not a project on paper, but a functioning, exporting factory. This is confirmed by yet another – the third – contract with Paramount Enterprises International, dated April 9, 2025, for 18,000 metric tons of TNT for the U.S. Army (2027–2029, approximately $310 million)[74]. Doubling the capacity to 20,000 metric tons per year is, however, a different story: the second facility has only a design contract dating from March 2026, and the CEO of PGZ himself confirmed in an interview in late April 2026 that construction of this line is "still ahead of us" (and has not yet begun)[75].

In August 2026, Nitroerg – a company whose majority shareholder is KGHM Polska Miedź and who operates outside the PGZ structure entirely – signed an agreement with the Katowice Special Economic Zone to support an investment worth approximately 300 million PLN in the construction of a production line for pentrite (PETN) and hexogen (RDX) in Krupski Młyn, with public aid of up to 130 mln zł under the Polish Investment Zone program. These are dual-use materials: primarily used for civilian purposes in KGHM's operations (mining, blasting) and for military purposes (explosives more powerful than TNT, detonator components)[76]. Construction has not yet begun; however, this is the second RDX project in Poland, independent of Nitro-Chem (alongside the earlier Nitro-Chem–PROZAP agreement from November 2025 for FEED documentation of an RDX/HMX facility – which, however, has not yet seen a follow up[77]), which diversifies domestic sources of this material and demonstrates that initiatives in this segment are not limited to PGZ companies.

72 Statement by Adam Leszkiewicz, CEO of Grupa Azoty and PGZ, quoted from: *"Grupa Azoty Wants to Expand, Including in the Defense Sector,"* Farmer.pl, November 7, 2024, https://www.farmer.pl/fakty/polska/grupa-azoty-chce-sie-rozwijac-m-in-w-sektorze-zbrojeniowym,153609.html.

73 Statement by Deputy Minister of Defense Cezary Tomczyk, cited in: B. Ciepielewski, *"Nitro-Chem, a Polish factory in Bydgoszcz that is crucial for NATO, will double its production of TNT,"* TVN24 Biznes, March 16, 2026, https://tvn24.pl/biznes/z-kraju/kluczowa-dla-nato-polska-fabryka-nitro-chem-w-bydgoszczy-podwoi-produkcje-trotylu-st8951140.

74 A. Pawłowska, *More Polish TNT for the U.S.*, Polska Zbrojna, April 9, 2025, https://polska-zbrojna.pl/home/articleshow/43621.

75 R. Lesiecki, *"Nitro-Chem Wants to Double TNT Production. It Is a Key Item in Polish Defense Industry Exports,"* wnp.pl, March 16, 2026, https://www.wnp.pl/bezpieczenstwo/nitro-chem-chce-podwoic-produkcje-trotylu-to-kluczowa-pozycja-w-eksporcie-polskiej-zbrojeniowki,1042721.html; R. Szulc, M. Kordek, *PGZ Wants to Invest, Needs One Billion Zlotys. Polish 155 mm Ammunition Is a Priority*, Strefa Obrony, April 17, 2026, https://strefaobrony.pl/pgz-chce-zainwestowac-potrzebuje-miliarda-zlotych-polska-amunicja-155-mm-to-priorytet/ar/c15p2-28911099; *PGZ After a Year of Changes – CEO Leszkiewicz on Ammunition, Drones, and the Future of the Army*, interview with PGZ CEO Adam Leszkiewicz, https://www.youtube.com/watch?v=b2h1K1pOl8c&t=16s.

76 *New production line for pentrite and hexogen with public support*, Nitroerg, April 27, 2026, https://nitroerg.pl/nowa-linia-produkcji-pentrytu-i-heksogenu-ze-wsparciem-publicznym/.

77 *Nitro-Chem and Prozap signed an agreement for a project to build an explosives production facility*, CIS, November 24, 2025, https://www.wnp.pl/rynki/nitro-chem-i-prozap-podpisaly-umowa-na-projekt-instalacji-do-produkcji-materialow-wybuchowych,1007324.html.

Propellant and Modular Charge Systems (MCS)

Poland does not produce nitrocellulose; it imports it from Germany, France, and the U.S.[78]. The construction of a nitrocellulose plant in Tarnów has not yet progressed beyond the letter of intent signed in November 2024 – no binding investment decision has been made as of today, and the project is further burdened by the financial crisis at Grupa Azoty[79]. Therefore, in August 2025, Mesko signed a strategic agreement with Eurenco for the supply of nitrocellulose[80]. Thanks to the launch of another project and the transfer of technology and documentation from Czechoslovak Group (CSG), in July 2026 Mesko announced that it had produced a trial batch of modern propellant in Poland. The propellant was tested with the Krab self-propelled howitzer and meets NATO standards, demonstrating that – unlike many announcements that remained sheer declarations – this project has already yielded tangible results[81]. The actual production of Poland's own propellant is described by many as a breakthrough[82]. However, an important caveat must be made: imported components are still necessary for the production of this propellant, and full self-reliance may be reached "within the next few years"[83]. Nonetheless, this represents a partial technological success, not elimination of a raw material bottleneck. At the same time, in 2024, Mesko launched the production of a so-called "modified propellant," and the start of multibase propellant production is scheduled for 2026 as part of a separate, internal "Project 44.7," aimed at full self-reliance in propellant production[84].

As for ready-made modular charges, the starting point is the Bi-Modular Charge System assembly line, which (according to the companies' August 2025 announcement) achieved "operational readiness" on July 25, 2025, and has been certified, with a target capacity of up to 100,000 sets per year. It is a joint venture between Eurenco and Mesko in Pionki[85]. However, it is important to be careful with terminology here: according to the same press release, Eurenco supplies the technology and ready-made sets of charge components from France, while Mesko performs local assembly – thus, this is more of an assembly line using imported components than independent Polish propellant production. On October 22, 2025, PGZ and Mesko signed two additional documents with Eurenco: *a term sheet* paving the way for a *joint venture* and a letter of intent regarding the securing of raw material supplies. The declared goal at that time was to produce 100,000 BMCS sets annually in Pionki[86]. On June 15, 2026, during the Eurosatory trade show, Mesko and Eurenco signed a binding shareholders' agreement,

78 W. Kaleta, *A Major Obstacle to Ammunition Production in Poland. We Lack a Crucial Foundation*, WNP, April 24, 2026, https://www.wnp.pl/bezpieczenstwo/duza-przeszkoda-dla-produkcji-amunicji-w-polsce-brakuje-nam-waznego-fundamentu,1044617.html.

79 B. Maziarz, *CEO of Azoty: We are aware of the low wages, but we must fight together for survival*, Radio Kraków, September 29, 2025, https://www.radiokrakow.pl/aktualnosci/tarnow/prezes-azotow-zdajemy-sobie-sprawe-z-niskich-pensji-ale-musimy-razem-walczyc-o-przetrwanie/.

80 A. Świerkowski, *Mesko Signs "Strategic" Contract for Ammunition Production*, Defence24, August 28, 2025, https://defence24.pl/przemysl/mesko-ze-strategiczna-umowa-dla-produkcji-amunicji.

81 B. Wesoła, *18 billion in debt and a major rescue plan. The giant has made a radical decision*, Strefa Biznesu, May 27, 2026, https://strefabiznesu.pl/18-miliardow-dlugu-i-wielki-plan-ratunkowy-gigant-podjal-radykalna-decyzje/ar/c3p2-29035633.

82 Cited in: W. Kaleta, *A Turnaround in Ammunition Production. Poland Finally Has Its Own Gunpowder*, WNP, July 25, 2026, https://www.wnp.pl/bezpieczenstwo/zwrot-ws-produkcji-amunicji-polska-ma-w-koncu-wlasny-proch,1083908.html.

83 https://tech.wp.pl/polska-produkcja-amunicji-problem-z-prochem-i-polski-trotyl-dla-nato,7312338708732256a.

84 J. Zagalski, *"New Opportunities for Mesko,"* Polska Zbrojna, May 27, 2025, https://www.polska-zbrojna.pl/home/ArticleShow/43879.

85 *EURENCO & MESKO Announce the Opening of the New Polish Assembly Line for EURENCO 155mm Modular Charges in Pionki*, EURENCO, August 29, 2025, https://eurenco.com/eurenco-mesko-announce-the-opening-of-the-new-polish-assembly-line-for-eurenco-155mm-modular-charges-in-pionki/.

86 A. Kiński, *MESKO to Launch Production of Modular Propellant Charges in Cooperation with EURENCO*, ZbiAM, October 23, 2025, https://zbiam.pl/mesko-uruchomi-produkcje-modulowych-ladunkow-miotajacych-we-wspolpracy-z-eurenco/.

formally taking the most advanced step in the entire series of announcements. The scope was also expanded: the joint venture is to produce not only BMCS systems but also "qualified modular payload systems and tripartite propellants". The declared production scale was increased from 100,000 to "hundreds of thousands of systems per year" – the target figure itself was thus raised between successive announcements[87]. The project is also set to utilize the existing Polish production of single-component propellant in Pionki, which – if confirmed in practice – would mean that Poland is contributing its own technology to the JV, not just a sales market. According to the disclosed schedule, the joint venture will begin operations in mid-2028 and reach full production capacity by early 2029 at the latest[88].

Hanwha Aerospace has also begun work on developing MCS technology in Poland by signing an agreement with the Military Institute of Armament Technology[89]. However, this collaboration is limited to research and testing. According to unconfirmed reports, the Korean company also considered building an MCS production facility by launching a joint venture with WB Electronics[90].

In June 2026, Rheinmetall notified the Ministry of National Defense of its readiness to build its own MCS plant in Pomerania (at least 600,000 modules per year, i.e., 100,000 sets). The assumed form of cooperation is a joint Polish-German project with extensive participation by Polish subcontractors, but the proposal is still under negotiation, with no binding agreements in place[91].

Projectile bodies

The reference point is the following volume: between 2016 and 2022, the Polish industry supplied a total of approximately 48,000 155-mm rounds, or over 6,500 per year[92]. PGZ CEO Adam Leszkiewicz confirmed in April 2026 that Mesko in Kraśnik currently produces 25,000 bodies per year – an increase of more than 3.5 times from that level, though still far from the target volume[93]. The investment from the Capital Investment Fund in Kraśnik is intended to increase this capacity to over 100,000 bodies per year by 2028 – and this remains a target, not the current status[94].

As previously mentioned, Niewiadów signed a letter of intent for the supply of projectile bodies from Northrop Grumman. At the same time, it is collaborating with Polska Grupa Odlewnicza, which, together with WITU (Military Institute of Armament Technology on Poland) is developing a 155-mm artillery projectile body. In April 2026, it passed

87 W. Kozioł, *A key component of 155 mm ammunition will be manufactured in Poland. PGZ and EURENCO have signed an agreement*, Defence24, June 15, 2026, https://defence24.pl/przemysl/kluczowy-skladnik-amunicji-155-mm-powstanie-w-polsce-pgz-i-eurenco-podpisaly-umowe.

88 M. Ławrynowicz, *"Agreement Signed. Pionki Will Become the Center of a European Armaments Revolution,"* Cozadzień.pl, July 1, 2026, https://www.cozadzien.pl/artykul/95385,umowa-podpisana-pionki-stana-sie-centrum-europejskiej-rewolucji-zbrojeniowej.

89 Hanwha Aerospace Enhances Strategic Cooperation with WITU in Ammunition Technology, Hanwha, September 5, 2025, https://www.hanwhaaerospace.com/eng/media/newsroom/view.do?seq=549.

90 T. Dmitruk [@goltarr], October 22, 2025, *A factory will also be built in Barcin near Bydgoszcz…*, post on Portal X, https://x.com/goltarr/status/1981303540233408583.

91 W. Kozioł, *"Rheinmetall Wants to Build a Factory in Poland,"* Defence24, June 18, 2026, https://defence24.pl/przemysl/rheinmetall-chce-zbudowac-fabryke-w-polsce.

92 Ł. Michalik, *Ammunition Production in Poland. The Problem with Gunpowder and Polish TNT for NATO*.

93 J. Graf, *"Can PGZ Handle SAFE? Leszkiewicz: More Borsuks and Grots, Production Capacity on the Rise* [INTERVIEW]," Defence24, April 22, 2026, https://defence24.pl/przemysl/czy-pgz-udzwignie-safe-leszkiewicz-wiecej-borsukow-i-grotow-rosna-moce-wywiad.

94 J. Złotorowicz, *Konrad Gołota on the production of 155 mm ammunition. Will Poland achieve full independence? Behind the scenes of the PGZ investment*, Defense Portal, September 15, 2025, https://portalobronny.se.pl/wideo/konrad-golota-o-produkcji-amunicji-155-mm-polska-osiagnie-pelna-niezaleznosc-kulisy-inwestycji-pgz-aa-CfYB-koov-YufQ.html.

a successful fragmentation test at the WITU testing range in Zielonka. The nominal production capacity is expected to be 50,000 projectile bodies per year[95].

Reloading

Domestic capabilities (previously described as Dezamet, Nitro-Chem, Elaboracja Niewiadów, and WB IM) therefore exist and are operational, but their scale is sometimes misrepresented. Nitro-Chem's trajectory is the most precisely documented: its capacity to manufacture large-caliber projectiles increased from approximately 3,000 units in 2023 to 80,000 units in 2026, and ultimately – following the launch of a third production line using the screw-feeding method (cost: 58.7 million PLN, launch planned for 2028) and the additional casting-method lines currently under negotiation (planned for two years from now) – it is expected to exceed 200,000 rounds per year[96]. Due to existence of precise documentation, this is one of the most reliable elements of the entire program.

It's worth rounding out the picture of the explosive manufacturing sector in Poland with a smaller player: Jakusz Sp. z o.o. from Kościerzyna. It is a privately owned company with several decades of experience that loads artillery and mortar ammunition with explosives (TNT, Composition B, thermobaric mixtures), produces the small-caliber ammunition and warheads for KRUK loitering munitions. It also offers loading of mines on behalf of other manufacturers. At Eurosatory 2026, the company's CEO, Marta Rados-Jakusz, emphasized that the company focuses on smaller calibers and drone warheads, and therefore does not compete directly with Nitro-Chem or WB IM[97].

Fuses

Some mechanical fuses are produced domestically by Dezamet, but Poland remains dependent on imports when it comes to modern electronic fuses. Some countries in the region have greater capabilities in this area, as exemplified by Fuchs Electronics Europe, which operates in Slovakia. In June 2026, Niewiadów Polska Grupa Militarna S.A. also announced unspecified plans to localize the production of igniters sourced from a German supplier (Junghans).[98].

Gas generators

Within the PGZ Group, Gamrat – which has already been mentioned - is responsible for gas generators. The capital injection it received from the State Treasury is intended to help develop its gas generator production line.

