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EDINA II

Security, Industry, and the Lost European Vision

How Russia's War in Ukraine Is Changing the European Defense Technological and Industrial Base

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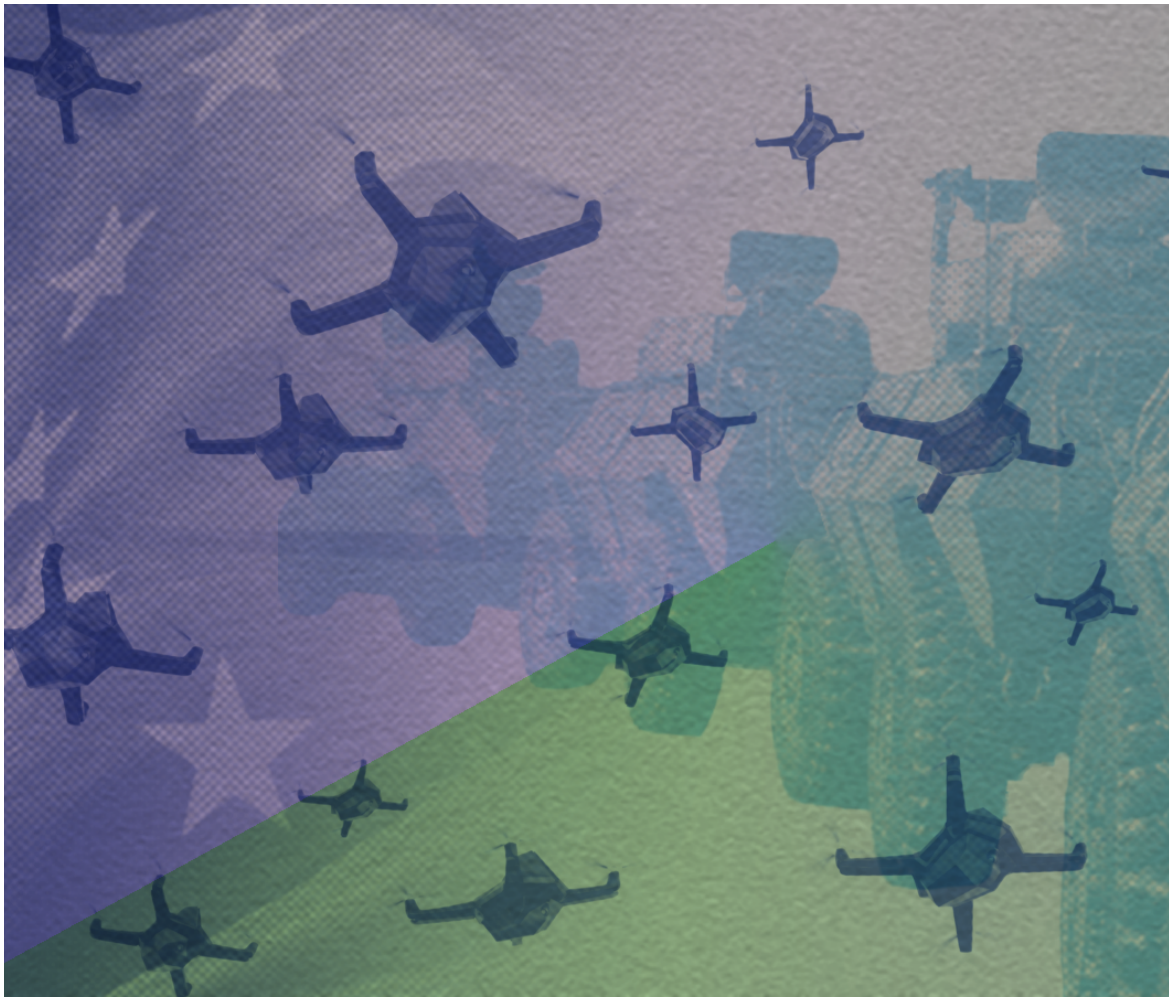

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Introduction

Russia's full-scale invasion of Ukraine in February 2022 has caused a dramatic shift in the European security landscape, and European defense is now entering a new era. DGAP has initiated a project to provide a comprehensive analysis of the changes in the European defense sector triggered by the Russian attack.

During the first phase of the project, carried out in cooperation with the Friedrich-Naumann-Foundation, the analysis concentrated on changes in the perception of the defense environment and their implications for the future military order and defense cooperation.

The second phase of the EDINA (European Defense in A New Age) project focuses on the European Defense Technological and Industrial Base (EDTIB)[1] in the new era of European defense. It highlights the impact of the Russian aggression on Europe's defense industry and analyzes the structural drivers and constraints that influence the future trajectory of the continent's industrial base.

The data base was generated in a similar way to the first phase of the EDINA project. In May and July 2023, DGAP brought together defense experts from European NATO members (Germany, France, United Kingdom, Spain, Italy, Greece, Türkiye, Poland, Hungary, Romania, Lithuania, Bulgaria) for two workshops (physical and online) to discuss the current situation and future development of the EDTIB. Prior to the workshops, the experts were asked to prepare country reports as their input to the discussions. The reports allowed to sketch out the industrial landscape in Europe and provided valuable insights into different positions on defense industrial cooperation, dependencies, and structural problems regarding the EDTIB. The reports were based on the following questionnaire:

- Industries/ RTO: What are current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

- How does your country assess the impact of cooperation, dependencies (import/export) and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

- Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for such a development?

After the workshop, the authors had the opportunity to update their reports in the light of the discussions. For this publication, they were then slightly edited to meet grammatical and spelling standards. Any opinions expressed in the reports are those of the authors and do not necessarily reflect the views of the German Council on Foreign Relations (DGAP).

This project report starts with a presentation of key findings from the workshop and country reports. This section also presents the research team's analysis of the current situation, a forecast of likely developments, and suggestions for measures to be taken to push the EDTIB forward. This executive summary is followed by the country reports.

1 "Defense Technological and Industrial Base" is an umbrella term. The DTIB organizes the infrastructure, institutions, and ideas that ensure the Security of Supply (SoS) of armed forces in times of peace and war. This includes safeguarding supplies of defense material and services against political risks (for example, another state blocking the delivery of means of warfare) or industrial risks (companies no longer offering supply). Stakeholders include actors involved on the supply side of arms production, for example, arms-producing companies, their suppliers, and research centers involved in the development of weapons systems. The DTIB can be defined nationally (for example, the German DTIB which consists of all actors based in Germany) or with a wider geographical scope (for example, the European DTIB which consists of all actors operating in Europe).

Executive Summary

Russia's attack on Ukraine in February 2022 marks the beginning of a new era in European security, and Europe's response to the Russian aggression will shape the development of the European defense technological and industrial base (EDTIB) for decades to come. At the same time, there are important economic and political factors influencing the continent's defense industrial development. Against this background, this report outlines the most likely development scenario for the European industrial base. It also describes the options open to European governments and the EU to maintain a highly capable defense industry and address current shortcomings.

A SNAPSHOT OF THE EUROPEAN DEFENSE LANDSCAPE

Europe's defense industry produces the full range of conventional capabilities needed by its armed forces. However, this capacity comes with significant dependencies: On the one hand, given the many years of insufficient national demand, manufacturers have become increasingly dependent on exports to countries outside of the EU and NATO to maintain their skills and production lines. On the other hand, the economization of defense, meaning a growing pressure on prices, has created significant import dependencies on raw materials and key components like semi-conductors. Both elements are now coming under scrutiny as security of supply is becoming a key concern for European nations and their armed forces.

The EDTIB reaches far beyond the EU and its member states. Despite EU initiatives like the Permanent Structured Cooperation (PESCO), the European Defence Fund (EDF), and lately the European Peace Facility, the lion share of defense industrial investment undertaken by EU member states takes place outside the EU framework. Also, countries outside the EU – the United Kingdom as a defense industrial heavy weight as well as Norway and Türkiye – add significantly to the landscape, be it through cooperation or competition. At the same time, non-European companies have become part of the continent's defense industrial ecosystem by contributing components or whole systems. This applies especially to the US industry but is also true for manufacturers for instance from South Korea.

Moreover, despite more than two decades of working toward closer cooperation in development and procurement within the EU, the EDTIB is still shaped by national choices taken decades ago – especially in the aftermath of the Cold War. These decisions were not primarily driven by defense considerations but influenced by broader domestic economic policies and philosophies, including on state ownership of defense companies. Thus, every country has its own story regarding its defense industrial base and ambitions. Eastern and central European countries had to address an extra challenge: Integration into NATO meant that their industries had to adapt to new standards for equipment and interoperability. With the dissolution of the Soviet Union and the Warsaw Pact, they also lost their supply basis and economic links. As a result, many companies ceased production or concentrated on the maintenance of legacy equipment or exports to former Soviet states and export destinations of Soviet-made weapon systems.

This brief look at recent history underlines the importance of the upcoming decisions for the EDTIB. Europe is entering a new historical phase. The Russian war of aggression is the key impulse that has put security of supply for the armed forces at the top of the political agenda. European countries, whether big or small, now realize the cost of their dependence on global supply chains. Their governments share an aspiration to generate security of supply nationally. But their understanding of what that entails differs significantly. In some cases, countries limit their definition of the supplies they consider essential at the national level to fairly basic elements like ammunition and maintenance. In other cases, governments strive to keep their country's technological edge regarding components or entire weapon systems. On a broader scale, the choices to be made indicate that the armed forces may require a new mix of quantity and quality.

Clearly, not every aspiration and every demand can be supplied nationally, resulting in a trade-off between ambition and feasibility that could open a path to cooperation. Current practice seems to reflect a pragmatic approach: While countries see their national basis as an indispensable core of their defense efforts, they also maintain their engagement in EU or multinational cooperation. Whether this is a legacy practice or a conscious choice will become clear when economic and financial pressures force

tougher decisions on the future path of the defense industrial base.