Beyond 155 mm: other calibers and applications of high-energy materials

The same supply chain – TNT, propellants, and fuses – supports a much broader range of products than just the flagship artillery ammunition. However, the 155 mm caliber strongly dominates TNT demand due to the weight of the charge per projectile and the scale of orders. Yet, the other categories are not marginal – together they account for about

95 R. Szulc, *PGO Projectile Following a Successful Field Test. Production of the 155 mm Projectile Body Is Getting Closer*, Defense Zone, May 12, 2026, https://strefaobrony.pl/pocisk-pgo-po-udanym-tescie-poligonowym-coraz-blizej-produkcji-korpusu-pocisku-155-mm/ar/c1p2-28993103.

96 *The Polish Armaments Group summarized a year of work on the project to achieve production sovereignty for 155 mm ammunition*, ZBiAM, July 28, 2026, https://zbiam.pl/polska-grupa-zbrojeniowa-podsumowala-rok-prac-nad-projektem-uzyskania-suwerennosci-produkcyjnej-amunicji-155mm/.

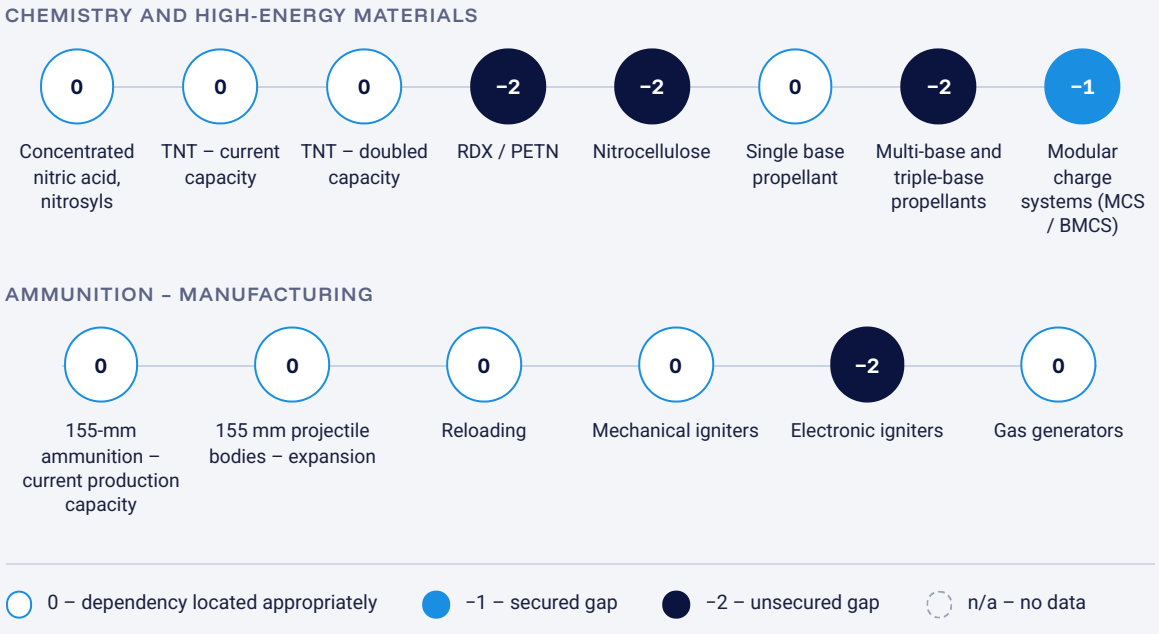
97 J. Link-Lenczowski, *Eurosatory 2026: Jakusz Offers Warheads and Loitering Munitions*, Milmag, 2026, https://milmag.pl/eurosatory-2026-jakusz-oferuje-glowice-bojowe-i-amunicje-krazaca.

98 A. Walkowski, *Polish ammunition factory reveals development plans*, Defence24, June 12, 2026, https://defence24.pl/przemysl/polska-fabryka-amunicji-zdradza-plany-rozwoju.

one-third of total demand, and each of them faces the same raw material bottlenecks described above. In the context of the Polish defense industry, this is best illustrated by the example of Dezamet, which – in addition to 155 mm ammunition – currently manufactures and supplies the military with mortar ammunition (60, 98, and 120 mm, including OF-834BM rounds for the M120K Rak self-propelled mortars), grenade launcher ammunition (40×46 mm and 40×53 mm), rifle and hand grenades, small-caliber aerial bombs, and fuses. This is a diversified product portfolio. The scale of mortar deliveries, however, is often much smaller than that of 155 mm ammunition: the 2020 contract for the modernization of 10,500 rounds for the self-propelled Rak mortar (65.5 million PLN) or the earlier 2016 contract for 6,318 units (carried out between 2017 and 2019) show volumes measured in the thousands, not tens of thousands of units per year[99]. 120 mm tank ammunition, in turn, is formally part of the same "150,000–180,000" program as the 155 mm – with a potential of up to 70,000 units per year, which means that its development is not a separate project but rather depends on what portion of the total production capacity will be allocated to it. Small-arms ammunition constitutes a different category – a smaller payload per unit but a significantly larger volume – and is one of the few areas in the entire ammunition segment where the declared growth has already actually occurred: Mesko has confirmed a fivefold increase in production, to 250 million rounds per year[100].

INFOGRAPHIC

Ammunition value chain – assessment of links (Δ)



99 Actual delivery of OF-834BM rounds for M120K Rak mortars under the contract dated December 17, 2020, valued at 65.5 million PLN for the modernization of 10,500 units; an earlier contract from 2016 for 6,318 units was fulfilled between 2017 and 2019. *New batch of ammunition for M120K Rak mortars*, MILMAG, https://milmag.pl/nowa-partia-amunicji-do-mozdzierzy-m120k-rak/.

100 *Mesko produces one million rounds of ammunition per day*, Ministry of State Assets, June 17, 2025, https://www.gov.pl/web/aktywa-panstwowe/mesko-produkuje-milion-sztuk-amunicji-dziennie.

5.1.4 Conclusions and recommendations

The segment gets a pass on the effectiveness test adopted in the report, however, subject to certain conditions. Actual, verified domestic effectiveness is confirmed by: Nitro-Chem's export position in the TNT sector, well-documented growth in Nitro-Chem's manufacturing capacity, a confirmed trial batch of propellant with the use of CSG's technology, and a confirmed – albeit lower than announced – increase in shell production in Kraśnik, verified firing tests by the WB Group, a new Nitroerg/KGHM investment in RDX/PETN independent of PGZ, the launched construction of the Hanwha WB Advanced System rocket factory in Gorzów Wielkopolski, and the existence of smaller, private manufacturing players outside of PGZ and the WB Group. However, actual progress remains significantly weaker than PGZ's schedules and than what declarations of private players would suggest: some of the ammunition already delivered was in fact manufactured abroad, key investments (the second TNT line, the nitrocellulose plant, and the full-scale MCS plant) are still at the stage of contract conclusions and feasibility studies, declared target volumes fluctuate between successive announcements, and production of the CGR-080 rockets will not begin until 2030 at the earliest.

Confirmed bottlenecks: nitrocellulose (zero domestic production, although the first trial batch of finished propellant made from imported components has already been tested); multibase/tribase propellants; electronic igniters; and the lack of transparency regarding actual domestic versus imported production volumes.

Over the next twelve months, the priority should be to introduce – as a condition for releasing subsequent tranches of the public funding – the requirement for independent, verifiable quantitative reporting for all companies receiving such support under the Capital Investment Fund, the SAFE mechanism, and the Polish Investment Zone, with a clear distinction between the volume actually produced in Poland and that outsourced abroad. Without such a mechanism, data on "ammunition sovereignty" will remain unverifiable, as illustrated by both the case of CSG-controlled plants in Slovakia and PGZ's refusal to disclose actual production volumes.

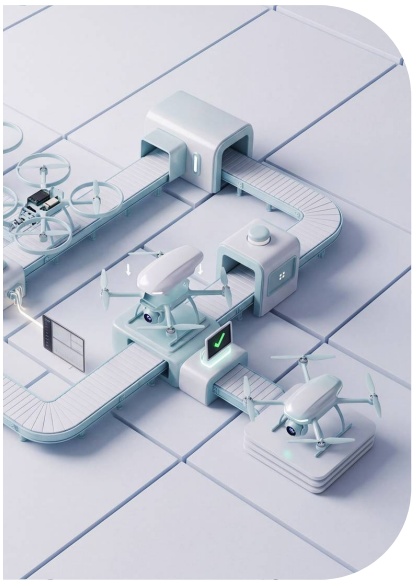
Within the next one to three years, it will be necessary to make a binding investment decision regarding nitrocellulose, regardless of Grupa Azoty's current financial situation, and along with it – provide for continuous monitoring to ensure that the second TNT line, the fully operational modular propellant plant in Pionki, and Nitroerg's investment in Krupski Młyn are indeed progressing beyond the expansion contract phase within the declared timelines. During the same period, it should be determined whether Grupa WB's withdrawal from the SAFE tender signals a structural problem with certification – given the required, at least two-year process at WITU – calling for procedural reforms, or whether it is an isolated incident.

In the longer term – spanning three to five years – it makes sense to support the parallel development of private manufacturers of complete ammunition as a natural, decentralized alternative to the PGZ model. The resilience built due such a solution – the absence of a single point of failure – is confirmed by the Ukrainian experience, with the caveat, however, that none of the entities in question has yet delivered complete rounds in

series production; therefore, the fulfillment of their 2026 commitments requires close monitoring. At the same time, it is worth formalizing Poland's regional role as a demand integrator, as this is an area where Polish financial commitment is already translating into actual deliveries.

A reliable test of these directions will be a set of questions to be resolved by the end of 2026. The key issues are whether PGZ will begin publishing actual production volumes, broken down into domestic and imported components; whether the WB Group and/or Niewiadów-PGM will deliver their first batch of missiles; whether the nitrocellulose plant in Tarnów will move beyond a letter of intent stage to a binding investment decision; whether Nitroerg's investment in Krupski Młyn will proceed to the physical construction phase; whether the full construction of the Hanwha–WB Advanced System rocket factory in Gorzów will begin as announced, and whether the Nitro-Chem–BAE Systems letter of intent will be converted into a binding agreement "later this year," as declared. The answers to these questions will reveal whether the segment's trajectory is indeed accelerating or whether it is repeating the pattern seen in 2024–2025, when announcements preceded implementation by one to two years.

5.2 Unmanned Aerial Vehicles and Anti-Drone Systems



In the unmanned systems segment, traditional measures of industrial sovereignty are particularly misleading. On the modern battlefield, a drone can perform numerous functions: from a weapon system, through a sensor or communications node, to an effector carrier or a component of a command-and-control system, and its configuration may become obsolete even before the completion of a traditional procurement process. An IWF report published in late 2025 identified three key trends:

- the democratization of precision strike capabilities through low-cost platforms;
- the growing importance of the scale and pace of innovation;
- a shift from thinking – in tactical terms – about a single drone to thinking about an integrated system combining reconnaissance, strike (including electronic warfare), and command functions[101].

From the perspective of the desired level of logistical sovereignty, this means that Poland does not have to independently manufacture every electric motor, battery cell, or semiconductor. However, it should control those elements of the supply chain that determine military utility and the ability to dynamically adapt the system: integration architecture, command software, communications and cryptography, the threat database, the integration of sensors and effectors, and the process of testing new versions. With regard to mass-produced components, the goal should not be self-sufficiency, but rather qualified substitution, stockpiling, and at least two alternative sources of supply in Poland or in allied and partner nations.

101 *Drone War–Status as of the End of 2025. Compendium by the Eastern Flank Institute*, specifically pp. 4–5 and the section on the Russian-Ukrainian War.

5.2.1 Capability needs – five categories

The rapid evolution of the drone sector makes it difficult to establish a classification system; nevertheless, for the purposes of this report, four categories of unmanned aerial systems and one category related to countering them have been identified:

1. low-cost FPV systems and other single-use, short-range platforms, where the advantages lie in cost, volume, and the ability to continuously change frequencies, communications, and software.

2. mini- and tactical reconnaissance UAVs, whose value stems from their reliability, sensors, and integration with command and control systems;

3. loitering munitions and search-and-strike systems.

4. mid- and deep-strike platforms, whose importance is growing along with their ability to inflict massive damage on the enemy's logistical infrastructure;

5. the C-UAS layer: detection, classification, electronic warfare, kinetic effectors, interceptor drones, and command-and-control systems[102].

The above typology is not exhaustive; nevertheless, it covers the most important products, i.e. the ones for which the armed forces on NATO's Eastern Flank currently report the greatest demand.

5.2.2 National ecosystem – current status and direction of development

The most mature national ecosystem is created by the WB Group, whose advantage stems not only from the FlyEye, FT-5, and WARMATE platforms but also from having its own integration layer. GLADIUS combines reconnaissance, command and control, and precision strike capabilities within a network-centric architecture; the manufacturer emphasizes that the system's value stems precisely from the integration of sensors, effectors, and C2, rather than from a single unmanned aerial vehicle. This model aligns with the logic presented by the IWF: sovereignty in this domain lies primarily in the ability to close the sensor–decision–effector loop and rapidly deploy subsequent versions[103].

At the same time, however, even a mature integrator remains part of an international supply chain. The WB GROUP–Hexagon memorandum signed in May 2026 provides for the integration of Canadian assured PNT, anti-jam, and anti-spoofing technologies on platforms such as the FT-5, FlyEye, and WARMATE 5. This does not constitute a weakness in the program but rather serves as a good example of an appropriate level of sovereignty: the platform and integration remain under the control of a Polish entity, while the specialized component is sourced from a trusted foreign supplier. However, stockpiles, alternatives, and integration rights that allow for a change of supplier[104] should remain a prerequisite for resilience.

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102 Ibid.

103 *GLADIUS, FLYEYE, and WARMATE – The Largest Unmanned Systems Contracts Ever Signed*, WB GROUP, June 1, 2026, https://www.wbgroup.pl/en/aktualnosci/gladius-flyeye-and-warmate-the-largest-unmanned-systems-contracts-ever-signed/.

104 *WB GROUP and Hexagon Sign Memorandum of Cooperation*, WB GROUP, May 27, 2026, wbgroup.pl/en/aktualnosci/wb-group-and-hexagon-sign-memorandum-of-cooperation/.

Apart from the WB Group, the market also includes PGZ and smaller private companies. Under the WIZJER program, the design was developed by ITWL, and production is being carried out by a consortium of PGZ, WZL No. 1, and WZL No. 2: the contract covers 25 sets, or 100 unmanned aerial vehicles, and the completion of testing in 2025 paved the way for delayed deliveries. The development of the Polish market is beginning to shift from the phase of individual demonstrators toward serial production capabilities: the Hornet production line in Sochaczew, launched in July 2026, was built around the ITWL design (a mid-strike drone with a range of approximately 400 km), which increases domestic control over modernization and the pace of change. The Polish drone sector is also developing proposals for deep-strike drones, as exemplified by the Striker systems manufactured by FlyFocus, which feature a range of approx. 1,000 km[105]. Although the Polish Armed Forces recognize the need to expand their long-range strike capabilities – which has been provided for in the new planning documents[106] – no specific procurement decisions have yet been made.

In the C-UAS domain, the SAN system is a joint venture between PGZ and Kongsberg, in which the radar base (the Polish company Advanced Protection Systems and the Danish company Weibel), effectors, and integration are to work in conjunction with foreign technologies. The contract covers 18 batteries, 52 fire platoons, and over 700 vehicles[107]. The structure of the SAN effectors shows a clear division of responsibilities. The detection layer and the extreme calibers are domestic: a 12.7 mm machine gun from ZM Tarnów, a 35 mm cannon from PIT-RADWAR, and non-kinetic jamming measures from Advanced Protection Systems[108]. The remaining three weapon classes are imported: a 30-mm cannon with a Kongsberg turret, 70-mm APKWS guided rockets, and MEROPS interceptor drones[109]. The Ministry of National Defense (MON) indicates that over 60% of the contract value will go to the domestic industry. Industry assessments suggest that the high proportion of foreign components stems from the requirement for the system – which did not previously exist as such – to achieve operational readiness quickly. Critical assessments have also pointed to the perpetuation of dependence on a foreign supplier of the 30 mm barrel effector, despite the technological capabilities of Polish industry in the field of similar solutions[110].

Resilience in this domain requires several classes of suppliers: a large system integrator, mass producers of low-cost platforms, companies specializing in optoelectronics and electronic warfare, suppliers of effectors and interceptor drones, manufacturers of high-energy materials, and software companies. The sector also qualifies as a model dual-use industry, including in agriculture and facility security. The criteria for eligibility for

105 Ł. Prus, *"Polish Industry Has Developed a Strike Drone with a Range of Over 1,000 km,"* Strefa Obrony, September 8, 2024, https://strefaobrony.pl/polski-przemysl-opracowal-bezzalogowiec-uderzeniowy-o-zasiegu-ponad-1000-km/ar/c1p2-26746409.

106 *Polish Armed Forces Development Program for 2025–2039 Signed*, Dziennik Zbrojny, December 23, 2025, https://dziennikzbrojny.pl/aktualnosci/news,1,12231,aktualnosci-z-polski,program-rozwoju-sil-zbrojnych-rp-na-lata-2025-2039-podpisany.

107 *The SAN system will enhance the Polish Army's capabilities to counter unmanned systems*, Ministry of National Defense, January 30, 2026, https://www.gov.pl/web/obrona-narodowa/system-san-zwiekszy-zdolnosci-wojska-polskiego-do-zwalczania-systemow-bezzalogowych.

108 *The SAN Program: The Lowest Layer of Air Defense and a Test of Polish Industry's Capabilities*, TekInfo, 2026, https://tek.info.pl/article/5138/program_san_najnizsza_warstwa_obrony_powietrznej_i_test_zdolnosci_polskiego_przemyslu.

109 K. Kaleta, *The Polish Army's New SAN Anti-Drone System – the First of Its Kind in Europe–Will Cost a Fortune*, Defense Sector, January 2026, https://sektorobronny.pl/nowy-system-antydronowy-w-polskiej-armii-i-pierwszy-taki-w-europie-bedzie-kosztowal-fortune/.

110 M. Dworczyk, *15 billion PLN for an illusion? Five questions about Poland's "anti-drone shield,"* Zero, April 21, 2026, https://zero.pl/news/tarcza-antydronowa-dlaczego-polski-system-san-moze-nie-zadzialac.

long-term contracts should include scalability and time-to-market for new versions, rather than specifications of the unit submitted for testing only.

5.2.3 Value chain and limits of national autonomy

- **Software, C2, and integration**

  This is the layer where national control is of the utmost importance. Proprietary C2 software, data exchange architecture, integration with artillery and reconnaissance, and the ability to modify algorithms and interfaces determine whether additional sensors and effectors can be integrated without the consent of a foreign OEM. Poland possesses real capabilities in this respect, particularly regarding the TOPAZ/FONET systems and domestic radar systems. Procurement policy should therefore require integration rights and APIs, and for critical systems, access to the source code as well.

- **Electronics, optoelectronics, and semiconductors**

  Full national sovereignty is impossible to achieve in this area. The European semiconductor supply chain remains highly internationalized, and a significant portion of input supplies and customers are located outside the EU. Similarly, unmanned technologies depend on global supply chains for materials and components. Poland's goal should therefore be to maintain a list of critical components, qualified substitutes, and strategic stockpiles, while limiting the use of components whose replacement would require a complete redesign of the system[111].

- **Batteries and electric drives**

  Batteries are another example of a dependency where achieving full production sovereignty is impossible in the foreseeable future. The JRC notes that Europe's position in the Li-ion supply chain remains weaker than that of its main competitors, and critical stages of raw material and cell production are concentrated outside the EU. In FPV systems, risks also extend to motors, controllers, and small electronic components purchased from the global market. Over the next 3–5 years, a reasonable goal is to establish a network of allied suppliers and the capacity to assemble battery packs, incorporating domestic contractors to the greatest extent possible – this opens up opportunities for greater involvement of entities that have previously specialized in solutions for the civilian market[112].

- **Testing, certification, and access to the test range**

  Currently, this is a bottleneck in the system, resulting, among other things, from a high level of bureaucracy and limited resources on the part of the Ministry of National Defense. A positive step – albeit only a partial one – is Decision No. 123/MON of September 2025, which introduced a special testing procedure for drones and C-UAS; solutions that pass testing and are recommended may be procured outside of the Public Procurement Law

111 D. Blagoeva et al., *"Materials Dependencies for Dual-Use Technologies Relevant to Europe's Defense Sector,"* Joint Research Center, Publications Office of the European Union, Luxembourg 2019, DOI:10.2760/570491, https://publications.jrc.ec.europa.eu/repository/handle/JRC117729; I. Cerutti, M. Nardo, *Semiconductors in the EU: State of Play, Future Trends, and Vulnerabilities of the Semiconductor Supply Chain*, Joint Research Center, Publications Office of the European Union, Luxembourg 2023, DOI:10.2760/038299, https://publications.jrc.ec.europa.eu/repository/handle/JRC133850.

112 *Battery Technology in the European Union – 2025 Status Report on Technology Development, Trends, Value Chains, and Markets*, Joint Research Center, May 20, 2026, https://setis.ec.europa.eu/battery-technology-european-union-2025-status-report-technology-development-trends-value-chains-and_en.

framework, provided the minister's approval is granted. Subsequent procedures call for distributed, parallel testing across multiple locations. This is a step in the right direction, but success should be measured by the average time elapsing between submission of a proposed solution to decision, the number of versions approved annually, and the proportion of systems that proceed to mass production following testing.

5.2.4 Regional dimension: C-UAS

Countries on the Eastern Flank, as they border states involved in conflict and also experience incursions by foreign drones into their own airspace, provide a natural breeding ground for the emergence of new leaders in anti-drone technology. Allied procedures within the region should include, among other things, joint test ranges, as well as the exchange of signature and threat databases, certification of interceptors, data on effectiveness of the electronic warfare, and potential joint procurement of components. Poland is home to one of Europe's largest manufacturers of anti-drone radars and related command and control systems (Advanced Protection Systems), and the region is home to numerous companies specializing in threat neutralization (e.g., Frankenburg Technologies).

In July 2026, NATO announced over $40 billion in allied investments into C-UAS capabilities over five years, as well as the creation of a market for solutions that are tested and NATO-compatible. Poland should take advantage of this process not only as a buyer but also as a country offering sensor systems, C2, effectors, and testing infrastructure[113].

5.2.5 Conclusions and recommendations



The segment passes the effectiveness test conditionally, with Poland's position clearly stronger in the areas of system integration, software, reconnaissance, and loitering munitions than in the mass component base. Verified strengths include the operational and exported FlyEye/WARMATE families, the GLADIUS system currently under development, domestic C2 capabilities, in-house designs by PGZ/ITWL, and the launch of major SAFE contracts. In the C-UAS sector, the development of the SAN system (Security Assistance Network) is driving demand and shaping the system architecture, but only actual deliveries will reveal the true domestic share in effectors, sensors, and software.

Potential logistical bottlenecks include most critical components: electronics and semiconductors, selected optoelectronic components, batteries, and propulsion systems for low-cost platforms. The ability to produce very large volumes of unmanned aerial vehicles, high-energy materials for warheads, and the pace of qualification for subsequent versions in the event of a high-intensity conflict or crisis remains are all in question. In these areas, sovereignty should be measured in delivery time as well and not just in the nominal percentage of domestic content.

In the short term, it is recommended to introduce a mandatory reporting requirement: a list of components for which there is no qualified alternative supplier from Poland or a trusted

113 *NATO Allies Invest 40 Billion Dollars in Counter-Drone Capabilities and Drone Training*, NATO, July 7, 2026, https://www.nato.int/en/news-and-events/articles/news/2026/07/07/nato-allies-invest-40-billion-dollars-in-counter-drone-capabilities-and-drone-training.

country, along with inventory levels calculated in months of production. This should apply not only to drones but also to all systems and weapons with high rates of wear and tear.

In the longer run, the priorities should be: the establishment of regional testing and training centers for C-UAS systems; multi-year procurement and modification frameworks for low-cost interceptors and FPVs with a requirement for scalability; and the qualification of at least two sources of components.

5.3 Land vehicles: production vs. sovereignty

The example of land vehicles illustrates particularly well that simply assembling a finished product domestically is not the same as having control over the entire process of its creation (the value chain) – from design through components to final production. The hull, turret, and assembly may be carried out in Poland, yet the operational readiness of the entire fleet remains dependent on a foreign powertrain, transmission, a potential active protection system, or the right to modify the documentation. Therefore, this segment should be evaluated not by the share of domestic value, but by answering the question of whether Poland can independently produce, repair, and develop the platform during a period of supply disruptions.

5.3.1 Overview of major programs and actual capabilities

- **K2/K2PL**

  The framework agreement provides for a total of 1,000 K2/K2PL tanks. The second implementation agreement, dated August 2025, covers the delivery of 180 tanks between 2026 and 2030, including 64 in the K2PL variant. 61 K2PL tanks out of this number are to be manufactured at Bumar-Łabędy, with the first three units produced in Korea. The contract provides for technology transfer, the establishment of a final assembly line, and full maintenance and operational capabilities. This is a significant step away from importing finished products toward controlling the entire life cycle, but it does not yet mean sovereignty over all components[114].

- **Borsuk**

  Borsuk is a different case: the platform was designed domestically, and the first implementation agreement from March 2025 covers the delivery of 111 IFV units between 2025 and 2029; the first 15 production vehicles were delivered in December 2025. This signifies domestic control over the vehicle's architecture, integration, and the development of variants. At the same time, the powertrain relies on foreign components, which shows that even a "Polish design" requires a separate policy for the engine and transmission[115].

- **Krab/K9**

  The Krab combines a Polish turret system with a chassis derived from the K9 self-propelled howitzer. In 2025, HSW signed a contract with Hanwha Aerospace for further deliveries of components for the Krab's chassis, including powertrain components. This program exemplifies advanced domestic manufacturing and integration capabilities,

114 K2 Tanks, Ministry of National Defense, https://www.gov.pl/web/obrona-narodowa/czolgi-k2.
115 BORSUK Infantry Fighting Vehicle, Ministry of National Defense, https://www.gov.pl/web/obrona-narodowa/bwp-borsuk.

albeit with continued reliance on foreign suppliers for key components. The K9, meanwhile, remains a platform sourced from South Korea, with a growing share of Polish components and maintenance, but with little domestic control over the base design[116].

- **Rosomak and its successors**

  Rosomak is the most mature Polish example of managed licensing interdependence. The agreement with Patria from December 2025 extends production capabilities through 2034 and modernization and maintenance through 2064; according to Rosomak S.A., it increases autonomy in modification and development, simplifies exports, and provides for solutions in the event of supply chain emergencies. This model is closer to the definition of sovereignty adopted in this report than the simple demand for full intellectual property rights[117].

5.3.2 Key elements of the value chain

- **Design and modification rights**

  Control over documentation, configurations, and interfaces is of the highest value. Borsuk provides this control to the greatest extent; Rosomak demonstrates that a similar effect can be achieved through a well-structured license. In K2PL, the key will be the scope of changes that Polish entities will be able to make without re-obtaining OEM approval, and whether the acquired capabilities will include actual production of parts, rather than just the assembly and maintenance.

- **Powertrain and transmission**

  This is the most significant shared bottleneck. Wojskowe Zakłady Motoryzacyjne already holds licensing authority to repair and overhaul MTU engines and RENK transmissions for the Leopard tanks, while for the Borsuk it supplies powertrain assemblies based on foreign components. Domestic maintenance capabilities significantly increase resilience, but they do not eliminate the risk of a prolonged cutoff from parts and new assemblies. Therefore, propulsion systems should be treated as a separate family of strategic components, shared across multiple programs[118]. This dependency could be mitigated by investing further in the domestic series hybrid powertrain that is currently being developed by Huta Stalowa Wola in collaboration with technical universities, and by deploying it in the selected heavy land platforms, including Borsuk and self-propelled howitzer chassis[119].

  Between 2026 and 2029, Poland faces decisions regarding the value chain – not so much concerning the complete tank engine as regarding the scope of capabilities maintained locally. These should include: major overhauls, production of selected parts, module refurbishment, diagnostics, rotational stock, and the ability to qualify replacement parts. Designing a new family of heavy power packs from scratch within the timeframe of this report is unrealistic. What is achievable, however, is a transition from importing complete assemblies to licensed maintenance and partial production, as well as

116 *HSW S.A. and HANWHA AEROSPACE signed an agreement for the supply of components for the Krab chassis*, HSW, April 7, 2025, https://www.hsw.pl/aktualnosci/hsw-i-hanwha-aerospace-podpisaly-umowe-ma-dostawy-komponentow-do-podwozi-kraba/.

117 *2025 Year in Review*, Rosomak S.A., January 12, 2026, https://www.rosomaksa.pl/aktualnosci/podsumowanie-roku-2025.

118 M. Dąbrowski, *Poznań Support for Armored Vehicle Powertrains in Kielce*, Defence24, September 9, 2021, https://defence24.pl/poznanskie-wsparcie-dla-pancernych-napedow-w-kielcach.

119 P. Ciesielska, *"Polish Powertrain for the Krab and Borsuk,"* Polska Zbrojna, July 21, 2026, https://polska-zbrojna.pl/Mobile/ArticleShow/46806.

establishing alternative sources for individual components in allied or partner nations.

- **Turrets, sensors, BMS, and active protection**

  In the aforementioned subsystems, Poland has a slowly growing base of its own solutions, such as the ZSSW-30 turret, domestic communications and BMS systems, optoelectronics, and soft-kill solutions. However, given the dominant role of the land forces in modernization programs and the expansion of their structure, further increasing the scope of domestic production, e.g., by developing a domestic hard-kill active vehicle protection system is clearly not a priority. At the same time, subsequent programs are introducing foreign active systems and sensors.