THE START OF A NEW ERA

There are three main factors that will shape the development of the EDTIB in this new era: The first is the transformation of the security environment, in particular through the dramatic changes brought about by the Russian invasion of Ukraine. Governments' responses to the war have a direct impact on the defense industry and shape the expectations of companies in the sector. The second element consists of the economic interests of states and major defense companies. Both types of actors shape markets, trade, and production chains through their preferences. As preferences have not significantly changed, neither has the general direction of the EDTIB. As a result, economic preferences act as structural barriers to the fundamental change that the development of the security factors would call for. Third, there are the political visions of European integration, both in defense and in overall politics. They should be seen as an underlying long-term factor. The near absence of a discourse about more EU cooperation among EU member states seems to indicate that there is not much appetite to give the EU a larger role.

Security Concerns as a Momentum for Change

The current situation of Europe's defense industries is primarily shaped by Russia's war in Ukraine. The conflict has brought security interests to the forefront of politicians' minds when considering defense decisions.

Arguably the most important consequence affecting the EDTIB is a significant increase in demand for military equipment. On the one hand, this is due to the massive amount of armaments that Europe is delivering to Ukraine (already worth more than €36 billion, including deliveries from EU institutions). As many countries do not have large reserves of materiel and ammunition, stocks depleted by deliveries to Ukraine need to be replenished. On the other hand, many European governments have realized that their past efforts were not sufficient to ensure a credible deterrence posture. Decades of austerity and underfunding have left major European players with "bonsai armies" that are no longer able to defend their territories in the event of a Russian attack.[2] This leaves Europe extremely vulnerable. European governments are now making efforts to reverse this trend and close existing capability gaps. Several major modernization programs have been launched, and major procurement decisions have been taken, such as Germany's purchase of F-35 fighter jets from the United States. To underpin this new level of ambition, many countries have significantly increased their defense spending. Poland's increase of the GDP share devoted to defense to four percent and Germany's creation of a €100 billion special fund stand out.[3]

As a result, the **overall size of the market has increased** and is set to increase further. European governments now all agree that Ukraine will need support for the foreseeable future, as there appears to be little hope for peace any time soon. With security concerns undiminished, defense will continue to be a high priority across the continent, creating an energizing momentum for European defense contractors.

Currently, however, the **EDTIB is not able to meet wartime demands**. It successfully adapted to decades of peace, maintaining high profits despite relatively low levels of defense spending, but it lost the capacity to scale up production for wartime needs. Traditional European manufacturers will be able to partially absorb the new demand by establishing new production capacities, but this will not be sufficient either in terms of volume or of speed. Hence, **third countries will benefit**. Although the United States is an obvious alternative for supplies and US companies are certain to secure more contracts from Europe, American industry experiences similar bottleneck problems due to high demand.

Other **players such as South Korea and Türkiye are ready to step in**. South Korea has recently won major contracts from Poland for K2 battle tanks and artillery ammunition and is establishing partnerships with other European countries as well (e.g., Romania). Türkiye also looks prepared to take on a greater role. Its Bayraktar drones have proved their worth in several conflicts, including the war in Ukraine. The Turkish DTIB has benefitted from high levels of domestic defense spending, which has allowed the sector to modernize and grow. Several Turkish

2 Major/Mölling. Europas Bonsai-Armeen können nicht weiter getrimmt werden. FAZ, 07.04.2020. Available at: https://t1p.de/gx48t

3 For a detailed discussion of the adjustments in defense expenditure, see: Mölling/Hellmonds/Winter. European Defense in A New Age - Geostrategic Changes and European Responses Shaping the Defense Ecosystem. DGAP Report, Juni 2023.

companies appear ready to become serious competitors to their western and northern European peers.

The war in Ukraine and the threat of further Russian aggression have given **new urgency** to efforts to fill capability gaps. Governments are prioritizing speed in new procurement programs. As a result, imports and off-the-shelf procurement are becoming more important. Since this usually means buying from non-European third countries (rather than setting up joint European development programs), there is a new momentum for European defense industrial cooperation. Even strong supporters of European cooperation have opted for imports, as demonstrated by Germany's decision to buy F-35 fighters as nuclear carriers. This has caused friction in Franco-German relations, with France, a strong supporter of European cooperation, expressing disappointment over the German decision.

In central and eastern Europe, defense industry partnerships and purchasing decisions are driven by the desire to keep the United States as the main regional security guarantor, which means **that central and eastern European states prefer to buy American rather than European.** This is facilitated by the fact that eastern European industries rarely play a role in major European development or procurement programs. As a result, central and eastern European countries do not benefit economically from buying European materiel or from engaging in joint development. Their tendency toward purchasing US equipment could be reinforced as security pressures remain high, speed in deliveries seem more important than ever, and NATO's position as the bedrock of European security is strengthened.

The outbreak of a major war in Europe also has consequences for the force structure of European militaries. There is a **new focus on quantity**. Major wars require more mass and deeper reserves and stocks than the external interventions that were the focus of the last two decades. Does this mean that Europe will focus less on innovation and that the EDTIB could fall behind in terms of technology? So far, this looks unlikely. Militaries and governments have defined requirements, and therefore innovation, years in advance, which means that for the next generation of systems, the innovation that industry needs to deliver has already been determined. Europe currently anticipates the production of cutting-edge technologies. However, there is a growing gap between current procurement plans and newly expressed demand in terms of volume. A new balance needs to be struck between mass production of current state of the art systems and high-end platforms designed to be built in smaller numbers.

Governments are increasingly aware of the importance of **ensuring security of supply**. Their ambition spans from spare parts and maintenance via components to entire platforms. As a result, central and eastern European countries are investing in building up their domestic industries to become more independent. While smaller industries (e.g., in Bulgaria and Romania) are trying to secure a share of the maintenance business, others aim to participate in the manufacturing process itself and benefit from technology transfers. Poland is a good example of a government with both the ambition and the funds to develop a strong industrial base. Poland and similarly ambitious players with sufficient financial resources will be able to continue their growth path and play a greater role in the EDTIB. But while they can become more independent from imports, including from their European partners, it is unlikely that they will turn into serious competitors to Europe's top producers.

A key issue for the future EDTIB is the **sustainability of the increase in defense spending.** Building a defense technological and industrial base capable of meeting the new level of ambition requires a sustained high level of defense spending to keep funds from being diverted to other government functions in the event of an economic downturn or a reappraisal of policy priorities. Most European governments seem to understand that defense spending must be sustainable to produce results. They are not only willing to maintain their budgets at the current high level but also envisage further increases in the near future. With security pressures expected to remain high, defense will remain a priority across the continent. As a result, **the defense market will continue to grow**.

Economic Interests as a Barrier to Change

Although security considerations currently drive the general direction of defense policy in Europe, there are economic trends and considerations that strongly influence the development of the EDTIB. In peacetime, they were arguably more dominant, but even now, **no government will take decisions that go against its economic and industrial interests**, which are to nurture national arms producers. Any analysis of the defense sector therefore needs to take the industry's political economy into account. Governments may claim that they are acting in the spirit of European integration or that their motives

are exclusively security related, but that is rarely the case. All, even small countries, have bold ambitions for using the additional money and demand to boost their national DTIBs. All envisage to evolve from the current size and product portfolio of the national companies to the next level. Moreover, all countries assessed are keen to boost exports, based on strategies drawn up by the government or the industrial players. They either want to enter foreign markets or expand their role there.

What differs is the character of these industries, especially the role they play in the production chain. A striking feature of the EDTIB is the **heterogeneity of the national industries** it comprises. They can be categorized into four different spheres: **core industries, traditional mid-sized industries, rising stars, and industries at the periphery**.

The European **defense industrial core** is situated in western Europe (France, Germany, Italy, Spain, UK), where strong industrial bases capable of producing almost the entire portfolio of weapon systems across all domains have been developed and maintained. Their industries are the largest in Europe, producing **technologically advanced products** that are highly competitive. While all of them also have a **strong export** profile, a high proportion of the equipment they produce gets purchased by the armed forces of their home countries. France, Germany, Italy, Spain, and the UK are home to several of the top 100 defense companies. All the major pan-European defense companies are at least partly owned by stakeholders from these countries, and direct state involvement is not uncommon. The core countries also lead major European development programs such as Eurofighter, A400M, Tornado, and more recently Tempest and FCAS. With the exception of the UK, all are **strong supporters of EU initiatives** such as PESCO and the EDF.

Countries such as Sweden, **Norway, the Netherlands,** and **Greece** are home to some **traditional mid-sized industries**. They participate in European joint development programs for complex weapon systems without being able to lead them – the naval sector gradually becoming an exception. These countries are heavily dependent on imports from both Europe and the United States.

Some smaller manufacturers (or traditionally less important producers for the EDTIB) have embarked on **ambitious growth trajectories**. Companies in **Poland** and **Türkiye** have already achieved remarkable technological developments that set them apart from their regional peers. Türkiye's industry, in particular, has undergone a major transformation in recent years. Turkish companies have achieved a leading position in the UAV market and moved to the forefront of technology in sectors that include turbojet engines and ballistic missiles. By some measures, **Hungary** can also be counted into this group, as there is considerable momentum with top tier producers opening facilities in the central European state. These countries are **rising stars** and can be expected to play a greater role in the future of the EDTIB.

Finally, there are countries with only **small or niche industries**. They constitute the **periphery**. This group consists mainly of former Warsaw Pact countries such as **Romania, Lithuania, Estonia,** and **Bulgaria**. While they can be competitive in niche sectors, their companies lack the overall technological edge to compete with the European core (let alone the United States). They have few or no system integrators. Most companies focus on component production and maintenance.

After the end of the Cold War, the state-owned industries of the periphery were partly privatized. As demand for standard Warsaw Pact components plummeted, they underwent a period of transition and reform which significantly weakened their DTIBs. NATO integration was another challenge, as many companies were unable to produce according to NATO standards and therefore could not be integrated into European supply chains. This means that in the periphery, the modernization of domestic armed forces does not necessarily lead to new orders for national DTIBs.

The differences in industrial portfolios translate into **different approaches to industrial policy and procurement**. Two approaches can be identified: a **capability-driven approach** and an **industry-driven approach**. The dividing line runs, broadly speaking, between western and eastern Europe, and between the core and traditional mid-sized industries on the one side and the rising stars and the periphery on the other. This is due to fundamental differences which are **unlikely to change** much over the coming decades.