5.3.3 The cases of the Rosomak and the Borsuk

- **Rosomak**

  Rosomak represents a specific case of licensed production that emphasizes logistical sovereignty while limiting export capabilities. The history of cooperation between Polish entities and the Finnish company Patria, spanning over 20 years, reveals a long-term approach to production and service rights, relative freedom to develop variants, and a focus on contingency procedures for the supply chain. At the same time, despite having well-developed manufacturing facilities, PGZ displays limited interest in export activities. Nevertheless, the process of production localization has reduced the risk that, in a crisis, a domestic manufacturer would become merely an assembly plant waiting for approval and parts from abroad. This is an important point of reference for the procurement of major weapons systems from abroad.

- **Borsuk**

  The Borsuk, in turn, demonstrates the benefits of owning the underlying architecture. The government can develop a family of specialized vehicles and modify their integration without having to renegotiate rights to the platform. A drawback of the design remains the use of foreign powertrain components and some equipment. From a supply chain security perspective, this is a more favorable situation than purchasing a ready-made, off-the-shelf system, because components can be replaced over the long term, whereas the lack of rights to the documentation for the entire platform creates a structural dependency.

  A similar model of gradual localization is evident in the Legwan program: the annexes to the Rosomak–KIA contract signed in 2025 extended production rights, allowing for the development of specialized variants and providing for the gradual transfer of component production to Poland. The conclusion is broader: vehicle sovereignty is best developed in stages if the agreement defines, from the outset, milestones for the transfer of specific production or maintenance capabilities, rather than relying on a general percentage of localization[120].

120 Signing of Annexes to the Contract with KIA for the Delivery of Legwan 4x4 Vehicles, Rosomak S.A., August 27, 2025, https://www.rosomaksa.pl/aktualnosci/podpisanie-aneksow-do-umowy-z-kia-na-dostawe-pojazdow-legwan-4x4.

5.3.4 Conclusions and recommendations

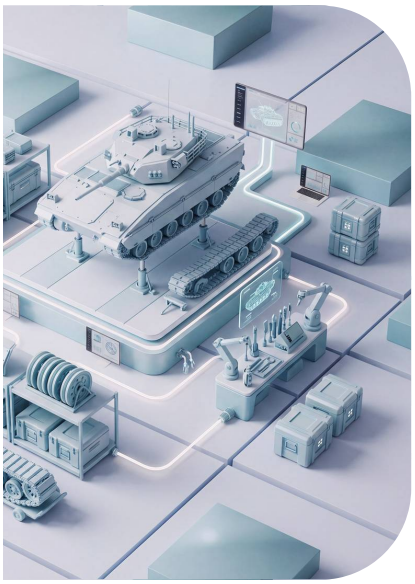
The segment passes the effectiveness test conditionally and unevenly. Poland has very strong capabilities in the design and integration of the Borsuk, the production and development of the Rosomak, barrel artillery, and the servicing of platform components. Weaker areas include powertrains and transmissions, and, in some programs, the rights to modify and manufacture the deep layer of subassemblies.

To increase the level of logistical security for large land platforms, a "substitutability map" of components – including those subject to restrictive contractual provisions – should be developed for each major program. In implementation contracts, final assembly should be separated from the actual production of subassemblies, and both metrics should be reported separately.

In the longer term, it should be the priority for Poland to develop full capabilities for the major overhaul of propulsion systems used in the largest fleets, as well as the production of selected critical parts and rotational stocks. New licensing agreements should be modeled after the Rosomak–Patria model, i.e., include contingency rights, freedom to modify, the ability to create variants, and export terms. In the long run, Poland should focus on those platform families over which it holds design control and treat the import of a complete platform as an exception, supplemented by the deepest possible maintenance and overhaul capabilities.

Periodic exercises and simulations should also be launched to assess the operational capabilities of the Ministry of National Defense and the Polish Armed Forces in the event of a multi-month disruption in supplies from one of the foreign manufacturers of large land-based platforms. The goal should be to answer the question: to what extent can the domestic industry reconfigure these platforms in response to a new threat without renegotiating contractual terms with the OEM, which takes years?

5.4 MRO as a regional asset



In the context of a protracted conflict, the availability of equipment depends at least as much on repair capabilities as on the pace of new platform deliveries. Therefore, in this segment, the measure of success should not be the opening of another center or contact closure with an OEM, but rather the number of platforms returned to service, repair turnaround time, the proportion of work performed domestically, and a parts inventory sufficient to maintain operations during supply disruptions.

5.4.1 Poland's MRO base – from maintenance to lifecycle management

The most mature heavy MRO facility is Wojskowe Zakłady Motoryzacyjne (WZM, Military Automotive Works) in Poznań. In 2025, WZM entered into a long-term contract for the overhaul of Leopard 2 tanks, a licensing agreement with BAE Systems regarding the M88A2, an agreement with General Dynamics Land Systems for support of the Abrams , and an Allison license for the maintenance, repair, and overhaul of transmissions in tracked vehicles. The plant also performed deprocessing of M1A1 FEP Abrams tanks, repairs of Leopard 2 power packs, and deliveries of power packs for the Borsuk[121].

Dęblin is a significant addition to this effort. In May 2026, WZL No. 1 and Honeywell signed an agreement regarding an authorized service center for AGT1500 engines for Abrams tanks; according to the Ministry of National Defense, this is to be the third such center in the world and the only one in Europe to offer a wide range of repairs and a stock of spare parts. If this capability is put into practice, it could potentially become a regional niche extending beyond the needs of the Polish Army itself[122].

In the area of Leopard tanks, WZM is the only authorized partner in Poland of MTU/Rolls-Royce and RENK for the overhaul of the relevant engines and transmissions. Bumar-Łabędy is simultaneously developing expertise in the K2PL and heavy vehicles, HSW has the infrastructure for the Krab and Borsuk, and Rosomak S.A. for wheeled platforms. Poland thus possesses a combination – rare in the region – of a large fleet, several OEMs, and numerous industrial centers. This creates sufficient demand to sustain capabilities that would be economically difficult to maintain in smaller countries[123].

5.4.2 MRO in wartime: dispersion and recovery capabilities

The Ukrainian experience shows that heavy repairs must be complemented with a network of lower-level maintenance facilities. Not every malfunction should be sent back to the central facility. A division is needed into: repairs at the unit level, mobile service teams, regional module replacement centers, and facilities performing major overhauls. A properly designed network reduces platform downtime and minimizes vulnerability to an attack on a single facility.

121 Summary of the year 2025 at Wojskowe Zakłady Motoryzacyjne S.A., https://wzm.pl/en/summary-of-the-year-2025-at-wojskowe-zaklady-motoryzacyjne-s-a/.

122 *The only facility of its kind in Europe. Agreement Signed for Abrams Tank Engine Maintenance*, Ministry of National Defense, May 18, 2026, https://www.gov.pl/web/obrona-narodowa/jedyny-taki-osrodek-w-europie-podpisano-umowe-na-serwis-silnikow-do-abramsow.

123 Powertrains for LEOPARD 2 tanks, Wojskowe Zakłady Motoryzacyjne S.A., https://wzm.pl/produkty/zespoly-napedowe-do-czolgow-leopard-2/.

Rheinmetall is developing such a model on a regional basis. The center in Lithuania supports, among others, the Boxer/Vilkas, PzH 2000, and the Leopard family, utilizing a local network of partners. In Satu Mare, Romania, near the border with Ukraine, a modular repair hub for combat-damaged Marder infantry fighting vehicles was quickly launched; its infrastructure can be adapted to the scale and type of repairs. In Western Ukraine, a joint Rheinmetall center – established in cooperation with the Ukrainian industry – is operational; it performs repairs on Marders and is set to expand its scope to include additional systems[124]. A similar center was launched in Ukraine by the Polish Armaments Group (PGZ) through its subsidiary PGZ Serwis Orel[125].

It is also worth emphasizing that the "cannibalization" of equipment – often viewed in peacetime as a sign of inefficiency – remains one of the key methods for maintaining the availability of parts during wartime. Of course, it should not replace proper stockpiling; nevertheless, even in peacetime, clear rules can be established regarding the process, its temporary nature, and so on. The government should in advance establish the rules for using damaged vehicles as module donors, develop a registry of components with limited service life, and the rules allowing for refurbishing the parts. This requires access to OEM documentation and the right to perform repairs outside of an authorized foreign service center.

5.4.3 MRO as a potential subregional specialization – conclusions and recommendations

Poland has the potential to become the main hub for heavy MRO on the Eastern Flank within a few years, provided three conditions are met. First, capabilities must include major overhauls, not just diagnostics and replacement of complete modules. Second, access to parts and documentation is required to allow for servicing of allied equipment during a crisis. Third, the infrastructure must have the capacity for a rapid increase in throughput – including additional workstations, backup stations, and mobile workshops.

The greatest opportunity – depending on the maintenance of positive political relations – concerns the American equipment. The scale of Poland's purchases of Abrams tanks and other U.S.-manufactured systems supports an allied relationship with the U.S. government and U.S. companies. Poland should seek formal recognition of selected facilities as regional support centers, with the capability to service military equipment of the U.S. Army as well as the American equipment of other European users, maintain a stock of spare parts in Europe, and manufacture selected high-turnover components. A similar system of cooperation should be developed with South Korea, with a clear emphasis on the economic dimension of the partnership (without an active military alliance component).

In the case of parts that are low in complexity but have a high failure rate, full imports are not justified. Domestic production of filters, cables, rubber components, wiring harnesses,

124 Opening of the maintenance and repair center in Ukraine with political support, Rheinmetall, June 11, 2024, https://www.rheinmetall.com/de/media/news-watch/news/2024/06/2024-06-11-rheinmetall-ukrainian-defense-industry-repair-hub.

125 PGZ Serwis Orel is repairing former Polish Krab howitzers in Ukraine, Milmag, August 8, 2023, https://milmag.pl/pgz-serwis-orel-naprawia-eks-polskie-haubice-krab-w-ukrainie/.

workpieces, tools, and selected modules may be less prestigious industrially than the production of an entire platform, but it has a significant impact on fleet availability. WZM already manufactures selected spare parts and specialized tooling; a similar model should be replicated at other facilities.

5.5 Radars, other sensors, and border protection

In reconnaissance and situational awareness systems, sovereignty cannot be limited solely to the possession of individual domestically produced sensors (e.g., radars). The level of actual sovereignty within the value chain should be analyzed by examining entire, multisensory systems that incorporate, among other things, various types of sensors – active and passive radar, optoelectronic, acoustic, radio-technical, and border sensors – as well as the means for integrating them into a unified picture and the capabilities for transmitting information to the appropriate effectors.

5.5.1 Detection architecture: from the Eastern Shield to a multilayered ADS

Poland is developing several multisensory systems simultaneously, including those focused on border protection. In the area of air defense, the Wisła and Narew programs form an integrated command architecture designed to incorporate radars of various classes. At the national level, an example of a large-scale contract is the one from 2025 – at that time, 46 PET/PCL passive detection radars were procured for NAREW – 28 in the base order and 18 as an option, with deliveries scheduled for 2030–2038[126].

Passive detection is particularly valuable from a resilience standpoint. It does not emit its own signal like an active radar, so it can supplement the situational picture while minimizing emissions and increase the survivability of the entire sensor network. It should not be treated as a replacement for conventional radars, but rather as one of the layers that makes it more difficult for an adversary to degrade reconnaissance capabilities by destroying a single type of sensor.

Border security systems that are slowly being developed are another example. Successive Polish governments have been designing and expanding electronic security measures along the borders with Russia and Belarus, constructing border security along the border with Ukraine, and developing the Automated Radar Surveillance System for Polish Maritime Areas (ZSRN 2.0). In June 2026, an agreement was signed regarding the construction and operation of this system. Thus, the same need arises in both the Eastern Shield and the protection of critical infrastructure: the integration of military and non-military data without building parallel, incompatible systems[127].

126 Radar stations for NAREW systems, Ministry of National Defense, https://www.gov.pl/web/obrona-narodowa/stacje-radiolokacyjne-dla-zestawow-narew.

127 P4 – Secure Borders – Development of Infrastructure and Operational Capabilities of Border Forces, and Effective Prevention and Combating of External Threats, Office of the Prime Minister, status as of June 30, 2026, Ministry of National Defense, https://www.gov.pl/web/priorytety/p4.

5.5.2 National industrial base

- **Radars and passive sensors**

  PIT-RADWAR is one of the strongest components of the national technological base. The PET/PCL contract is based on a domestic solution, and at the same time, the company is developing active radars for air defense. In 2025, 1.72 billion PLN was allocated from the Capital Investment Fund for a new PIT-RADWAR production and technology facility in Kobyłka, complete with laboratory facilities; it is intended to increase production capacity for WISŁA, NARWEW, and PILICA+, as well as to produce radar reconnaissance systems, command and fire control systems, IFF systems, and other components[128].

- **Optoelectronics and auxiliary sensors**

  The domestic industrial base also includes PCO and other optoelectronics manufacturers, radio-technical systems, and electronic reconnaissance solutions. For national sovereignty, what matters is not only the production of a sensor head or camera, but also the ability to perform local calibration, repairs, software updates, and to replace one detector with another. In the case of mass C-UAS, the ability to use less expensive supplementary sensors – acoustic and electro-optical – will also be important to avoid making each layer dependent on expensive military radars.

- **Communications, data fusion, and C2**

  The integration layer is the most critical. Poland is acquiring the IBCS for the WISŁA and NAREW systems under an intergovernmental agreement with the U.S. worth approximately $2.53 billion net, to be implemented between 2024 and 2031. The contract covers, among other things, communications equipment, passive IFF identification, cryptography, software development, laboratories, and the integration of radars and launchers. This ensures a very high level of allied interoperability but also creates a dependency on foreign command and control architecture. A key criterion for sovereignty is therefore the scope of rights and competencies to integrate additional Polish sensors and effectors[129] independently.

  The offset agreement with Northrop-Grumman includes, among other things, the integration of the SAJNA and BYSTRA radars with the IBCS, as well as the development of domestic laboratory and technical capabilities. This is the right direction: instead of trying to replace the allied C2 system, Poland should maximize its ability to independently integrate domestic components into it while maintaining a domestic data fusion layer for applications that do not require IBCS[130].

128 *3 billion PLN from the FIK for the Polish Armaments Group for investments in the Narew program*, Ministry of State Assets, October 20, 2025, https://www.gov.pl/web/aktywa-panstwowe/3-mld-zl-z-fik-dla-polskiej-grupy-zbrojeniowej-na-inwestycje-w-program-narew.

129 *The Polish Armed Forces will receive a state-of-the-art air and missile defense command and control system*, Ministry of National Defense, February 29, 2024, https://www.gov.pl/web/obrona-narodowa/wojsko-polskie-otrzyma-najnowoczesniejszy-system-dowodzenia-obrona-przeciwlotnicza-i-przeciwrakietowa.

130 *Another Offset Agreement in the WISŁA Program*, Ministry of National Defense, February 20, 2024, https://www.gov.pl/web/obrona-narodowa/kolejna-umowa-offsetowa-w-programie-wisla.

5.5.3 Integration as a potential regional niche

The Eastern Flank has over a a short period of time purchased and installed an exceptionally large number of new sensors, air defense systems, and border installations from various manufacturers. Without a common integration layer, there is a risk of “sensor islands”: the country has many individual sensors, but data is not exchanged quickly enough to create a unified situational picture. This is a problem that can be solved with appropriate software and procedures. These requires resources, but also for internal organizational barriers to be overcome.



Poland can build a competitive advantage as an integrator since it combines its own radar network with the implementation of IBCS, national C2 systems, large-scale C-UAS programs, and the expansion of border infrastructure. At the regional level, common standards for exchanging data on low-flying and unmanned objects as well as their integration with higher-level air defense systems, and notification of civil warning systems, as well as agreed-upon levels of information classification are needed. It is also advisable to organize regular exercises combining the operations of military systems, the Border Guard, and operators of critical infrastructure facilities.

CHAPTER 6

06

From Prototype to Sustainable Industrial Capacity: Scaling, Funding, Personnel, and Test Infrastructure

As chapters 4 and 5 have shown, industrial sovereignty is not determined solely by the place where the final product is assembled or by the nominal share of domestic production, but rather by holding control over those links in the value chain whose unavailability could halt the production, repair, or modification of a system. In accordance with the analytical framework adopted in Chapter 3, the goal here is not self-reliance, but rather guaranteed access to necessary products and services, and operational continuity – the ability to maintain and restore that access even under conditions of limited, delayed, or conditional external support.

Identifying the critical link and determining the appropriate organizational level – national, subregional, European, allied, or global partners – is, however, only the first step. The mere decision that a specific capability should be located in Poland or in the region does not mean that this capability actually exists. It must be possible to finance this capability, find appropriate personnel, test, and certify this capability as well as then scale it up and restore in a crisis. In this sense, possessing technology becomes an element of sovereignty only when it can be translated into mass production that can be scaled up and reproduced. Scaling is therefore a practical dimension of operational continuity and industrial capability.

The Ukrainian experiences described in Chapter 4 further demonstrate that an advantage in a protracted conflict is secured not by possession of any single product, but by operating a system capable of continuously replenishing losses, adapting, and scaling up production. The Ukrainian model of distributed production and short feedback loops between users and industry cannot be directly transferred to NATO countries operating under peacetime conditions. However, it confirms the importance of resilience, of the ability to substitute components and eliminate single points of failure. This chapter analyzes the cross-cutting conditions required to achieve such agency: scalability, access to financing, human capital, and testing and certification infrastructure. The basic

timeframe for the recommendations remains consistent with the three- to five-year period adopted in the report, although in the case of building certain capabilities and infrastructure, it is also necessary to take into account a longer-term perspective.

The same logic applies to the "hidden bottlenecks" identified in Chapters 4 and 5: scalability must be assessed for the entire length of the value chain, not just the end integrator. Expanding the final manufacturer's facility will not yield the expected results if one of the downstream suppliers is unable to increase the supply of electronics, specialty materials, igniters, propulsion systems, or testing services. A component of modest value can, in fact, determine whether the entire system can at all be manufactured. Therefore, for capabilities deemed strategic, it would be wise to develop not only maps of major manufacturers but also maps of key suppliers at subsequent levels and to identify individual points of failure.

A useful tool for this could be a test that answers three questions:

1. How many units can be delivered under normal operating conditions?
2. What volume can be produced after 6–12 months of mobilization?
3. How will production capacity change in case of loss of the most important foreign supplier?

Such an analysis should cover not only the nominal capacity of the production equipment but also the availability of personnel, stockpiles, testing infrastructure, and the ability to quickly substitute components.

6.1 Division of roles between the public and private sectors

The concept of sovereignty adopted in this report – defined as guaranteed access and operational continuity – has no bearing on the form of company ownership. Industrial sovereignty cannot come to mean state ownership of every company operating in the defense sector. Real control over capability is also determined by rights to technology, documentation, maintenance, and product modification; the location of infrastructure; access to key components; and the state's ability to prioritize the use of production in a crisis situation.

A greater role for direct state capital, including PGZ, seems justified primarily in activities characterized by high entry barriers, high capital intensity, a long payback period, and a long time required to restore capacity. This may apply, among other things, to heavy manufacturing, high-energy materials, ammunition, selected MRO capabilities, parts of costly research infrastructure, and infrastructure requiring special safety and security conditions. These are areas where a private investor may lack sufficient incentive to incur very high expenditures or maintain reserve production capacity that remains unused for periods of time. In this context, the Liberté report indicates that PGZ should focus on technologies with high entry barriers, mass production, and the development of domestic supply chains, leaving more room for the private sector where competition and faster innovation are possible[131].

A different approach may apply to segments characterized by short technology cycles, lower entry costs, and dual-use potential. Drones, software, artificial intelligence, sensors, autonomy, robotics, cybersecurity, and certain C-UAS systems constitute a natural competitive environment for private companies. In such cases, the state's role should primarily be to create demand, ensure access to infrastructure, financing, and testing, and facilitate competition among multiple suppliers. In such segments, the appropriate instrument of sovereignty need not be state ownership, but rather fostering a competitive domestic ecosystem of suppliers that is also available to the state in times of crisis.

Thus, the optimal model should not pit the public sector against the private sector. In many programs, the most effective approach may be to combine the heavy infrastructure and integration capabilities of large conglomerates with the innovation and agility of private companies. This requires transparent selection of partners, adequate protection of intellectual property, and the ability for suppliers to develop their own products in foreign markets as well. The form of ownership remains a tool ensuring an appropriate level of control over capacity, rather than an independent sovereignty metric.

6.2 Financing the scaling: from prototype to mass production

The gap between product development and the launch of industrial-scale production remains one of the most significant constraints on the industrial development. The support system offers a relatively large number of instruments for research and development, as well as significant funds for arms procurement itself; however, it has so far been less responsive to the needs of companies that have a product but need capital to build a facility, purchase machinery, obtain certification, build inventory, or increase their working capital. A report by the Eastern Flank Institute highlights precisely this gap – sometimes referred to as the "valley of death" – between the R&D stage and mass production[132].

A company's financial needs change as it grows. A grant may be appropriate during the research phase; equity capital may be needed to finance the first production run and organizational expansion; investment debt may be required to construct a production facility and purchase machinery; and working capital may be needed to fulfill a large

131 P. Wojciechowski, W. Decewicz, *Investments in the Polish Defense Industry*, Liberté! Reports, 2026, specifically pp. 5 and 23 ff., https://liberte.pl/app/uploads/2026/02/Inwestycje-w-polski-przemysl-obronny-Raport-Liberte.pdf.

132 A. Lisicka-Firlej, K. Michalski, P. Woyke, *A Springboard to Competitiveness. A Concept for an Instrument to Support the Polish Defense Industry*, Eastern Flank Institute, April 20, 2026, in particular pp. 2, 5, and the sections *"Dispersion of Support Instruments–An Analysis of Fragmentation"* and *"Financial Instruments,"* https://wschodniaflanka.pl/wp-content/uploads/2026/04/Perspektywa-IWF-Fundusz-Wsparcia-Przemyslu-Obronnego-IV-2026.pdf.

contract. In addition, companies need contract guarantees, advance payments, export financing, and, in some cases, a mechanism that compensates them for maintaining spare production capacity.

The challenge, therefore, does not lie merely with the availability of individual programs, but with the ability to combine them into a coherent financing pathway leading from technology to scalable production. The ability to combine equity, subordinated and commercial debt, risk-mitigation instruments, and long-term contracts that ensure the predictability of future cash flows is of particular importance.

6.3 The Security and Defense Fund and Chrobry S.A.

A significant change in this area is the establishment of the Security and Defense Fund (FBiO) as part of the National Recovery and Resilience Plan. Poland was the first EU member state to redirect a portion of its National Recovery and Resilience Plan funds toward objectives related directly to security, defense, and the state's crisis preparedness. The fund's value exceeds 22.5 billion PLN[133].

The Fund covers four main areas: civil protection, dual-use infrastructure, cybersecurity, and the modernization of enterprises. From the perspective of the defense industry, the last component is particularly important, encompassing, among other things, the construction and modernization of infrastructure for enterprises, the purchase of machinery and equipment, software, and investments that increase production capacity for security and defense purposes[134]. In this sense, FBiO may serve as one element of the response to the previously described gap – the so-called "valley of death"[135] – between R&D funding and the launch of mass production.

FBiO operates through two complementary instruments. Nearly 70% of the funds – approximately 15.7 billion PLN – have been allocated to a loan instrument administered by BGK (Polish Development Bank), while about 30% – approximately 6.7 billion PLN – has been allocated to equity investments carried out by Chrobry S.A.[136]. This structure addresses two distinct types of needs: companies with more stable cash flows can take advantage of debt financing, while enterprises undertaking riskier or capital-intensive projects can strengthen their equity.

As a general rule, Chrobry is intended to acquire minority stakes, including in private companies. The instrument is to be available to both startups and well-established companies, and the scale of individual investments can range from 10 to 750 mln zł[137]. A distinctive feature of this solution is the combination of strategic and financial criteria. Projects are evaluated, among other things, in terms of their impact on national security and technological autonomy, reducing dependence on third countries, building domestic production capacity, market potential, feasibility, and risk. The process also includes full

133 *MFiPR and BGK Launch an Investment in Security and Defense*, Ministry of Funds and Regional Policy, April 17, 2026, https://www.gov.pl/web/fundusze-regiony/mfipr-i-bgk-uruchamiaja-inwestycje-w-bezpieczenstwo-i-obronnosc; see also Security and Defense Fund, Ministry of Funds and Regional Policy–National Recovery Plan website, July 10, 2026, https://www.kpo.gov.pl/strony/o-kpo/reformy-i-inwestycje-mfipr-w-kpo/inwestycje/fundusz-bezpieczenstwa-i-obronnosci/.

134 Security and Defense Fund.

135 A. Lisicka-Firlej, K. Michalski, P. Woyke, *"A Springboard to Competitiveness: A Concept for an Instrument to Support the Polish Defense Industry,"* esp. p. 2.

136 MFiPR and BGK Launch an Investment in Security and Defense.

137 Investment Criteria, Chrobry S.A., 2026, https://chrobrysa.pl/kryteria-inwestycyjne.html (accessed: Aug. 14, 2026); FAQ, Chrobry S.A., 2026, https://chrobrysa.pl/faq.html.

due diligence and a private investor test[138].

From an industrial policy perspective, it is worth considering treating Chrobry primarily as an instrument complementing market operations. Public capital can deliver the greatest value where its presence enables the implementation of a project that, without such support, would not have been realized on an appropriate scale or within a reasonable timeframe. This may apply in particular to private growth companies, new suppliers of strategic components, and tech companies that have a product but not yet sufficient capital base to launch large-scale production.

At the same time, there is no need to exclude state-owned enterprises from the scope of the instrument. In their case, however, it is worth paying particular attention to the assessment of additionality, especially if a given entity has access to other sources of equity, bank, or budgetary financing. This would allow the instrument to remain ownership-neutral while directing capital to where its impact on creating new capacity is greatest.

Similarly, the issue of institutional governance should be approached in a balanced manner. The FBiO Steering Committee includes representatives from several ministries, including the Ministry of State Assets, and the Committee's tasks include, among other things, developing investment priorities and providing opinions on larger and particularly significant capital investments[139]. Given the Ministry of State Assets' (MAP) role as the owner of a significant portion of the state-owned defense industry, it may be worth considering the implementation of transparent procedures regarding potential conflicts of interest when reviewing policies and projects involving entities under the ministry's ownership oversight.

However, the FBiO's greatest potential is realized when the instrument is viewed as part of a broader system. In the case of a large industrial investment, a model could be elaborated where **Chrobry would provide equity capital, BGK and commercial banks - debt financing, MRiT/PAIH - cash grant for the new investment, Export Credit Insurance Corporation (KUKE) would mitigate financing risk, and the Armaments Agency would ensure predictable demand through a long-term contract**. This structure would allow to achieve a significantly greater investment value with a relatively small expenditure of the public capital.

In practice, therefore, it is worthwhile to develop this instrument based on three principles: additionality – that is capacity building that would not occur quickly enough without support; private capital mobilization (*crowding-in*) rather than its substitution; and measuring industrial outcomes, such as increased production capacity, domestic value added, exports, or reduced dependence on individual suppliers.

However, equity capital and subordinated debt do not represent full range of available instruments. Another element of this same structure could be the mitigation of risk borne by the financing entity through insurance and guarantee instruments.

138 Investment Process and Stages, Chrobry S.A., 2026, https://chrobrysa.pl/proces-i-etapy-inwestycji.html; FAQ, Chrobry S.A., 2026, https://chrobrysa.pl/faq.html (accessed August 14, 2026).

139 Act of December 4, 2025, on Special Rules for the Implementation of Tasks Related to Security and Defense Investments Carried Out Under the National Plan for Reconstruction and Resilience, Journal of Laws of 2025, item 1846, Article 15.

6.4 KUKE as a lever for debt financing

Insurance and guarantee instruments offered by the Export Credit Insurance Corporation (KUKE) as part of the system guaranteed by the State Treasury could become a key component of the system. Their significance lies not in replacing bank loans, but in mitigating the risk borne by financial institutions, particularly through debt repayment insurance and guarantees. As a result, a bank may potentially accept greater risk exposure, a longer financing term, or reduce its requirements for additional collaterals.

Currently, KUKE instruments are widely applied, among other things, to financing the exports, foreign investments, and selected energy transition projects[140]. In 2026, at the initiative of the Minister of Finance and Economy, the government began legislative work to broaden KUKE's mandate[141]. The proposed changes are intended to enable the provision of protection to investments justified by the economic interests of the Republic of Poland or the security and defense interests of the Republic of Poland. The draft provides, among other things, for the possibility of granting insurance guarantees for the repayment of loans that finance CAPEX of businesses engaged in the deliveries of products or services to the Polish Armed Forces[142].

A model combining a long-term contract from the Armaments Agency, an investment loan, and a KUKE guarantee may be of particular interest. The contract mitigates demand risk, while the guarantee reduces the bank's credit risk. As a result, it can improve a project's ability to secure financing (bankability) and facilitate the implementation of investments such as ammunition factories, MRO facilities, drone production lines, or infrastructure for manufacturing strategic components.

This solution may be particularly useful in project finance arrangements, where the investment is carried out by a special-purpose vehicle that has no significant assets other than the project itself and future cash flows from the contract. It should be noted, however, that the fact that any given project may be justified by the economic interests of the Republic of Poland or by the security and defense interests of the Republic of Poland alone does not eliminate the need for risk assessment – KUKE remains responsible for credit analysis, and the guarantee or insurance itself is provided for a fee.