Central and eastern European states tend to emphasize **capability development over industrial interests** (capability-driven approach) to address the security pressure resulting from their geographical proximity to Russia. Of course, they also take their

domestic industrial base into account when establishing industrial partnerships. They will attempt to secure small work shares for their domestic companies, especially in maintenance (to be able to operate independently), and seek to benefit from technology transfers. All in all, however, they prioritize operational readiness and capability development over industrial gains. In terms of cooperation, they favor US products over participation in European development projects, which are notorious for cost overruns and delays. Third-country imports and off-the-shelf purchases (which often go hand in hand) are seen as less costly and more efficient than European co-development.

This tendency is reinforced by the fact that their industries are not in a position to contribute significantly to European projects. In some cases, they were even actively excluded from such projects as when Poland's request to participate in the MGCS was rejected by Germany and France. As a result, rising star and peripheral countries see little or no economic benefit in participating in major European development programs. They are increasingly open to forging new partnerships with non-European producers such as South Korea if these promise rapid delivery and participation in maintenance (and sometimes even production).

Western and northern European core countries and countries with a traditional mid-sized industry take a different approach. When they take purchasing decisions, they accord at least the same priority, of not more, to the **interests of their domestic industries** than to their military needs. Governments try to get their domestic producers involved as much as possible when awarding contracts. As a result, their industries focus more on producing high-end systems that are competitive on the world market than on operational readiness.

At the same time, governments realize that the technological complexity of modern armaments systems means that a purely national production is no longer possible. In this situation, western and northern European countries (especially the industrial core) prefer joint European development programs to non-European imports because the former benefit their domestic producers more. This approach is very much in line with the **concept of European strategic autonomy,** which basically calls for all major platforms to be produced by European companies in Europe.

Yet that same rationale does not make joint projects run smoothly. Even when working together, core countries are wary of their economic competitors both inside and outside Europe. This causes problems of co-ordination in European development programs and can lead to the exclusion of potential competitors and the duplication of projects just to ensure a greater share of work for domestic companies (as in the case of Tempest and FCAS).

The core (and thus the EDTIB in general) is also marked by an element of **risk aversion** on the part of large companies, which is turning into an obstacle to innovation. There is not enough private investment to provide funds for research and development (R&D). In contrast to other sectors of the economy, innovation in defense is largely state-funded, which makes companies reluctant to use their own funds, as they know that eventually the government will pay for technological development.

In addition, major arms producers have been reluctant to ramp up production following Russia's invasion of Ukraine. In part, this can be explained by ambivalent signals from governments about the sustainability of long-term financing. If companies are uncertain whether an investment will pay off in the medium and long term, they will be reluctant to make it. However, such investments would be crucial for production to meet wartime demand even if not all production capacity is used in peacetime. There seems to be a conflict between the security interests of states (i.e., creating enough capacity to ramp up production in wartime) and the economic interests of firms (avoiding overcapacity to maximize profits).

The Absence of Political Visions

Political visions are key to the long-term future of the EDTIB because they **create coherence** with regard to key design features, such as procurement and cooperation strategies. Even more importantly, they help generate a coherent idea of the vision that a European industry should serve and therefore the shape it should take.

The most influential vision of the last decade has been that of **European strategic autonomy**. The concept was prominently introduced through the EU's

Global Strategy[4], in which the EU outlined its ambition to become a more credible security and defense actor. A key element of strategic autonomy is the development of an integrated European defense industrial base capable of producing major weapon systems in Europe. According to this concept, the EDTIB should be able to provide European armed forces with all the weapons they need without having to rely on the United States or other third countries. In short, EU countries should buy European equipment from European producers. In domains where EU countries currently lack capabilities, they should set up joint development programs. The proponents of strategic autonomy see a self-sufficient EDTIB as vital to strengthening Europe's security of supply and thus boosting its geopolitical weight in systemic competition.

However, the pursuit of strategic autonomy is **by no means an undisputed vision**. First, there is a debate about which countries the EU should cooperate with. Some governments, including those that are part of the core, wish to allow third countries such as the United Kingdom and the United States to participate in EU-funded programs. Others want to restrict access to EU funds to the European continent and EU countries.

Second, many peripheral and rising countries within the EU do not consider European strategic autonomy a priority, mainly because they do not see the benefit of it. On the contrary, they suspect that core countries with industries at the cutting edge of technology are pursuing their own interests under the guise of a supposedly impartial vision. As it happens, the strongest supporters of the concept of European strategic autonomy are the countries best positioned to benefit economically from European development projects.

Another factor weighing against the concept of strategic autonomy concerns the difficulties associated with joint European development programs in the past. Projects such as the NH90 helicopter, the A400M aircraft, or the Eurofighter were notorious for cost overruns, delays, and a failure to deliver the initially promised benefits in terms of economies of scale and military interoperability.

Finally, attitudes regarding the future of European integration differ within Europe. Countries such as Poland, Hungary, and the UK are keen to uphold their national autonomy, which also has implications for the defense sector.

As a result, there is no consistent common vision or idea of what the EDTIB should look like in terms of regional distribution, production portfolio, rules for exports, or cooperation partners. Nor is there any consensus on how much Europe should import or which degree of autonomy it should aim to achieve.

This does not mean, however, that there is no common ground. The EU has established a number of instruments for facilitating joint arms development that are widely regarded as successful, notably the EDF. Although these instruments lack clarity, coherence, and compatibility with NATO processes, most governments agree that such **EU policies will be crucial** for the future development of the EDTIB.

HOW WILL THE EDTIB DEVELOP?

The analysis presented above suggests that absent major political initiatives, there will be **no major changes to the basic design of the EDTIB** in the new era of European defense. Instead, **business will be conducted as usual**. That is, the European core will continue to produce state-of-the-art capabilities that provide a degree of political and operational autonomy from the United States. The periphery will seek to reduce its dependence, including on its European allies, while maintaining an ambivalent attitude toward European cooperation and European strategic autonomy.

Although the increase in budgets may revive parts of the defense sector and generate some momentum for defense companies, there are few signs of improved coherence and coordination. Currently, there is **no momentum for closer defense industrial cooperation** in Europe, nor do waves of consolidation seem likely in the foreseeable future. While small-scale mergers are possible, there appears to be nothing major on the horizon. The overall industrial structure will remain unchanged.

Regional and economic divides will persist, as will the wide differences over sourcing and cooperation. However, there will be opportunities for more ad-hoc, country-to-country, and sectoral cooperation

4 European Union. A Global Strategy for the European Union's Foreign And Security Policy. Brussels, 2016: Available at: https://t1p.de/0nm18

formats such as the European Sky Shield initiative. But there will be **no grand design, no coherent European vision** of how to coordinate and drive the EDTIB.

The sources of change are the rising stars and the non-European suppliers. The main players to watch are South Korea, Poland, and Türkiye. The United States is a traditional European supplier already. Its share in Europe may increase but without larger industrial relevance to the American DTIB.

Some mid-sized and smaller European players will continue to grow and increase their role. But there will be **no major shift in the industrial balance of power**. The industrial core will continue to determine the development of the EDTIB. The fundamental power asymmetry will remain, with all its consequences for European cooperation and coordination.

What are the **game changers** that could shift this trajectory? If European countries were to agree large multilateral programs with sufficient funding to generate major technological advances, new champions and pan-European companies could emerge, which would transform the industrial landscape. Another game changer could be a reform of EU policies to harmonize existing instruments and shape a consistent development path for the EDTIB.

RECOMMENDATIONS

Given the most likely scenario for the future development of the EDTIB, what can the EU and member state governments do to influence the trajectory of the defense sector and produce a better outcome? The following section sets out which actions can be taken to make the EDTIB more coherent and capable.

1 Regard the EDTIB as a strategic asset: Europe needs to equip the EDTIB to meet both its short and long-term needs. It should regard the EDTIB as a strategic asset, which includes finding answers to questions such as:

- How can "bonsai industries" be rebuilt to meet European demand?
- What can governments do to enhance the development of defense technologies and avoid being overtaken by competitors such as China?
- How can governments make the best use of a wide range of instruments, including political control over the sector? Since the defense industry is vital for national and European security, there is no doubt that political intervention in the market and the exercise of political control over market players can be justified.

2 Establish a mechanism for building up stocks: In response to the current shortage of ammunition and materiel, European government should pass legally binding requirements to ensure that the EDTIB has sufficient depth in terms of industrial capacity to be able to equip European militaries in a war scenario. They should also provide for sufficient reserves of ammunition and other critical goods. The design of such a system could be inspired by Cold War arrangements.

3 Secure funding: To stay at the cutting edge of technology, the EU and its member states must make the necessary funding available, particularly for R&D. This means that funding must be sustainable, which will also **attract more private investment.** Governments need to be able to credibly tell defense companies that the current increases in defense spending and the new level of ambition for European defense are more than a blip. Doing so would send a message to shareholders and owners that investing into the development of new weaponry carries a low risk and that investments will pay off.

4 Set up major European development programs: Involving as many European countries as possible in major multilateral development programs is the most effective way to boost the technological development of the EDTIB. Such programs ensure that sufficient financial resources are pooled to produce the high-end capabilities needed to remain competitive. At the same time, they create economies of scale and increase interoperability, which is a decisive military advantage.

5 Develop a strategy to deal with third countries: As third countries become more important as arms suppliers, European governments should develop a common approach toward them. To this end, they need to decide:

- Who should be allowed to participate in EDF and PESCO projects and thus benefit from EU funds? This concerns primarily the United Kingdom and the United States but potentially also Indo-Pacific partners such as Australia or Japan.

- How much should US companies operating in Europe be allowed to contribute to European projects? What share would make it possible for them to add value without compromising European autonomy?

- How should Europe deal with Türkiye and South Korea? As partners? As competitors? Each categorization has different policy implications.