If the proposed amendment is adopted, it would be wise to consider developing products tailored to the needs of defense investments as soon as possible: investment loan guarantees, working capital financing, and contract guarantees. Combining these instruments with FBiO and long-term public procurement contracts could be particularly valuable. In such a model, the procurement contract, equity capital, debt, and risk-hedging instruments do not function separately but constitute successive elements of the same mechanism for scaling up production.

140 Act of July 7, 1994, on Insurance Guaranteed by the State Treasury, Journal of Laws 2026, item 146 (Consolidated Text).

141 Draft Act Amending the Act on Insurance Guaranteed by the State Treasury, Office of the Prime Minister, March 20, 2026, https://www.gov.pl/web/premier/projekt-ustawy-o-zmianie-ustawy-o-ubezpieczeniach-gwarantowanych-przez-skarb-panstwa.

142 Draft Act Amending the Act of July 7, 1994, on Insurance Guaranteed by the State Treasury, together with the Explanatory Memorandum and Regulatory Impact Assessment (number from the Council of Ministers' list of legislative and programmatic work: UD380), May 11, 2026.

6.5 Workforce as an element of strategic infrastructure

Capital allows for the construction of a facility, but it does not, by itself, create industrial capacity. The defense sector needs not only engineers, but also technologists, machine operators, welders, mechanics, electronics technicians, chemists, embedded systems programmers, and specialists in quality, certification, and supply chain management. In many of these professions, the time required to reach full productivity is measured in years.

From the perspective of the replacement time criterion used in this report, this means that the critical resource is not only the number of employees but also the ability to replace specific competencies. In some cases, a production facility or a machine can be acquired more quickly than a process engineer, a high-energy materials operator, or a maintenance specialist with several years of experience in running a specific process. The loss of a team can therefore create a bottleneck just as significant as the lack of a machine or component.

For this reason, major industrial investments should be linked to workforce plans that include the projected staffing levels, recruitment sources, training duration, and the ability to transition to multi-shift operations. Public policy could make greater use of corporate-sponsored education, dual education, industry-commissioned degree programs, scholarships, and training centers established at production facilities.

It is also worth treating the skills of former soldiers and law enforcement officers as a resource for the entire innovation ecosystem. Those leaving the service possess practical knowledge of user needs, procedures, logistics, and the limitations of current equipment. These skills can be particularly valuable in startups, venture capital funds, due diligence processes, product testing, and procurement management. Making broader use of them can also shorten the feedback loop between end-users and industry, as described in Chapter 4.

In this context, one might consider creating a scholarship program enabling former soldiers and law enforcement officers to pursue, among other things, technical studies, an MBA, or education in entrepreneurship, cybersecurity, or venture capital, combined with internships at startups, funds, and development institutions[143]. This would be a way to retain operational knowledge within the security system even after the end of service.

6.6 Testing infrastructure and certification

Testing infrastructure and certification constitute one of the cross-cutting bottlenecks also identified in the matrix in Chapter 7. It is not a physical lack of infrastructure that is always at fault. In many cases, the limitation may be its capacity, its accessibility for businesses as well as time required for qualification procedures and their predictability. In the sovereignty matrix, testing and certification infrastructure has been classified as a national capability whose primary weakness lies in the procedural dimension.

A company may have a ready-made solution but lack timely access to a test range, airspace, a ballistic laboratory, or infrastructure enabling testing of electronic warfare or

143 An example of a program supporting the further professional development of former soldiers is *The Cambridge MBA Scholarship for Military Veterans*. For more information: https://www.jbs.cam.ac.uk/scholarships-loans/the-cambridge-mba-scholarship-for-military-veterans/.

C-UAS systems. The problem with the access to testing and certification infrastructure has also been highlighted in gap analyses of the Polish defense industry support ecosystem[144]. For example, in sectors characterized by short development cycles – especially in the case of unmanned systems – long wait times for the next test can be a barrier just as significant as a lack of funding.

Startups and SMEs are particularly affected. The solution does not necessarily have to be a single central testing center or the construction of an entirely new infrastructure from scratch. A national network encompassing the infrastructure of the Armed Forces, military institutes, the Łukasiewicz Research Network, universities, and private laboratories may prove to be more effective.

Considerations could include development of a public catalog listing available infrastructure, a single point of contact for businesses, testing vouchers for SMEs, and a fast-track process for technologies addressing urgent operational needs. In some areas, regional cooperation and mutual recognition of test results may also be beneficial. This would allow for an increase in the system's effective throughput without the need to duplicate all types of infrastructure in every country.

6.7 Maintaining competencies and regionalizing the demand

Recovery time applies to individual components as well as to specific industrial capabilities. Once a team, a network of subcontractors, certifications, and practical manufacturing know-how are lost, rebuilding them may take longer than acquisition of physical assets themselves. Building a factory or service center is therefore only the first step. If no further orders come in after the program ends, personnel, subcontractors, and capabilities are gradually lost.

Therefore, industrial policy should encompass not only the development of new capabilities but also their long-term utilization. It is essential to plan **a long-term order portfolio (*pipeline*)** covering production, repairs, modernization, and exports. In large programs, it is worth considering in advance which subsequent projects will be able to put to use the existing infrastructure and trained workforce.

One way to increase the scale of demand is through regional specialization. Not every capability needs to be maintained in its entirety by every country. As the conclusions from the chapter on MRO show, Poland can leverage the scale of its own fleets and industrial expertise to provide some services to other countries in the region as well. At the same time, excessive concentration of capabilities in a single facility or a single country creates a new single point of failure. Regional specialization combined with a reasonable level of redundancy may therefore be the right approach. Chapter 5 has already indicated that the prerequisites for leveraging Poland's MRO potential are the ability to perform major overhauls, access to parts and documentation, and the capacity to rapidly increase throughput.

Looking beyond the basic scope of this report, the example of the shipbuilding industry may provide good illustration of a a similar logic. The Miecznik program has led to significant investments in the infrastructure and capabilities of PGZ Stocznia Wojenna and

144 A. Lisicka-Firlej, K. Michalski, P. Woyke, *"A Springboard to Competitiveness: A Concept for an Instrument to Support the Polish Defense Industry,"* esp. p. 15.

its partner entities[145]. Once the construction of the three frigates is complete, these resources should be utilized as effectively as possible in subsequent programs – such as those involving logistics and transport ships[146], patrol vessels, or support units – provided that they align with the operational needs of the Navy.

This does not mean equipment must be ordered only to keep plants operational. Operational needs should remain the top priority, while the schedule for future programs can be designed to minimize multi-year gaps, which lead to the loss of specialized personnel, subcontractors, and infrastructure.

6.8 Strategic stockpiles

A scalable production line does not constitute real capacity if there is shortage of raw materials and input components. This applies, among other things, to chemical precursors, high-energy materials, electronics, optics, batteries, permanent magnets, bearings, drive components, and other semi-finished products with long lead times.

As noted in Chapter 3, the solution does not necessarily have to be the full localization of production for every component. Depending on the lead time for replacing a given component, appropriate measures may include stockpiles, a secondary qualified supply source, contracts that secure access, or regional and European mechanisms. In this context, stockpiles should be assessed from the perspective of actual production continuity – including in "Days of Supply" – rather than just their book value.

Not all such resources need to be held by the state. A multi-tiered model is possible, encompassing state reserves, reserves maintained by companies in exchange for appropriate compensation, option contracts, and joint regional and European mechanisms.

From a scaling perspective, this primarily means that capacity expansion plans must be linked to securing the materials necessary for production and the financing of working capital and stockpiles. Expanding production lines without ensuring access to key raw materials or components may increase a plant's nominal capacity without a corresponding increase in actual production capacity.

6.9 Conclusions

Identifying the appropriate level of control over a link in the value chain is only the first step toward ensuring its resilience. In practice, capacity exists only when it can be financed, staffed, tested, supplied with materials as well as expanded and restored in a timely manner under crisis conditions. Therefore, the ability to scale is not solely a company characteristic but the result of the interaction between procurement policy, the financial system, human capital, testing infrastructure, and supply chain organization.

145 J. Ciślak, *"Mieczniki Under Construction,"* Defence24, May 21, 2025, https://defence24.pl/sily-zbrojne/mieczniki-w-budowie-raport.

146 R. Kamiński, *"Another Transport and Mine-Laying Ship Up for Refurbishment. Will the Navy Acquire New Ones?"*, GospodarkaMorska.pl, May 15, 2026, https://www.gospodarkamorska.pl/kolejny-okret-transportowo-minowy-do-remontu-czy-marynarka-wojenna-pozyska-nowe-92561. According to information provided by the Navy Inspectorate, plans are in place to acquire up to five vessels by 2039 to replace the Lublin-class transport and mine-laying ships. The author notes that the successors to the Lublin-class transport and mine-laying ships could potentially be transport ships or amphibious dock landing ships "of similar size or larger, often with greater capabilities (...), which can also carry, provided they have a deck adapted for this purpose, aircraft such as helicopters and drones." Hypothetically, the construction of ships of this class and size over many years could ensure the utilization, maintenance, and development of the expertise built up in the shipbuilding industry as part of the Miecznik Program.

In parallel, building industrial sovereignty does not require a uniform model of ownership and organization across all segments of the defense sector. The state should concentrate its own assets primarily where barriers to entry are highest, the time required to restore capabilities is long, and the market is unable to maintain the necessary infrastructure or reserve production capacity on its own. In more competitive areas, a greater role may fall to the private sector, supported by predictable access to orders, capital, testing infrastructure, and other public policy instruments. The key, therefore, is not to maximize the share of state ownership, but to select for capabilities an organizational model that best ensures guaranteed access, scalability, and operational continuity.

Poland is gradually developing an increasingly broad range of financial instruments. A model combining predictable public procurement with equity capital from Chrobry S.A., financing from BGK and commercial banks, and – once the proposed changes take effect – KUKE instruments that mitigate part of the financing risk provide a model of particular interest. It allows procurement and financial policies to be treated as components of a single mechanism for building industrial capacity.

For links deemed particularly critical, it is therefore advisable to supplement the assessment of the "appropriate level" with a practical scaling plan covering funding sources, key suppliers, staff replacement time, access to testing, and security of production materials. Chapter 7 applies this perspective to identify specific links in the value chain and prioritize bottlenecks based on their importance, maturity, and replacement time. The unit of analysis remains the value chain link, not the final product – thereby making it possible to do both: identify dependencies common to many programs and distinguish between managed dependencies and gaps that are – in practice - unprotected.

CHAPTER 7

07

Sovereignty Matrix for Selected Areas and Risk Map

The previous chapters described the five selected areas individually. Here, without summarizing them again, we compare them side by side in order to answer questions that cannot be addressed within a single case study. Which link in the value chain is a bottleneck in several programs at once? Where does the same type of dependency recur? Are national competencies concentrated in the layers that actually determine operational continuity? This chapter answers these questions in four sections. For the purposes of this report, several technological areas were selected as critical to specific operational capabilities or branches of the military – ranging from heavy land platforms to the lower tier of air defense. Consequently, it was necessary to adopt a certain level of generalization, for example, with regard to counter-drone (C-UAS) systems, which consist of numerous components and pose a particular challenge when it comes to analyzing value chains.

The unit of analysis is the value chain link, not the product. Powertrains and transmissions are not an issue specific to the Borsuk, Krab, or K2PL individually, but rather a single family of components common to all these programs. Similarly, nitrocellulose is not an issue specific to the 155 mm caliber, but rather to the entire ammunition portfolio. A product-based approach would scatter these interdependencies across a dozen or so separate paragraphs, systematically downplaying their significance.

Each link is described twice. The “appropriate level” column indicates where a decision regarding a given capability should be made to ensure guaranteed access and operational continuity, regardless of where the decision-making authority is located. The “actual level” column describes the status as of August 2026. The difference between them (Δ) constitutes the proper findings made in the chapter. This structure has one significant conclusion: for many links, the appropriate level is not national, and Δ is zero despite

full dependence on imports. Under these assumptions, Δ takes on four values:

- 0: the actual level corresponds to the appropriate level or exceeds it, with a number of qualified sources that makes the dependency manageable; the dependency, if it exists, is located where it should be;
- −1: secured gap: at least one reserve instrument exists (e.g., a second qualified source, stockpile, right to repair, or qualified substitute); this category also includes links where the actual level corresponds to the appropriate level but relies on a single supplier;
- −2: unmitigated gap: none of the above are present;
- N/A: Δ cannot be determined because the supplier is known, but the mitigation measure has not been publicly disclosed.

The most important distinction is between "−1" and "−2." A component that is entirely imported but has two qualified allied sources, a stockpile, and a right to repair is a managed risk. A component from a single supplier without a right to repair and without stockpile is a real risk, even if assembly takes place in Poland and the localization rate looks favorable.

Maturity:

- F: status confirmed by deliveries, production, or exports;
- B: construction has physically begun or a production line under commissioning;
- U: a signed contract without production launch;
- D: letter of intent, framework agreement, declaration, or target timeline;
- bd.: no verifiable public data;
- –: a category where there is no national program or implementation phase to which the maturity level could apply.

In several rows, Δ is zero, even though the capacity has not yet been commissioned, the level of capacity organization is appropriate, and the risk lies in the maturity, not location. Both columns should be read together.

In several cells (including the most important one – that is, the relationship between the volume produced in Poland and that outsourced abroad), the table cells are shaded gray. The data necessary to determine the level of sovereignty are not publicly available, and in some cases, a refusal to disclose them has been explicit. The matrix covers the areas discussed in Chapter 5, supplemented by four cross-sectional cells identified in Chapters 4 and 6.