6 Europe must also find solutions to the underlying problems of the EDTIB's economic structure and the lack of a common political vision. A first step would be a **comprehensive review of EU policies** to assess which have proved useful and which have not. An important issue for discussion would be to reexamine the European Commission's approach to competition and consolidation in the defense sector. Before the Russian attack on Ukraine in February 2022, consolidation was seen as beneficial because it reduced overcapacity, pooled technological knowledge, and created synergies. Some effects, however, have proved problematic. As players left the market or merged and overcapacity was reduced, the EDTIB was unable to ramp up production quickly enough to meet current demand. This shows that a certain amount of industrial overcapacity is probably necessary to be able to scale up production in a war scenario.

Another side-effect of consolidation is the **concentration of market power** in the hands of a small number of European system integrators. In some sectors, this has led to quasi-oligopolistic market structures, with all the negative effects associated with such a concentration of economic power. Paradoxically, the EU's emphasis on competition has in some cases led to a reduction in competition as consolidation increased.

7 **Align EU and NATO defense industrial frameworks:** A better fit is needed between NATO instruments, such as the NATO Defence Planning Process (NDPP) and NATO standards, and the EU industrial framework and, more generally, the EDTIB, to reduce duplication and create synergies. This is one of the few aspects on which there is almost complete consensus among European governments. Eastern European countries in particular stress that EU initiatives should not be realized at the expense of NATO frameworks.

8 **Reduce regional imbalances:** A major structural obstacle to greater coherence and coordination in the EDTIB consists of regional imbalances between core countries on the one side and mid-sized countries and the periphery on the other side in terms of industrial capacity and technological advantage. The EU – and especially the industrial core – must find ways to make participation in joint European development programs attractive to central and eastern European countries. This will most likely mean the transfer of knowledge and some part of the production. Such a step requires a willingness on the part of core governments and companies to support industrial development in central and eastern Europe even at the expense of some of their domestic profits. This is the price to be paid for greater coherence, coordination, and involvement of peripheral and mid-sized industries. A good starting point could be to use the additional funds becoming available from rising defense budgets to build production facilities in mid-sized and peripheral countries and integrate them into European supply chains.

9 **Establish a secondary market for used and modernized equipment:** Smaller countries with fewer financial resources are calling for the establishment of a secondary market to help modernize their armed forces and meet NATO standards in a cost-effective manner.

10 **Address structural dependencies:** Europe has become dependent on imports of raw materials, alloys, and components such as semiconductors, mainly from Asia. Given the systemic competition between Western countries and China, security of supply will be a key issue. Europe's dependence should be addressed.

11 **Deal with other challenges and structural barriers** at the national level:

- Reduce Bureaucracy: Slow and complex procurement processes are a major obstacle in countries across Europe. Eliminating some of the influence of vested interests on the production process will help to speed up procurement decisions. As procurement processes differ from country to country, this is mostly a task for national governments.

- Create the necessary legal environment and defense ecosystem: Some eastern European states have laws which ban the government from supporting and guiding the development of their

domestic DTIBs. Yet the production of high-end capabilities requires a comprehensive defense ecosystem with a highly skilled workforce and a sophisticated R&D network, including public research centers. Building such a network across Europe and enabling smaller countries to participate will be crucial.

- Stabilize funding: Another challenge is the lack of binding long-term fiscal legislation that guarantees funding on a multi-year basis. Spain, Italy, and Germany are major players that lack multi-year budget allocations. Companies are discouraged from investing because they cannot be certain that sufficient funds will be available to complete a project. Defense budgets must be approved annually, which means they are subject to change every year. This contradicts the logic of large procurement and development programs which tend to run for several years.

For the future of Europe's defense technological and industrial base, it is crucial that the additional public resources invested in defense translate into higher operational readiness of the armed forces and more industrial capacity. This analysis suggests that major reforms are needed to advance the development of the European defense sector. With new funds available, there may be a window of opportunity for change – not necessarily for a fundamental transformation of the sector but certainly to address some of the shortcomings of today's EDTIB.

Please note that the following country chapters were published as provided by the authors, without any editorial changes.

Bulgaria

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THE BULGARIAN DEFENSE INDUSTRY AND THE EU'S DEFENSE TECHNOLOGICAL AND INDUSTRIAL BASE

The Bulgarian defense industry was established in the 1950s and 1970s. At that time, the main enterprises for the production and repair of armaments and military equipment were built according to the standards of the former Warsaw Pact. The entire industry was state-owned, and production was integrated within the former socialist countries.

In the early 1990s, the Warsaw Pact was dissolved, and Bulgaria embarked on the road to democracy. This was the time of complete transformation of the country's military-industrial complex. Most of the enterprises were privatized and became private property. Currently, the state owns only „VMZ" and „TEREM Holding" (a company for the repair of armaments and equipment used by the Bulgarian Armed Forces). Some of the enterprises have been closed as inefficient. For example, the plant for armored personnel carriers was closed.

This transformation resulted in several processes. First, economic and trade relations between the former socialist countries were disrupted, and some components for the defense industry were not traded between the new countries. Second, the state could not provide any assistance to defense industry enterprises, as it could be considered illegal to support private companies. Third, Bulgaria decided to join NATO and modernize its armed forces according to NATO standards. The Bulgarian Army stopped buying from the country's own military enterprises, because they were still producing equipment and armaments according to the standards of the Warsaw Pact. As a result, the Bulgarian defense industry began to work exclusively for foreign markets, which still demanded Soviet-style weapons.

Bulgaria has been a member of NATO since 2004, at which time a complete modernization of the Bulgarian Army began. This transformation was also seen as an opportunity for Bulgarian companies to start production according to NATO standards. The acquisition of new weapons and systems was seen as an opportunity to invest in domestic production according to NATO standards. For various reasons, this did not happen. At the same time, the state could no longer provide support to private enterprises. It turned out that Bulgaria produces defense products, but they do not contribute to the development of the capabilities of the Bulgarian Army and do not meet NATO and EU standards. Participation in cooperative production and supplies for NATO and EU countries is negligible. Bulgarian companies, with few exceptions, are outside the chain of suppliers of materials, components, and parts for defense products of leading manufacturers in NATO and EU countries.

MAJOR BULGARIAN DEFENSE COMPANIES

Due to their production portfolio as well as the fact that their products do not meet NATO and EU standards, the main Bulgarian companies from the military-industrial complex do not participate in EU projects. It can be stated that Bulgaria has the capacity and history of production of defense equipment and armaments, but the defense industrial and technological base is not compatible with NATO and EU standards. This means that at present it cannot fully contribute either to the European defense production or the building of national defense capabilities.

None of the large companies participates in the Preparatory Action on Defence Research (PADR), the European Defence Industrial Development Programme (EDIDP) or the European Defence Fund (EDF). The Bulgarian defense industry is unable to contribute to increasing the defense production within NATO and the EU, unless there was a technology transfer from European companies or a common European decision. VMZ is the only Bulgarian company that can produce 155 mm shells according to NATO standards, but additional investments and know-how are needed. There are some smaller Bulgarian companies, mainly in the field of scientific research and software companies, which are involved in European projects as subcontractors of other companies.

The Bulgarian government has often stated that the potential and capabilities of the Bulgarian defense industry should be used in the process of acquisition and maintenance of armaments and equipment for the Bulgarian Armed Forces. Obviously, a lot of

investment and know-how are needed to transform and increase production according to NATO standards. The dilemma of the Bulgarian government is that on the one hand, there is a desire to improve the defense and technological facilities for the production of armaments and equipment according to NATO standards, but on the other hand, the companies are private, and the government has no leverage to influence their policies. Another problem is that there is no possibility to provide direct state aid to these enterprises for the modernization of their production.

The critical issue is how to ensure investment in the modernization of defense enterprises. Such investments could be made through state funding or through a comprehensive "Defense Innovation Scheme" created at the EU level. Through this approach, EU member states could be encouraged to invest in the joint production of defense capabilities, joint procurement, and the reduction of the Union's technological dependence.

Another possibility is direct contacts and direct investments by private companies. The Bulgarian government is trying to encourage foreign companies that participate in tenders for the acquisition of major defense equipment for the Bulgarian army to invest in Bulgaria and produce arms and ammunition locally. So far, however, European companies have shown no interest in investing in Bulgaria's defense production.

It is clearly stated in the national documents that the Ministry of Defense will commission the BDTIB units to implement research projects aimed at the development and production of advanced weapon and equipment systems, to create national/local potential, to reduce dependence on foreign suppliers, and to ensure participation in joint projects with allies and partners.

There is no alternative to modernizing the Bulgarian Army with NATO/EU standard weapon systems. The modernization plans provide for the purchase of various equipment and armaments from companies from NATO and/or EU member states. As the main option for starting the production of equipment and ammunition according to the NATO/EU standard, the government sees the inclusion of a clause for local production or investment and transfer of knowledge to the Bulgarian defense sector in purchasing contracts. So far there are no successful projects in this direction. At the same time, investment clauses in domestic production increase the cost of the defense product, which is a problem for the Ministry of Defense, as this depletes the resources for new equipment. As a result, the Bulgarian defense industry cannot contribute to the modernization of the Bulgarian Army according to the new standards. This has often been used by anti-European and anti-NATO political forces in the country. They claim that Bulgaria is forced to buy weapons and equipment from other countries without being able to use its own capacities.

Table 1: Major Bulgarian defense companies (2019)

COMPANY	PRODUCTS, SERVICES OR PROJECTS	TURNOVER IN MILLION €	EMPLOYEES
ARSENAL JSCO	Design, manufacturing, and trade in small arms and artillery armaments, ammunition, primers, powders, charges, pyrotechnic products, hunting and sports weapons and ammunition, cemented carbide tools, tips and inserts, casting, forging etc.	260	8.885
ARCUS	Production of ammunition, fuses, and weapon systems.	55	1.895
"VMZ" EAD	"VMZ" EAD (100 percent state owned company)	127	3.796
DUNARIT	Design, manufacture and trade of aviation, artillery and engineering ammunitions, and industrial explosives. Ammunition destruction (utilization). Manufacture of railroad maintenance and repair machines.	38	921
OPTICOELECTRON GROUP JSC	Optomechanical, optoelectronic, and laser devices and systems for defense and security, medicine, device-building, and machine-building.	15	650

Source: Data compiled by the author

France

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National defense industries are an integral part of French defense policy. France has always maintained a robust defense technological and industrial base and aims to be able to develop and produce almost the entire range of weapon systems and armament technologies, from all major land, naval, and air platforms and equipment, electronics and C2 systems to space and nuclear systems. This posture distinguishes France from other major European players, which are more willing to accept dependence on American technologies. Moreover, Paris has traditionally viewed this capability as a key element of its strategic goal of preserving its independence on the global stage.

France has thus developed and maintained an ecosystem that is unique in Europe, combining:

- **A strong procurement arm for the French ministry of armed forces**, the Délégation Générale pour l'armement (DGA), which is responsible for procurement per se (more than €22 billion per year), technology, industrial policy as well as capability delivery.

- **A robust industrial base that remains closely linked to the Ministry of Defense**, even though most of the major prime contractors are no longer state-owned (although the French government may retain some minority shares and a seat on the board of directors in some cases).

- **A solid network of research and innovation network of private start up and public laboratories** which benefits from a long-term investment policy in defense research with over a billion euros per year dedicated to research and development.

Finally, this ecosystem is heavily dependent on defense exports (mainly outside Europe): According to the SIPRI database, France will be the world's second largest exporter of defense equipment from 2021 (and traditionally the third after the United States and Russia, but well ahead of China, Germany, Italy, and the United Kingdom), with exports of €2 billion to €4 billion euros per year, often won (or lost) after fierce competition with American and European competitors.

This unique ecosystem has become much more European in recent decades through partnerships and mergers. Airbus epitomizes this model in a German/Spanish/French construct, but companies such as MBDA in the missile domain (a joint venture between Airbus, Bae Systems and Leonardo; France, UK, Italy, Germany, Spain), Thales Alenia Space (TAS) (France and Italy), or more recently KNDS (KMW-Nexter Defense Systems) for land vehicles (France and Germany) are other successful examples. Some of the more "national" champions, such as Thales, also have a strong European presence, with a strong presence in the UK and the Netherlands. Even the major platform developers (Dassault, Nexter, and Naval Group), traditionally less integrated into this European industrial landscape, are increasingly involved in European projects and constructs.

In practice, French defense procurement relies primarily on this French defense industrial base (including Europeanized companies), and only marginally on off-the-shelf procurement, usually from the United States, which remains a major supplier to the French armed forces year after year, with major contracts related to air surveillance (E-6, E-2), MALE drones (Reaper), transport aircraft (C-130), or critical components (aircraft carrier catapult), with approximately one billion euros per year of defense procurement across the Atlantic.

Politically and within the EU, France is a strong proponent of a strong European DTIB and has traditionally pushed for more European integration and incentives to "buy European." France is a strong supporter of recent EU initiatives in this area (including the European Defense Fund) and is often cited as one of the main driving forces behind these initiatives. Less well known is that French companies are well positioned in the NATO ecosystem for the acquisition of jointly funded capabilities, with Thales being a major supplier of C2 and communications systems and services to NATO.

Industries/ RTO: What are current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

The French industrial landscape is structured around major companies (six of which are among the top 30 defense companies in the world, according to the 2021 SIPRI Top 100 arms-producing and military service companies list,[5] which focuses on the sole defense revenues, a list dominated by US and Chinese companies). This list is consistent with the Defense News annual ranking.[6] Among the French or partially French defense companies, seven stand out in this list (ranking as per SIPRI, defense revenue as per Defense News):

- **Airbus Group:** (including Airbus Defense and Space): Airbus Group is a multinational aerospace and defense company. It is one of the largest defense companies in the EU, involved in military aircraft, helicopters, satellites, and other defense-related systems, although defense accounts for less than 20 percent of the company's revenue (#15, defense revenue $10.85 billion).

- **Thales Group:** Thales is a multinational company specializing in defense, aerospace, transportation, and security systems. It is a major player in the global defense industry, offering a wide range of products and services (#16, $10.21 billion).

- **Dassault Aviation:** Dassault Aviation is a prominent French aerospace company known for its production of military aircraft, including the Rafale fighter jet. It is a well-established player in the defense sector (#19, $6.15 billion).

- **Safran:** Safran is a multinational aerospace and defense company. It operates in various sectors, including aircraft engines, aerospace propulsion, defense systems, and avionics (#24, $4.98 billion).

- **MBDA:** MBDA is a European defense company specializing in missile systems. It is a joint venture between Airbus Group, Leonardo (Italy), and BAE Systems (UK). MBDA develops and produces a wide range of missiles, including air defense systems and precision-guided munitions (#27, $4.96 billion).

- **Naval Group:** Naval Group (formerly DCNS) is a major French naval defense company specializing in the design and construction of submarines and surface vessels. It is known for its expertise in conventional and nuclear submarine technologies (#29, $4.85 billion).

- **KMW-Nexter Defense Systems (KNDS):** KNDS is a leading Franco-German defense company specializing in land defense systems, armored vehicles, and artillery. It is involved in the design and production of tanks, artillery systems, and other military equipment (#44, $3.17 billion).

Of the 15 EU companies that make it into the top 100 defense companies in the world, eight are French or partially French (six German, three Italian, one Spanish). In Europe, only the United Kingdom has a similar presence.

It is also worth noting that the French defense industry goes well beyond the major primes. It is estimated that more than 4,000 SMEs are involved in defense in France. The total workforce is estimated to be between 150,000 and 200,000 nationwide.

How does your country assess the impact of cooperation, dependencies (import/export), and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

French companies are involved in the production of all major land, naval (including submarines), air (combat and transport aircraft, attack, and transport helicopters), and space (satellites and launchers) platforms. They are involved in most of the major past, present, and future collaborations for the development and production of major European platforms and combat equipment (e.g., A400M, NH90, Tiger helicopters, FREMM frigates, SAMP/T air and missile defense system, SCALP/Storm Shadow missiles). This is likely to continue, as French companies are involved in the joint development of next-generation systems ranging from main battle tanks (MGCS) to combat air systems (FCAS) or air and missile defense systems and missiles.

5 See https://t1p.de/zn6bm
6 See https://people.defensenews.com/top-100/

While France remains a major proponent of joint development and acquisition of European weapon systems, its experience with European cooperation is mixed. Past programs have suffered from delays and cost overruns, and cooperation can often be cumbersome from a French perspective. When responsibilities are shared, French authorities and industry sometimes publicly express frustration with their European partners. Cooperation with Italy or the United Kingdom has been mostly fruitful and, although marked by debates about work-sharing arrangements, remains a mostly successful series, especially in the missile and naval domains. With Germany, the main historical partner with a long list of past and ongoing cooperation since the 1960s, the perception is more contrasting, as both partners often compete for leadership, disagree on export policies, and have to work hard to resolve disputes and establish a solid cooperation framework that sometimes seems driven more by politics than by positive military or industrial dynamics.

With this caveat, France remains strongly committed to developing cooperation and values projects such as the FCAS or the MGCS, which are perceived as important tools for strengthening the European DTIB and further structuring the industry.

From the French perspective, the deepening of European defense cooperation is seen as a critical element of the broader political objective of European sovereignty. In this context, the United States (and other non-European actors) are perceived as clear competitors who hamper the objective of developing a stronger European DTIB by retaining a large share of the European defense market. While many Europeans see no problem in buying American, Israeli, or South Korean products, the French argue that such a massive dependence on non-European suppliers for major equipment is a strategic challenge. They would like to see Europeans act "more European."

This perception is not only driven by commercial interests, but also by a more strategic approach that would like to see Europe (starting with the EU) raise its level of ambition and choose to act more, just as France has done over the past decades. This does not always find a strong echo among France's European partners, who see economic and strategic advantages in developing strong ties with the United States. The French do not see this as an obstacle to strong transatlantic ties, as they do not recognize a link between buying American and US security commitments to Europe (although many others do make this calculation).

Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for its development?

France sees the war in Ukraine as a major turning point for a number of reasons. First, the war has changed the European debate on defense and defense spending. After decades of decline, all Europeans are now firmly committed to increasing defense spending and investing in their security. Second, it is an opportunity for the European Union to move faster and deeper into defense. The massive use of an expanded European Peace Facility, the incentives for joint procurement, and the first use of the European Commission budget to support the defense industry are seen in Paris as opening the door to much deeper integration of the EDTIB, using the many tools of the European Union. Third, the United States itself expects the European allies to mobilize additional resources to support Ukraine and rebuild its armed forces, recognizing that US industry alone is unable to meet demand at this pace.

France clearly expects the EU (possibly with other partners) to turn the corner in this context and hopes that this will create opportunities for deeper cooperation among Europeans as French leaders have repeatedly stated. France certainly hopes to see major projects get off the ground and deliver, and it has high hopes for its European partners. This explains some of the frustration in Paris with Polish or German decisions to prefer off-the-shelf solutions to more ambitious and structuring European projects.

While Paris recognizes that the road to deeper European defense integration is long and often marked by setbacks and disappointments, creating a European DTIB remains a strategic goal for France. The new EU toolbox, bilateral and mini-lateral cooperation mark some steps along that road, but the French certainly believe that there is room for considerable progress and many new projects. This proposition will be tested against the actual implementation of the major projects under way, starting with the FCAS, and will require from Paris a probably more sophisticated argument to reassure its partners of the value and benefits of such a deepening of European cooperation, and from France and its partners a willingness to accept the costs and compromises involved in this level of ambition.

Germany

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Industries/ RTO: What are current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

The German defense industrial base is characterized by a handful of prime system integrators, especially in the land and naval sectors, with an extensive network of suppliers in the following tiers.[7] Due to the particularities of the consolidation process after the end of the Cold War, Germany retained a quasi-duopolistic system integrator structure in the land, naval, electronics, and missile sectors instead of having national champions develop. Where such a duopolistic structure does not exist, European consolidation has taken place (mainly in the aerospace sector).