7.1 Sovereignty matrix

#	Value chain link	Chapter	Appropriate Level	Actual Level (August 2026)	Replacement time	Maturity	Δ
Chemistry and High-Energy Materials							
1	**Concentrated nitric acid, nitrosyls**	5.1.3	domestic	domestic, export	–	F	0
2	**TNT – current capacity**	5.1.3	domestic	domestic, export	–	F	0
3	**TNT – doubled capacity**	5.1.3	domestic	project agreement, construction not yet started	–	U	0
4	**RDX / PETN**	5.1.3	national / subregional	import; two national projects in the pre-construction phase	>24 months	U	−2
5	**Nitrocellulose**	5.1.3	national / subregional	European (DE, FR)	>24 months	D	−2
6	**Single base propellant**	5.1.3	domestic	domestic, but no information on scale	–	n/a	0
7	**Multi-base and triple-base propellants**	5.1.3	domestic	import of components; trial batch produced	>24 months	U	−2
8	**Modular charge systems (MCS / BMCS)**	5.1.3	domestic	assembly from French components	6–24 months	B	−1
Ammunition – manufacturing							
9	**155-mm ammunition – current production capacity**	5.1.3	domestic	domestic	–	F	0
10	**155 mm projectile bodies – expansion**	5.1.3	domestic	under construction	–	B	0
11	**Reloading**	5.1.3	domestic	domestic + international orders; proportion undisclosed	–	F	0
12	**Mechanical igniters**	5.1.3	domestic	domestic	–	F	0
13	**Electronic igniters**	5.1.3	subregional	imports; the region is ahead of Poland	6–24 months	D	−2
14	**Gas generators**	5.1.3	domestic	domestic, under expansion	–	B	0
15	**Complete sets outside of PGZ**	5.1.2	domestic	under development, not yet in serial production	–	U	−1
16	**Long-range guided missiles**	5.1.2	domestic	imports; domestic production starting in 2030	>24 months	B	−1
17	**Anti-tank mines**	5.1.2	domestic	domestic	–	F	0
18	**Anti-personnel mines**	5.1.2	domestic	agreements after February 2026	–	U	−1
UAVs and C-UAS							
19	**Reconnaissance platforms and loitering munitions**	5.2.2	domestic	domestic, export	–	F	0
20	**Integration layer, C2, cryptography**	5.2.3	domestic	domestic	–	F	0
21	**Assured PNT, anti-jam, anti-spoofing**	5.2.2	NATO	NATO (Canada)	6–24 months	D	−1

#	Value chain link	Chapter	Appropriate Level	Actual Level (August 2026)	Replacement time	Maturity	Δ
22	**Semiconductors and mass-market optoelectronics**	5.2.3	European / global partners	global	>24 months	–	0
23	**Battery cells and packs**	5.2.3	European	global; battery packs can be assembled domestically	n/a	U	–1
24	**C-UAS radars**	5.2.2	domestic	contract under delivery	–	U	0
25	**RF Sensors**	5.2.2	domestic	domestic	–	n/a	0
26	**Barrel-type effectors**	5.2.2	domestic	12.7 mm (domestic); 30 mm (NATO); 35 mm (domestic)	6–24 months (30 mm)	U (30 mm)	–1 (30 mm)
27	**Interceptor drones**	5.2.2	domestic	European / global partners	n/a	n/a	n/a
28	**Jammers**	5.2.2	domestic	domestic	–	F	0
29	**70 mm rocket projectiles**	5.2.2	domestic	NATO	>24 months	n/a	n/a
	Land Vehicles and MRO						
30	**Platform architecture and documentation**	5.3.2	domestic	domestic (Borsuk); licensed (Rosomak)	–	F	0
31	**Emergency and modification powers**	5.3.3	domestic	license secured through 2034 / 2064	–	F	0
32	**Powertrains and gearboxes**	5.3.2	subregional	NATO (OEM); domestic service	>24 months	B	–1
33	**Major overhaul of powertrains**	5.4.1	domestic	partial, licensed	>24 months	B	–1
34	**Active hard-kill protection**	5.3.2	national / subregional	import; no national program	>24 months	–	–2
35	**Heavy MRO of allied platforms**	5.4.1	domestic	domestic, licensed	–	F	0
36	**High-speed rotating parts (high-wear parts)**	5.4.3	domestic	partially domestic	<6 months	B	–1
	Sensors and command						
37	**Active and passive radars**	5.5.2	European, global partners	domestic, European, global partners	–	F	0
38	**C2 Architecture for air defense**	5.5.2	European, global partners, NATO	domestic, European, global partners, NATO	N/A	F	0
39	**Capabilities for integrating national sensors**	5.5.2	domestic	offset in implementation	–	B	–1
40	**National data fusion layer outside the IBCS**	5.5.3	domestic	fragmented	–	U	–1
	Cross-sectional						
41	**Test infrastructure and certification**	5.2.3, 6	domestic	domestic; procedural bottleneck	–	B	–1
42	**Power supply and the insularity of facilities**	4.3	domestic	lack of systemic solutions	–	D	–2

#	Value chain link	Chapter	Appropriate Level	Actual Level (August 2026)	Replacement time	Maturity	Δ
43	**Stockpiles of critical components**	4.3	domestic	undisclosed	n/a	n/a	n/a
44	**Production volume reporting**	5.1.4	domestic	no mechanism	–	n/a	-2

The analysis reveals five findings that are not apparent within the individual case studies:

First, Poland is strong at both ends of the chain but weak in the middle. At the input end of the ammunition chain, there are two links with confirmed export status – chemical precursors and TNT. At the output end, in the integration layer, command and control software, data exchange architecture, and unmanned platform design, domestic capabilities are equally robust. Unsecured gaps are concentrated in the middle: in propellant chemistry, in fuse electronics, and in active vehicle protection; gap in the propulsion systems is secured solely by licensed service. This reverses the intuition prevalent in the public debate, where sovereignty is measured by the presence of a final assembly line. In the production matrix, final assembly is precisely the link where Poland is the strongest and which, at the same time, contributes the least.

> **Poland is strong at both ends of the chain but weak in the middle.**

Second, there are seven unaddressed gaps, not several dozen. A value of −2 is assigned to: RDX/PETN, nitrocellulose, multi-base and triple-base propellants, electronic fuses, active “hard-kill” protection, power supply for facilities, and the lack of a reporting mechanism. The first three fall within a single technological field (the chemistry of propellants and explosives), which means that the list of investment priorities is short and internally consistent. The problem is therefore narrow in scope and thus solvable within the timeframe of this report. The bad news is that all these components have a replacement cycle exceeding two years, so decisions made today will translate into actual capabilities in 3–5 years at the earliest.

7

unaddressed gaps, not several dozen

−2

Δ value: no second source, stockpile, right to repair or substitute

Third, most import dependencies are appropriately managed and should not be subject to a “Polonization” policy. For over 30 components, the dependence is either at the appropriate level or is hedged by a reserve mechanism. A Δ equal to zero – indicating full dependence on foreign supplies – occurs in semiconductors. For these components, the appropriate level for capacity organization is the European, allied, or global partners level, and any attempt to bring them to the national level would be costly and illusory. The criterion of sovereignty shifts here from the component’s origin to the conditions of access: integration rights and access to APIs, qualified substitute, stockpile measured in months of production, and the right to repair outside an authorized foreign service center. Distinguishing between these two categories serves as a practical test for the quality of

industrial policy – an instrument suitable for line 5 is useless for line 22, where only a list of critical components with qualified substitutes is effective.

Fourth, the risk has shifted from production to effectors. The expansion of the anti-drone segment reveals a pattern absent in other areas: the detection and command layer is domestic and proven through deployments, while three out of four classes of effectors are entirely or predominantly imported. Domestically produced items include 12.7 mm and 35 mm barrel-fired effectors (as well as conventional ammunition for weapons of all calibers) and non-kinetic measures. In the fastest-growing segment of procurement, this dependency takes a different form than in the case of artillery ammunition: it is not based on raw materials but on effectors, and has so far been absent from the public debate.

Fifth, it is currently impossible to determine the level of sovereignty for three areas based on public data. These are: the terms of supply for interceptor drones and 70-mm missiles, and stockpiles of critical components. In all cases, it is not the supplier that is unknown, but the safeguard – stockpiles, a secondary source, or a qualified substitute – meaning that the very information needed to determine whether the risk is under control or real is lacking.

7.2 Hierarchy of bottlenecks

The matrix shows where capabilities are located. This subsection, in turn, answers another question: which of them will fail first, and how far-reaching will the impact be? Three factors determine the answer to this question: how long it takes to restore or replace a link, how likely a supply disruption is, and in how many of the programs described in Chapter 5 name the same link as a prerequisite. The third criterion is the most important and is fully quantifiable without additional data, because it reveals what the domestic value share indicator conceals: a single, low-value component without which the final product cannot be manufactured at all.

Five components are at the top of this hierarchy. Nitrocellulose and multi-base propellant are essential for four classes of ammunition at once (artillery, mortar, tank, and rocket) with a replacement time exceeding 2 years. Electronic fuses are used in three of these classes, with the region ahead of Poland with their production. Powertrains and transmissions are common to the Borsuk, Krab, K2PL, and Rosomak, as well as to the maintenance of Leopard and Abrams fleets, meaning they cascade from the highest level in the entire list. A component not previously described as shared stands there with them: the 30 mm cannon with a remotely controlled turret, used in the SAN system, which is structurally similar to the armament of the Rosomaks and Borsuks; thus, a single foreign effector component simultaneously determines the ability to secure the lowest layer of air defense. The matrix classifies the first three components as unprotected gaps; the last two are equipped with a protective measure, albeit a weak one: domestic repair licenses in one case and a declaration of turret production in Poland in the other. This qualifies them for the watch list: if the declaration does not turn into a contract, they must be moved to the first category.

The effector layer, meanwhile, reveals a pattern opposite to that of the ammunition layer. Detection, command and control, and non-kinetic measures are domestically produced and proven through deployment, whereas three of the four effector classes are entirely or

predominantly imported: a 30-mm cannon from Norway with an American main gun, interceptor drones, and 70-mm rounds from the United States. Only the extreme calibers – 12.7 and 35 mm – remain domestically produced.

Two links are not subject to supply risks and require separate treatment. Certification and testing infrastructure cannot be replicated in a market-based sense, as their duration depends on administrative decisions; however, they apply to every program introducing a new product version. The withdrawal of a private manufacturer from the 155-mm ammunition procurement process, given the impossibility of reconciling the two-year certification process with funding deadlines, demonstrates that this risk materializes not as a delay but as a reduction in the number of suppliers; in the anti-drone sector, it has an even greater impact, as the pace of version updates is incomparably higher there. Power supply, in turn, is the only link whose disruption is not independent of the others: dispersing production does not increase resilience if all facilities depend on the same vulnerable power infrastructure.

Three links cannot be placed within this hierarchy at all. Data on the supply conditions for interceptor drones and 70-mm missiles, as well as the status of critical component stockpiles, are not public. The supplier is known, but the protective measure is unknown – in other words, the very information that determines whether the risk is under control is missing. At the opposite end of the spectrum there are the most technologically advanced and least dangerous dependencies: semiconductors, battery cells, and resilient navigation technologies. In their case, low risk does not result from the location of their production but from the number of qualified sources in allied countries. This mechanism works both ways, so monitoring the number of suppliers is a cheaper and faster option here than investing in localization – and, in practice, it is the only feasible one.

7.3 The subregion's specialized niches in European value chains

A list of niches can easily turn into a wish list, which is why each candidate is evaluated with the use of four questions:

- Does the capacity physically exist today, rather than being part of a future target timeline?
- Does regional demand exceed national demand? Otherwise, it is not a niche but production for domestic consumption;
- Is there any other entity in the region that is clearly further along?
- and does Poland control the entry conditions – that is, licenses, access to documentation, and export conditions – that allow for production without the consent of a third party?

Three sectors meet all four conditions. TNT is the clearest example: the only large, operational factory in the European Union, an export position confirmed by contracts with an American customer, no competitors in the region, and complete freedom to set sales terms. Loitering munitions and reconnaissance drones have a proven export track record and, what is crucial in this segment, a domestic integration layer that allows for the sale of

a system rather than individual units. Anti-drone radars and command systems are based on capabilities proven through deployments, and regional demand in this sector is structurally greater than domestic demand, as every country on the Eastern Flank is building its own detection layer. There is one caveat, however: control over entry conditions covers detection and command, but not effectors, so the export offer is complete only if the customer has its own strike capabilities or acquires them in parallel.

Three candidates meet the criteria conditionally, and each is limited by the same factor – the fourth criterion. This is most evident in heavy MRO: the capability exists, regional demand is real, there is no competition in the region, but the expertise is licensed, and it is the licensor who decides whether a Polish facility can service another user's equipment. The recommendation to formally recognize selected facilities as regional support centers is therefore, in essence, a recommendation to resolve this single issue, and its implementation will determine whether MRO becomes a niche market or remains limited to servicing its own, Polish fleet. Similarly, in the integration of sensors and data fusion, the scope of rights obtained under the offset program determines whether Poland can integrate third-country components into the allied command architecture or only its own. Test and range infrastructure is the least obvious yet cheapest option: the bottleneck affects the entire region, and the first country to offer a predictable and rapid validation process for new versions of unmanned systems will gain an advantage without any investment into production capacity.

Two testing candidates do not meet the criteria, and this determination is analytically stronger than simply adding them to the list with reservations. 155 mm artillery ammunition, treated in the public debate as a flagship indicator of success, does not meet the first criterion – since target production capacity stays on paper only – nor the third, since a regional competitor has already reached the phase of production and export deliveries. This does not mean that investments in this segment are misguided, but that they are justified by the need to meet domestic demand and rebuild stockpiles, rather than to establish a position as a regional supplier. Distinguishing between these two objectives has direct implications for expectations regarding timelines and for how the program is accounted for. Modular chargers and propellants are ruled out for the same reasons, but in a more severe form, since domestic capability in this area currently consists of assembly from imported components.

The above analysis provides both: a filter and a result. The institutional mechanisms for entering these niches – including shared stockpiles, maintenance hubs, shared training ranges, industrial mobilization exercises, and procurement instruments – are the subject of Chapter 8.

7.4 Cross-cutting conclusions

Sovereignty is organized in layers, not geographically. A comparison of the five areas shows that national competencies are concentrated in the design, integration, and program layers, as well as at the upstream end of the raw materials chain with gaps in the intermediate chemical and mechanical links. Since the latter have the longest replacement time, the application of a domestic value share indicator results, under these conditions, in systematically overestimating the sovereignty levels and should not be used as a criterion for evaluating programs.

The list of actual priorities is short. The matrix identifies seven links with unaddressed gaps, three of which fall within a single technology band, and the hierarchy in Section 7.2 highlights five links where the consequences of disruption are most severe. Both lists overlap for three items, so in total we are talking about nine links – a scope that is feasible within the report's timeframe, provided that investment decisions regarding the propellant and explosive chemistry segments are made a priority rather than a secondary consideration. Replacement time for all the links found on both lists exceeds 2 years, which means that delays in decision-making cannot be made up for by increasing expenditures later on.

Managed dependency is an objective here, not failure. For more than three-quarters of the links, the appropriate response is not localizing the production, but a set of access instruments: a second qualified source, stockpiles measured in months of production, integration rights, and the right to repair. Recommendations should distinguish between these two types of intervention, as the instruments are not interchangeable, and the use of investment tools to address access problems is the primary reason for squandering in this area of industrial policy.

Measurability is a prerequisite, not a reporting requirement. Three elements remain impossible to assess based on public data, and their distribution is not random: in each case, the supplier is known, but the hedging instrument is unknown – that is, there is a lack of information on whether the risk is under control. In practice, this means that decisions on subsequent funding tranches are made without data that would allow for an assessment of the effects of previous ones. Closing this gap requires neither legislation nor new funding; it is therefore both the least expensive and can be implemented the most quickly out of all recommendations in this report.

> **Managed dependency is an objective here, not failure.**

CHAPTER 8

08

Recommendations

The recommendations formulated at the end of each case study are not repeated here. The purpose of this chapter is to select the most important ones, determine the factors influencing each element, identify the addressee who holds the actual decision-making authority, and specify the instrument they can use.