German domestic procurement decisions support this duopolistic structure via the creation of joint ventures between the respective two companies for specific projects (land, naval sectors). With the government clinging to the illusion of a functioning market[8], different ownership structures in the companies, and a regulatory policy aimed at limiting state influence and shaping power, it is likely that this structure will remain in place for the foreseeable future.

Table 2: Top Tier German DefenSe Industrial Companies (2021)

COMPANY	SECTOR	ROLE	REVENUE	EMPLOYEES
AIRBUS	AEROSPACE	SYSTEM INTEGRATOR	TOTAL: $61.671 BN DEFENSE: $10.850 BN	127.000
DIEHL	ELECTRONICS, MISSILES	COMPONENT INTEGRATOR	TOTAL: $3.745 BN DEFENSE: $0.870 BN	16.000
HENSOLDT	ELECTRONICS	COMPONENT INTEGRATOR	TOTAL: $1.743 BN DEFENSE: $1.610 BN	TOTAL: 6.400
KRAUSS MAFFEI WEGMANN/NEXTER (KMW/KNDS)	LAND	SYSTEM INTEGRATOR	TOTAL: $3.193 BN DEFENSE: $3.030 BN	TOTAL: 8.700 (4.000-5.000 AT KMW)
LÜRSSEN	NAVAL (SURFACE)	SYSTEM INTEGRATOR	TOTAL: $1.3 BN - $2.1 BN	TOTAL: 1.500
MBDA	MISSILES	COMPONENT INTEGRATOR	TOTAL: $5.007 BN DEFENSE: $4.960 BN	TOTAL: 14.000
RHEINMETALL	LAND (INCL. MUNITIONS), ELECTRONICS, SOLDIER SYSTEMS	SYSTEM INTEGRATOR	TOTAL: $6.691 BN DEFENSE: §4.450 BN	TOTAL: 28.000
THYSSENKRUPP (MARINE SYSTEMS)	NAVAL (UNDERWATER & SURFACE)	SYSTEM INTEGRATOR	TOTAL: $40.226 BN DEFENSE: $2.390 BN	TOTAL: 96.000 (6.500 AT TKMS/DEFENSE)

Source: Mostly SIPRI Arms Industry Database (https://www.sipri.org/databases/armsindustry), respective company Websites for employee numbers.

7 Perspektiven der wehrtechnischen Industrie in Deutschland. Hans-Böckler-Stiftung, Düsseldorf, p.57ff. https://t1p.de/tywom

8 See governmental responses negating any impact of their decisions on defence industrial investment decisions, e.g. https://t1p.de/qyuhv p.11 or https://t1p.de/pp55d p.15.

In addition to system integrators, there are several suppliers of critical components. Foremost among these are Renk, ZF Friedrichshafen (transmissions), and MTU (engines) for land and naval systems. Others include Jena Optics for optical equipment for land and naval systems. However, there is no publicly available overview over these companies and their respective relationships with system integrators.[9] While many companies are still considered German, their ownership has changed in recent years, as in the cases of MTU, Hensoldt and others. At the same time, international companies often need a national branch to compete in German tenders, such as Thales.

Beyond products, a number of key players are closely involved in the R&D and R&T of new technologies for defense. The Fraunhofer-Gesellschaft, the universities of the Bundeswehr, the technical centers of the armed forces, and IABG are involved in basic research, concept development, and the testing and evaluation of (emerging) technologies.[10] In addition, defense companies report that they invest a high proportion of their turnover in R&D – around seven percent.[11] Major projects in the German defense industry are mostly tied to national development and procurement programs, although there is some internationalization through company-funded development projects.

Table 3: Major Projects of the German Defense Industry (Domestic and Export)

SECTOR	COMPANY	PROJECT	NATIONAL, MULTI, EXPORT	DESCRIPTION
AEROSPACE	AIRBUS	FCAS	MULTI	Future combat aircraft and system of systems project with France and Spain
AEROSPACE	AIRBUS	EUROFIGHTER	MULTI	Legacy multi-role combat aircraft with continued production & upgrade
AEROSPACE	NHI (AIRBUS)	NH90	MULTI	Legacy tactical medium transport helicopter project, standard system for German army and navy
AEROSPACE	AIRBUS	A400M	MULTI	Legacy tactical transport aircraft project
AEROSPACE	AIRBUS	EUROMALE	MULTI	European MALE UAV project
AEROSPACE	LOCKHEED MARTIN	F-35	IMPORT	Import, plus some industrial participation by Germany
AEROSPACE	BOEING	STH CHINOOK CH-47	IMPORT	Import, plus some industrial participation by Germany

9 For the best available overview see Weingarten, Jörg; Wilke, Peter; Wulf, Herbert (2015) – like footnote 1 - p.60 ff.

10 For an innovation-centric view, see Becker, Sophia; Mölling, Christian; Schütz, Torben (2020): Learning together: UK-Germany cooperation on military innovation and the future of warfare. The Policy Institute – King's College London. https://t1p.de/v1wbh

11 Ostwald, Dennis; Legler, Benno (2015): Der ökonomische Fußabdruck der deutschen Sicherheits- und Verteidigungsindustrie (SVI). Bundesverband der Deutschen Sicherheits- und Verteidigungsindustrie e.V. S.29.

SECTOR	COMPANY	PROJECT	NATIONAL, MULTI, EXPORT	DESCRIPTION
AEROSPACE	BOEING	P-8 POSEIDON	IMPORT	Import, plus some industrial participation by Germany
AEROSPACE	LOCKHEED MARTIN	C-130	IMPORT	Import of tactical transport aircraft for joint wing with France
LAND	KMW/KNDS; RHEINMETALL	MGCS	MULTI	Future MBT (and long-range fires) project with France
LAND	KMW/KNDS; RHEINMETALL	BOXER	NATIONAL EXPORT	Legacy APC project
LAND	RHEINMETALL; DIEHL	SHORAD AD	NATIONAL	National short-range air defense project
LAND	KMW/KNDS; RHEINMETALL	PUMA	NATIONAL	National IFV project
LAND	RHEINMETALL	PATRIOT MODERNIZATION	LICENSE	Air defense system modernization with domestic participation
LAND	DIEHL	IRIS-T	NATIONAL EXPORT	Domestic air defense system (for European Sky Shield Initiative)
LAND	KMW/KNDS; RHEINMETALL	LEOPARD 2	NATIONAL EXPORT	Legacy MBT with continued production and upgrades
LAND	RHEINMETALL	LYNX	EXPORT	Export IFV
LAND	RHEINMETALL; KMW/KNDS	WHEELED 155MM ARTILLERY SYSTEM	NATIONAL	Prototypes for an armament project for the German army
LAND	RHEINMETALL	PANTHER MBT	EXPORT	Prototype MBT
NAVAL	DAMEN SHIPYARDS; LÜRSSEN	F-126	NATIONAL	National frigate project, design in Netherlands, production largely in Germany

SECTOR	COMPANY	PROJECT	NATIONAL, MULTI, EXPORT	DESCRIPTION
NAVAL	TBD	F-127	NATIONAL	National frigate project, development phase
NAVAL	TKMS	U212CD	MULTI	Joint submarine project with Norway
NAVAL	LÜRSSEN; MEYER WERFT	NAVAL TANKERS	NATIONAL	Replacement of national assets
NAVAL	LÜRSSEN	SIGINT VESSELS	NATIONAL	SIGINT replacement of national assets
NAVAL	LÜRSSEN; TKMS; GNY	K130	NATIONAL	Domestic corvette project
NAVAL	TKMS	MEKO FRIGATES	EXPORT	Export variant of frigates
NAVAL	TKMS	U212 VARIANTS	EXPORT	Export variant of AIP submarines

Source: Mostly SIPRI Arms Industry Database (https://www.sipri.org/databases/armsindustry), respective company websites for employee numbers.

How does your country assess the impact of cooperation, dependencies (import/export), and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

Germany's DTIB is assessed according to its performance regarding capability, competitiveness, capacity, and cooperation (building on the traditional C3s[12]):

Capability: Germany's defense industrial base can develop, produce, and maintain technologically advanced weapon systems for most land and naval applications. This capability is somewhat limited in the aerospace sector and for stand-off munitions, especially missiles. However, both limitations are probably more related to traditional procurement patterns having to do with multinational cooperation and imports than to shortcomings in the overall industrial potential.

Competitiveness: Germany is one of the world's largest arms exporters despite lukewarm government support for arms exports, and many of its products, including complete land and naval systems, are competitive on the world market. In addition, German subcontractors have successfully specialized in the export of components, such as engines, transmissions, and even marine propellers.[13]

Capacity: Russia's attack on Ukraine had European and American allies scrambling to supply both the Ukrainian and their own armed forces, exposing their dependence on global supply chains and the constraints on production capacities, at least for

12 See e.g., Mölling, Christian; Chagnaud, Marie-Louise, Schütz, Torben; von Voss, Alicia (2014): European Defence Monitoring (EDM). Stiftung Wissenschaft und Politik Working Paper, p.24ff. https://t1p.de/vrwe0

13 See SIPRI Arms Trade Database or e.g., Phillips-Levine, Trevor (2023): The Art of Supply Chain Interdiction: To Win Without Fighting. War on the Rocks. https://t1p.de/db7bb

war-related production such as munitions and land systems. Germany's defense industry, in the many years since the end of the Cold War, had successfully adapted its production to peacetime conditions but lost the ability to scale up for wartime conditions. Nevertheless, it retains a comparatively large capacity for certain products, and some defense companies are actively working to increase production.

Cooperation: Armaments cooperation is deeply rooted in German political and industrial tradition, with multinational European and transatlantic projects dating back to the 1960s. Domestic producers also cooperate frequently on export sales, for example in the production of submarines for South Korea or of Leopard 2 hulls in Greece. Today, Germany participates in 28 PESCO projects. The most important cooperation projects are FCAS, MGCS, U212CD and EUROMALE. However, smaller and less symbolically important cooperation projects may get cancelled, as for instance the Tiger upgrade and probably the MAWS MPA.

Dependencies: German companies are largely dependent on foreign suppliers for many raw materials, some alloys, and components where the production is concentrated outside of Germany and Europe, such as semiconductors. Here, the suppliers are mainly located in Asia. In other areas, Germany depends on US components, products, and systems, for example regarding medium to long-range air defense, 5th generation fighter aircraft, and heavy transport helicopters. Some types of missiles, naval guns, radars, and UAVs are sourced from Europe or globally.[14] While Germany is worried about depending on imports from China – though not so worried that it would engage in decoupling – imports from the United States or European countries are not viewed as critical or problematic.

Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for its development?

Domestic policy decisions (trigger points) that will shape the future of Germany's DTIB include the procurement priorities set by the government and the armed forces (currently speed is considered of the highest importance), decisions on the future of European cooperation projects, budget decisions (both for procurement and R&D), and a new law on arms exports (which is expected to be more restrictive in general while allowing more leeway for multinational exports). All four elements will have a financial impact on industry players generating revenue in Germany and beyond. So far, Germany's domestic defense spending does not appear to be growing quickly enough to generate a steady stream of revenue after the EUR 100 billion special fund is spent, limiting domestic R&D and procurement spending.[15]

The war in Ukraine and the resulting changes in the global market have a major impact on the future of the German DTIB: First, previously unimportant producers gain market shares as the material consumption in Ukraine is larger than what European companies can provide to replenish stockpiles or transferred equipment, thus opening up markets in Europe itself.[16] Second, states change their capability priorities according to the lessons identified/lessons learned from conflict monitoring (e.g., C-AUS, missile artillery).[17] Defense manufacturers will need to adapt their products and incorporate innovations accordingly.[18] Third, Ukraine and Russia will cease to be exporters on the world market because they need their capacities for the war.[19] To some extent, this also applies to European and American manufacturers if they prioritize production for Ukraine. Finally, the war creates the potential for new markets as new products and capabilities prove themselves in combat. Depending on the target market and sector, non-traditional suppliers are beginning to see success in Europe. Outside of Europe, it is still unclear how Russia's exports and its traditional markets will evolve over the coming years. In any case, these markets may not be suited to European and American manufacturers, as they are likely to favor lower-cost emerging suppliers such as China, Türkiye, or South Korea.

Thus, Germany's defense industry will likely face subdued demand both domestically and in terms of

14 Assessment largely based on SIPRI Import/Export registers for Germany over the past 15 years. See https://www.sipri.org/databases/armstransfers

15 See e.g. Relermann, Christian (2023): So will Finanzminister Lindner das 20-Milliarden-Loch stopfen. Spiegel. https://t1p.de/ij1er

16 McLeary, Paul; Hudson, Lee (2022): Better call Seoul: U.S. watches nervously as Europe turns to South Korea for weapons. Politico. https://t1p.de/zsfxr

17 See e.g. Spin aiming to recreate its rocket artillery capability. Gosselin-Malo, Elisabeth; Frantzman, Seth (2023): Israel's Elbit looks to cash in on European artillery appetites. Defense News. https://t1p.de/0ofoc

18 See e.g. Borchert, Heiko; Schütz, Torben (2022): Die neue Währung heißt Einsatzerfahrung. Tagesspiegel. https://t1p.de/6uvca

19 MacDonald, Alistair; Emont, Jon (2023): Russia's War in Ukraine Hurts Its Arms Industry, Creating Openings for Rivals. The Wall Street Journal. https://t1p.de/gh9a5

exports if the government does not provide for more stable domestic defense spending and a more active export policy. Moreover, if speed continues to be the main priority in procurement, as seems likely, imports could gain in importance and further limit investment in domestic technological development. Consequently, more co-production and imports seem likely, especially in non-core technologies and systems. If Rheinmetall's (and, to a limited extent, Lürssen's) aggressive growth/internationalization strategy pays off, this could shift the ecosystem toward more concentration and consolidation over time.

If imports and offsets were to favor companies other than those currently working on export-related goods, which are marked by a high export dependency, the new impetus from import and license products would change Germany's DTIB. Yet it may be useful to think in terms of stages or tasks of industrial production and trade: Supporting Ukraine is one, replenishing European arsenals is another, and supplying the changing global market is a third. At different times and in different markets or with different customers, the balance between quantity and quality may change. At the same time, one should note that a more passive defense industrial policy would leave the drive for consolidation and exports/global market participation to the companies. Navigating these many changes over the next decade or two will be a challenge both for governments and companies.

Greece

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INTRODUCTION

This presentation will briefly review the current state of the Greek DBIT, assess its key drivers, and speculate on its future development. The first section will provide an overview of the strengths and weaknesses of the current Greek DBIT in order to provide context for the six major defense contractors presented in the appendix. the second section will examine the larger driving forces shaping Greece's DBIT, focusing on the interplay of geopolitical and political economy imperatives. The third section presents projections about the future of the Greek DBIT, assuming that the EU's Common Security and Defense Policy (CSDP) will indeed play a formative role in the structure of the European DBIT and that the EU, together with its key member states, will build on its record in the Russo-Ukrainian war as a significant security provider.

Industries/RTO: What are the current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

The factors that currently shape the strengths and weaknesses of the Greek DBIT can be traced to three features of the Greek national security environment: First, the Imia crisis (1996), which brought Greece and Türkiye to the brink of war and led to a major arms acquisition spree in the late 1990s and early 2000s, a spree fueled by offset agreements under which some major weapons systems were manufactured in Greece. Second, the limitations of NATO as a security provider forced Greek policymakers to strengthen their defense ties with France through procurement decisions. Third, Greece's fiscal crisis, which lasted almost a decade and resulted in the weakening, but not elimination, of the Greek DTIB buildup through the offset agreements mentioned above.

Table 4: Indicative weapon systems procurement orders with Greek DTIB participation

WEAPON SYSTEM	GREEK DTIB OFF-SET CONTRIBUTION	AGREED DATE OF DELIVERY
10 MIRAGE 20000 EG FIGHTER JETS UPGRADE (FRANCE)	MIRAGE 2000-5 MK2 CONFIGURATION UPGRADE	2007
3 T-214 SUBMARINES (GERMANY)	ASSEMBLY AND MANUFACTURING IN GREECE	2006-2009
170 LEOPARD 2A5 MBTS (GERMANY)	COMPONENT PARTS MANUFACTURING	2006-2009
20 NH90 HELICOPTERS (FRANCE, GERMANY, ITALY)	COMPONENT PARTS MANUFACTURING	NO DATE PROVIDED
1100 STINGER MANPADS (UNITED STATES, FROM THE EUROPEAN STINGER PRODUCTION PROGRAM)	COMPONENT PARTS MANUFACTURING	1993-2004
PATRIOT AIR DEFENSE SYSTEM UNITED STATES	COMPONENT PARTS	2002-2004
30 F16 BLOCK	FOLLOW ON SUPPORT	NO DATE PROVIDED

Source: Information derived from Paraskevi Vlahou, Defense Industry, Sectoral Study 222,IOVE, March 2009 (in Greek, unpublished)

The Imia crisis led Greece to substantially replenish its major weapon systems at a time when other EU member states were massively reducing their Cold War force structures. Significantly, the Greek armed forces acquired American F16 and French Mirage 2000 fighter aircraft, German Leopard main battle tanks (Greece currently has one of the largest Leopard tank fleets in Europe) and T-214 submarines, and US Patriot air defense systems. These acquisitions, by virtue of the offset agreements, meant that Greece's major defense companies, which are mostly but not exclusively state-owned, were obligated either to manufacture these weapon systems in part and under license, to produce component parts for the global supply chains of their foreign manufacturers (in the case of Lockheed Martin's F16s), and/or to participate in future upgrades of the weapon systems acquired.

As the weapons systems mentioned above show, Greece has bought quality and spread its bets.

The threat of the much larger Turkish armed forces means that Greece's political leadership will heed the military's call for qualitative parity with Türkiye. The United States is among Greece's most important suppliers because of its ability to intervene to avert a conflict between Greece and Türkiye if it so chooses (exercised in Imia in 1996, but not in Cyprus in 1974). At the same time, Greece's unique status as the only NATO member country not covered by NATO's Article 5 explains why Greece also chooses to favor France as a supplier in its procurement, especially of advanced fighter jets, notwithstanding the inefficiencies and costs associated with a mixed fleet of Hellenic Air Force aircraft. France, as an important Mediterranean power willing to differentiate itself from the United States, offers Greece implicit or explicit security guarantees vis-à-vis Türkiye. Germany, as a highly advanced producer of weapons systems and the leading net contributor to the EU budget, is also a preferred supplier to the Greek armed forces.

From the point of view of the Greek DTIB, these factors mean that Greek defense companies have been involved in highly advanced weapon systems of mixed US and European provenance.

Poor governance, union capture leading to excessive labor costs, a political leadership focused on nominal over real strength and thus underfunding follow-on support and upgrades, and no government spending on defense R&D (in good times or bad) have undermined the ability of Greek defense firms to use offsets as a launch pad for developing an export portfolio. As a result, when Greece's fiscal crisis hit, the state-owned defense sector was subjected to ruthless cost-cutting, with Greece's creditors pushing for its near total elimination. Greece's most promising defense company, the aerospace firm EAV, was forced to lay off valuable staff, jeopardizing its status as a supplier to Lockheed Martin, while the two shipyards serving the needs of the Hellenic Navy, Skaramanga and Elefsina, were forced into administration, also depriving the workforce of valuable expertise.

Nevertheless, Greece's DTIB still stands. The strengths of the DTIB that survived the financial crisis are: a) its portfolio of partnerships with leading foreign defense companies; b) a capital base of facilities and equipment and valuable licenses for weapons production and testing, which means that the industry does not face major NIMBY obstacles to expansion; c) an experienced workforce, despite its partial depletion during the financial crisis.

To these legacy strengths must be added the benefits of the post-financial crisis environment. Three out of five of Greece's financially troubled defense companies, listed in this paper's appendix of Greece's top six defense companies, have been put on sound financial footing through recapitalizations and have been or will be strengthened through subsequent acquisitions or minority stakes by well-capitalized outside investors.