The matrix from Chapter 7 groups the links into four distinct sets which correspond to three intervention pathways:

- For links marked as lacking verifiable data only a decision regarding the reporting obligation is required: this is the measurement track, which requires no resources. This also includes the absence of a volume-based reporting mechanism, which the matrix classifies as an unprotected gap because no protective instrument exists for it, yet its elimination requires neither legislation nor new financial means.

- Links with Δ equal to zero and links in a secured gap require implementation of contractual clauses, stockpiles, alternative sources, and rights: this is the access track, covering a total of 34 out of 44 links, mostly without new funding, implemented by amending document templates rather than through investments. In the first of these sets, the dependency is properly addressed, and the access instruments serve to maintain it; in the second, they serve to close the existing gap.

- The links in the unsecured gap require capital and a binding investment decisions: this is the investment track, the most expensive and the one with the longest implementation timeline.

The order on the list follows from this division and is the opposite of what one might intuitively expect. The measurement track comes first not because it is the most important, but because it determines the rationality of the other two. As long as

domestically produced volume is not separated from the production volume outsourced abroad, and final assembly is not separated from component production, subsequent tranches of the public funding are released without information on the effects of the previous ones – not out of bad faith, but due to lack of data that no one is required to produce. The access track comes second because its instruments are inexpensive, fast, and entirely within the responsibility of the contracting authority. The investment track is third in the order of implementation, but decisions it requires must be made earliest, as their implementation timeline extends beyond the report's horizon. This asymmetry – implementing the cheapest measures first, deciding on the most expensive ones first – aptly summarizes the entire chapter.

8.1 The Nordic countries as a reference point: what exactly can be adopted

The Nordic countries (Denmark, Finland, Iceland, Sweden, Norway) serve as an appropriate point of reference not only because of the threat perception they share with Poland, but also because they have solved a problem similar to Poland's: how to coordinate industrial capabilities among countries of varying sizes without creating a complex structure that additionally requires unanimity.

The answer lies in the principle upon which all Nordic cooperation has been based since the establishment of NORDEFCO in 2009: participation in individual projects and the pace of their implementation remain a national decision; cooperation does not have to include all participants; and bilateral and trilateral projects are open to the subsequent accession of others. For a region where countries differ in the size of their demand, this is the only structure that does not raise suspicions that the joint instrument may be, in fact, the industrial policy of the largest participant. Below there is a brief overview of two example mechanisms that are suitable for direct implementation, each addressing a different finding of this report:

- Harmonization of certification. In early 2025, Finland, Denmark, Norway, and Sweden concluded a technical agreement on the standardization of ammunition certification. The goal, explicitly stated, was to simplify joint procurement and ensure access to the same types of ammunition. This is the least expensive measure in the entire catalog and, at the same time, the one that addresses the bottleneck with the largest cascading effect in the Polish matrix. The Nordic countries treated certification not as a technical issue, but as a prerequisite for any industrial cooperation – and they did so before, rather than after, making procurement decisions[147].

- Strategic partnership agreement with the manufacturer. In June 2025, Denmark, Finland, Norway, and Sweden signed an agreement with Nammo that focuses not on volume but on capability: deliveries and service in peacetime, during crises, and in wartime; joint procurement of ammunition; cross-border joint stockpiles; and the potential to scale up production capacity, initially for 155 mm caliber and small arms ammunition[148]. This model addresses the problem described in this report as the lack

147 *Nordic Nations Unite to Harmonize Ammunition Certification*, Nordic Defense Review, 2025, https://nordicdefencereview.com/nordic-nations-unite-to-harmonise-ammunition-certification/.

148 *Nordic Countries Enter Strategic Partnership with Nammo*, Nammo, 2025, https://www.nammo.com/nordic-countries-enter-strategic-partnership-with-nammo/.

of emergency powers and the absence of a second contractor: the state does not need to take ownership or build a second facility if it has contracted for supply priority and defined conditions for increasing volume in advance. Moreover, the structure is contractual, not statutory, which makes it transferable without changes to the law.

8.2 Five general recommendations

ROADMAP **Five general recommendations over time**

RECOMMENDATION	UP TO 12 MO.	1–3 YEARS	3–5 YEARS	COST
1 Volume reporting as a condition for releasing a financial tranche	12 months			decision
2 A single investment procedure for the entire range of propellant and explosive chemicals	decision		implementation	capital
3 Drivetrains and gearboxes as a horizontal family of components	map and owner		maintenance cap.	regulation, then capital
4 Shifting the burden of certification from the product to the process	12 months			decision and limited outlays
5 Subregional cooperation: three products, one host, twelve months	12 months			decision

Based on the “Timeframe” and “Cost” fields in subsection 8.2.

1. Volume reporting as a condition for releasing a financial tranche

Addressees: the Ministry of State Assets as the administrator of the Capital Investment Fund, the Armaments Agency, Bank Gospodarstwa Krajowego as the owner of the special-purpose vehicle Chrobry S.A., and the Ministry of Funds and Regional Policy as a party to the Security and Defense Fund agreement.

Instrument: a uniform reporting requirement in the template of the grant agreement and in implementation agreements, which also covers support provided under the Polish Investment Zone.

Timeframe: 12 months.

Cost: decision.

Metric: the first report distinguishing between volume produced in Poland and that outsourced abroad, as well as between final assembly and component production, covering the year 2027.

2. A single investment procedure for the entire range of propellant and explosive chemicals

Addressees: The Ministry of State Assets and the Ministry of National Defense, in collaboration with the minister responsible for the economy.

Instrument: A multiyear program covering nitrocellulose, multi-base propellant, and hexogen as a package, with a purchase guarantee as a condition for private capital investment.

Timeframe: decision within 12 months; implementation over 3–5 years.

Cost: capital.

Metric: a binding investment decision with allocated funding and schedule.

3. Drivetrains and gearboxes as a horizontal family of components

Addressees: The Armaments Agency as the owner of the implementation contracts, the Ministry of National Defense as the managing authority.

Instrument: a replacement map as a mandatory attachment to every implementation contract for a land-based platform and a single manager for the component family across programs.

Timeframe: 12 months for the map and designation of the manager; 3–5 years for maintenance capabilities.

Cost: regulatory measures, followed by capital expenditure.

Metric: the number of programs covered by the common substitution map and the first *make-or-buy* decision defining the scope of capabilities maintained domestically.

4. Shifting the burden of certification from the product to the process

Addressees: The Ministry of National Defense as the decision-making body; the Armaments Agency; and research institutes as implementing entities.

Instrument: A ministerial decision extending the special testing procedure beyond unmanned systems, along with the recognition of test results conducted by regional partners.

Timeframe: 12 months.

Cost: the decision and limited expenditures on testing facility capacity.

Metric: average time from submission to decision and the number of versions approved annually.

5. Subregional cooperation: three products, one host, twelve months

Addressees: The Ministry of National Defense and the Ministry of Foreign Affairs, together with regional partners.

Instrument: an agreement concluded within the existing cooperation framework, without creating a new institution.

Timeframe: 12 months.

Cost: decision.

Metric: Three signed implementing documents:

1. on the mutual recognition of test results and certification, covering at least ammunition and unmanned systems;
2. on a joint schedule for industrial mobilization exercises;
3. on agreed rules for the creation and release of joint stocks of critical components.

8.3 Addressees

Poland

The Ministry of National Defense is responsible for two recommendations of a decision-making nature: shifting the burden of certification from the product to the process and assigning a manager to the horizontal family of powertrain components.

The Armaments Agency is the primary addressee of most of the action plan, as it possesses an instrument that no one else has at their disposal: the template executive contract. Amending the contract template is the most frequently cited implementation tool in this report and, at the same time, the least expensive: the obligation to report the assembly and production of subassemblies separately, the requirement to identify a second qualified source, crisis clauses, and integration rights – all of these are contractual provisions, not statutory ones (though they will have undetermined financial consequences as additional contractual provisions).

The Ministry of State Assets, as the administrator of the Capital Investment Fund and the corporate governance body, is the addressee of the reporting requirement and the investment decision regarding propellant and explosive chemicals.

The national technology and industrial base – including both state-owned companies and private entities – is subject to a single requirement: quantitative reporting and substitution maps are a condition for access to public funding, not an additional administrative burden.

Regional partners

With regard to regional partners, the division of roles should result from an analysis of market niches, not from negotiations over proportions. Poland contributes to the common pool what it has proven through deliveries: high-energy munitions, anti-drone radars and command systems, loitering munitions, and reconnaissance drones, as well as the scale of its maintenance base, which no one else in the region possesses. In return, Poland seeks two things it cannot provide on its own: mutual recognition of research results, which would shorten the time needed to introduce new versions, and participation in joint component stockpiles, for which it relies on the same sources as its partners.

EU and allied level

In accordance with the narrowed scope adopted in the report, the recommendations addressed to this level cover only these matters where Poland and the countries of the region act as proposers rather than petitioners. There are the three recommendations:

1. inclusion of the propellants and explosives on the lists of critical components and in the multinational stockpiling mechanisms referred to in the allied action plan for defense production;

2. structuring the successors to current financial instruments in a manner that makes support contingent upon verifiable volume reporting, which is also the essence of Recommendation no 1;

3. recognition of mutual acceptance of test results and certifications as an element of interoperability, rather than a matter of national regulatory sovereignty. Without this step, no joint procurement will shorten delivery times.

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INSTYTUT SOBIESKIEGO

The Sobieski Institute is a Polish private think tank whose mission is to "Create ideas for Poland." Having launched its activities in 2003, it was registered as a foundation in 2005. Between 2003 and 2010, the Institute published the quarterly "Międzynarodowy Przegląd Polityczny" (International Political Review). Between 2011 and 2015, it organized annual congresses "Poland – The Great Project". In 2017, it organized the National Innovation League. Since 2017, the Institute has been placing a strong emphasis on publishing studies and recommendations aimed at showing how the Polish economy should take advantage of the opportunities offered by the fourth industrial revolution, innovation, and new technologies.

The Sobieski Institute also conducts educational activities through the implementation of the "Academy of Young Experts" project, which supports young people in developing leadership competencies and soft skills. Each edition of the program focuses on a different key issue, responding to the current needs of the younger generation. At present, in its sixth edition, the project focuses on the European Union, educating knowledge and preparing participants to take part in European Personnel Selection Office (EPSO) competitions. The program opens the door to an international career in the EU institutions. It provides unique opportunities to gain practical skills and for professional development at the highest level.

One of the Sobieski Institute's latest projects is the "Sobieski Channel", which we invite you to subscribe to on YouTube. The channel was created with the aim to provide platform for inspiring conversations on topics important for Poland. It is where we meet with interesting people to jointly shape the debate.

Over the years, the Sobieski Institute has enticed broad collaboration. To date it involved:

- non-governmental organizations: Polish Automation and Robotics Forum, Fundacja Wspierania Ubezpieczeń Wzajemnych, Republican Foundation, Instytut Jagielloński, Nowa Konfederacja, Ambitna Polska, Młodzi dla Polski, Studenci dla Rzeczpospolitej, Konrad Adenauer Foundation, Central European Energy Partners, Sławomir Skrzypek Foundation, Wacław Felczak Foundation, Institute for Foreign Affairs and Trade (Külügyi és Külgazdasági Intézet), Institute for Politics and Society (Institut pro politiku a společnost), The F. A. Hayek Foundation Bratislava;
- commercial companies: Aiut, Assay Group, Rohde&Schwarz, WB Electronics, Asseco, Samsung, Lotos, Google, Procter and Gamble, PWC, Cisco, EY, Phoenix Systems, Uber, USP Zdrowie, Fortum, Orange, Energa, Zysk i S-ka, Collegium Wratislaviense, 4CF;
- State/supranational institutions: Ministry of Foreign Affairs, European Commission Representation in Poland, Ministry of Climate and Environment, Future Industry Platform Foundation, Industrial Development Agency for Development and Industry, Stock Exchange, Bank Gospodarki Krajowej, Chancellery of the Prime Minister, Ministry of Digital Affairs, Law and Justice, Hungarian Embassy, Senate of the Republic of Poland, European Conservatives and Reformists Party, European Parliament Office in Poland.

A complete list of reports and publications, as well as information about the Institute's activities, can be found at www.sobieski.org.pl.

We invite you to subscribe to the Sobieski Channel on youtube.com/kanalSobieski.

Eastern Flank Institute

What is our mission?

The Eastern Flank Institute aims to provide a comprehensive analysis of security policy in Central and Eastern Europe, with particular emphasis on the experiences of the Russian invasion of Ukraine.

As one of the largest military forces in Europe, Poland plays a special role and its role on the NATO's eastern flank is particularly important. Previous strategic thinking in Poland lacked a broader perspective, which would provide for the challenges faced not only by Warsaw but also by other capitals in the region that must assert their agency on the international stage.

The results of the Institute's work include:

1. aggregating data and disseminating knowledge about challenges to security and defense policies in Central and Eastern Europe;
2. formulating realistic recommendations for systemic changes (both at the strategic and operational levels) to security and defense policies, taking into account, among other things, the specific nature of the region, the experience of the Ukrainian defensive war and the opportunities arising from cooperation with allies;
3. creating a platform for dialogue between representatives of the military, civil service, experts, business and those interested in security issues.

Who are we?

The Eastern Flank Institute is a non-political think tank registered in Brussels, which integrates the activities of a network of experts representing primarily the countries of NATO's Eastern Flank and Ukraine.

The Council of the Eastern Flank Institute consists of:

- Jadwiga Emilewicz, former Deputy Prime Minister and Minister of Development of the Republic of Poland;
- Michał Dworczyk, former Head of the Chancellery of the Prime Minister and Deputy Minister of National Defense; Vice-Chair of the European Parliament's Committee on Security and Defense;
- Oleksandr Kubrakov, former Deputy Prime Minister and Minister of Infrastructure of Ukraine;
- Oleksiy Reznikov, former Deputy Prime Minister and Minister of Defense of Ukraine.

How do we operate?

The Institute conducts analytical activities in cooperation with renowned experts and focuses on publishing and organizing public debates in formats that allow for free exchange of ideas. The results of the Institute's analytical work will be published on the website www.wschodniaflanka.pl. We encourage experts and individuals with experience in the national security sector to contact us.

The Institute's areas of particular interest include issues related to:

- organization of the State defense system and the activities of uniformed services;
- transformation of the armed forces, including technical modernization;
- improving the resilience of the State and social structures in crisis situations;
- coordinated support for the development of the defense industry;
- protection of critical infrastructure.

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About the report partner

ONODRIM

About Onodrim Industries

Onodrim Industries is a European, technology-driven scale-up platform that strengthens the continent's defence and industrial foundations. It brings technology, capital and operational expertise to critical industries, including defence, aerospace, and manufacturing. Its leadership draws on senior experience in private equity, government, advanced engineering and global technology companies.

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SOBIESKI INSTITUTE

Creating IDEAS for Poland

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