How does your country assess the impact of cooperation, dependencies, (import/export), and competition among Europeans but also vis a vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

The current Greek government has doubled down on the policy mix of a) acquiring high-end weapon systems while b) cementing optionality with major security providers. Vis-à-vis the United States, this has meant the transition of much of the F16 fleet to the Viper configuration, as well as an expression of interest in the acquisition of F35 aircraft, with EAV implementing the former agreement and expected to play a yet-to-be-determined role in the latter.

Regarding France, the package includes the acquisition of Rafale fighter jets, Belharra frigates, and the possible acquisition of Gowind corvettes. The Greek DTIB's involvement, after the acquisition

of the Belharra frigates, is being initiated with mostly medium-sized Greek companies entering into agreements with the manufacturer of the Belharras, the Naval Group. If Naval wins the upcoming corvette contract, it is expected that these will be built at Skaramanga Shipyards.

In land systems, there has been considerable "noise" around the upgrade of the Leopard MBT fleet, which would involve a partnership between its German manufacturers, Rheinmetall and Krauss-Maffei, and one of the Greek state companies and possibly one or more of the private companies, as well as the possible acquisition of the latest generation Lynx IFV.

There are two other major drivers of the existing Greek DTIB, involving partnerships with mostly US and European companies: The first is the issue of follow-on support, which has been massively neglected during the years of fiscal crisis, affecting both availability rates and critical modernization of weapon systems, with land, air, and naval fleets all being cannibalized for components. A decisive reversal of this practice will lead to a further increase in the technological sophistication of the Greek DTIB.

Table 5: Selected Hellenic Armed Forces military systems in need of Follow On Support and / or upgrades

MILITARY SYSTEM	MANUFACTURER
C-27J SPARTAN TRANSPORT AIRPLANE	ALENIA AERONAUTICA, LEONARDO, ALENIA AERMACCHI, LOCKHEED MARTIN
LEOPARD MBT	RHEINMETALL, KRAUSS MAFFEI
MEKO FRIGATES	BLOHM + VOSS
NH90 AS332 UTILITY MILITARY HELICOPTER	AIRBUS HELICOPTERS, LEONARDO, FOKKER AEROSTRUCTURES

Source: Reports published by Greece's specialist defense press

Second, there is the question of the Greek DTIB making a significant contribution to the replenishment of the European arsenals mandated by the EU's Strategic Compass. An indication of the possibilities here is the participation of a Greek company, EODH, a Krauss Maffei subcontractor, in the production of armor for Leopard tanks ordered by Norway after the outbreak of the Russo-Ukrainian war. EODH owes its existence to the offset agreement generated by the earlier purchase of Leopard tanks by the Hellenic Army mentioned above. Inevitably, the Greek DTIB's participation in the massive effort to replenish European arsenals will be affected by each company's ability to overcome legacy constraints, with the need to rebuild a skilled workforce being the biggest challenge of all.

Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for its development?

Of course, EU-wide developments will be critical, and there, Greece will be a regime-taker, not a regime-maker. To the extent that such key EU member states as Germany and France, and secondarily Italy and Spain, take a decisive step toward a consolidated European DTIB, supporting a „geopolitical Europe" fiscally and through corporate consolidation, Greece will follow suit.

In this scenario, the Greek DTIB would gradually replace the current European industrial partnerships, which are mostly bilateral, with the pan-European consortia that would come to develop the common European fighter, frigate, MBT, and so on. After all, the major French, German, and Italian defense companies that have bilateral partnerships with Greece will, one way or another, be the core pillars of any future pan-European consortia that would produce these platforms.

To the procurement-oriented portfolio of Greek DTIB partnerships, as an entry point to a future European DTIB, one should add the R&D portfolio accumulated by Greek defense companies through EDF and PESCO. Sixty Greek companies participate in thirty EDF-funded partnerships, which means that Greece ranks 5th in the EDF EU country rankings in terms of participation. Greek entities participate in twelve PESCO projects, of which six are lead partners. Overall, Greece ranks among the top five EU member states in terms of number of participations in EDF and PESCO, the first four being France, Italy, Spain, and Germany.[20]

20 See, Spyros Blavoukos, Panos Politis-Lambrou, and Thanos Delatolas, Mapping EU Defense Collaboration One year on from the Versailles Declaration, ELIAMEP, Policy Paper 133, 20 April 2023.

Thus, and to the extent that there may be catalytic developments in the consolidation of the pan-European DTIB, a transition to a different business model for Greece's DTIB seems possible: transitioning from part-manufacturing of mature technologies via offset agreements to participation by Greek defense firms from beginning to end, from R&D to production and follow-on support and upgrades of various pan-European innovative defense systems.

This bifurcation point must be placed in the larger post-economic crisis context of Greece's business model, whereby the policy consensus is that the Greek state must fund R&D from national sources, so as to enable the Greek business community to migrate to higher value-added activities.[21] The Greek government has yet to bite the bullet, with the Greek R&D ecosystem still primarily funded by the European Research Council and the Cohesion Fund.

The Greek DTIB, as an integral member of a consolidated and reinvigorated European DTIB, may turn out to be a catalyst in this regard, with the geopolitical imperative overwhelming the resistance to committing scarce fiscal resources that cannot be wealth-creating within the electoral cycle.

Finally, with regard to the future DTIB, to the extent that the European Investment Bank (EIB) lifts all restrictions on financing the European defense sector, Greek venture capital firms that have received EIB funding and have been critical to the dynamic development of Greek high-tech start-ups, would be enabled to take stakes in Greek defense-oriented start-ups as well as in more mature Greek private sector mid-sized defense companies that can make a valuable contribution to both the Greek and the European DTIB.[22]

Annex: Greece's Top 6 Defense Companies

COMPANY NAME	REVENUE IN MILLION EUR AND EMPLOYEES	CURRENT MAJOR PROJECTS	ROLE IN SUPPLY CHAIN/ PRODUCT PORTFOLIO	COOPERATION PARTNERS:	INVOLVEMENT IN EUROPEAN PROJECTS/ COMMENTS
EAV	**REVENUE**: €74 MILLION IN 2021 **EMPLOYEES:** 1780	• Upgrade of 83 F16 to the Viper configuration, expected year of completion 2027 • Upgrade of 5 P3 naval cooperation aircraft • Manufacturing F16 and C130 J component parts for Lockheed Martin's global supply chain (ongoing)	Integrated in Lockheed Martin's global supply chain (see above)	• Lockheed Martin in the main • Involvement in European Projects • Lotus UAV	Lotus UAV
SKARAMANGAS SHIPYARDS	**REVENUE**: NO DATA PROVIDED (Due to company's recent status under administration) **REVENUE**: NO DATA PROVIDED. (Due to company's recent status under administration)	Bidding, as a subcontractor, for the Hellenic Navy's 3+1 corvette acquisition programme, with Naval's Gowind corvette.	Has built three out of the four 214 submarines, in a past partnership with HDW so it may be a HDW partner in any future 214 upgrades.	Naval Group	See cooperation parners

21 This consensus has been encapsulated most prominently in a government commissioned report led by Greek-Cypriot Economics Nobel Prize winner, Professor Christopher Pissarides, see https://t1p.de/n7xy8

22 Interview of the author with a partner at a leading Greek venture capital firm.

COMPANY NAME	REVENUE IN MILLION EUR AND EMPLOYEES	CURRENT MAJOR PROJECTS	ROLE IN SUPPLY CHAIN/ PRODUCT PORTFOLIO	COOPERATION PARTNERS:	INVOLVEMENT IN EUROPEAN PROJECTS/ COMMENTS
ELEFSINA SHIPYARDS	**REVENUE:** €22 MILLION IN 2019 (Last year the company published financial results) **EMPLOYEES:** 600	Bidding, as a subcontractor, for the Hellenic Navy's 3+1 corvette acquisition programme, with Fincantieri's FCx30 corvette.	No known information	Fincantieri	**COMMENT:** The acquirer of Elefsina Shipyards, ONEX, has received a 125 $ million loan from the US international Finance Corporation.
EAS	**REVENUE:** €6 MILLION IN 2021 **EMPLOYEES:** 500		Produces various land weapon systems and munitions mostly under liecense	Recently signed an agreement with Heckler and Koch which may lead to manufacturing orders, as a Heckler & Koch subcontractor, to the tune of 50 million euros for the next 2-3 years.	**EU. PROJECT INVOLVEMENTS:** Potential supplier for 155 mm artillery shells, in the context of the EU's munitions purchasing programme, in the reported range of 50-80 million euros.
ELVO	**GENERAL INFORMATION:** No meaningful information provided in the company's website on size, revenue, projects and Role in Supplychain/Portfolio		**COMMENT:** ELVO has been acquired by the Israeli company Pasal, after experiencing protracted financial difficulties. As of yet there is no information on personnel, turnover or projects undertaken. Its main advantage, its unique in Greece production line for the manufacturing of armoured vehicles, has yet to be utilized, as there have been no procurement decisions, by the Ministry of Defense, for MBTs upgrades or IVFs acquisition.		
INTRACOM DEFENSE	**REVENUE:** €59 MILLION IN 2021 **EMPLOYEES:** 454	• Upgrade of Hellenic Air Force's Patriot batteries.	See Cooperation Partners	• Recently acquired by Israel Aerospace Industries (IAI) so should be partaking in IAI R&D and manufacturing effort. • Raytheon	Participates in 6 EDF projects

Source: Data and Information Extracted from Company Websites and the Greek Press

Hungary

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DEVELOPING HUNGARIAN DEFENSE INDUSTRIAL CAPACITIES AND CAPABILITIES FOR THE 2030S

When examining national defense industrial capacities and capabilities in Europe, Hungary – once again – should be considered a special case compared to other countries. First, because as an overarching trend, the Hungarian defense sector has been chronically underfunded, cutting into bone and muscle. This has led to the abandonment of entire services and weapon systems (such as artillery of almost every kind) and the loss of hardware, leaving the Hungarian Defense Forces (HDF) exposed and vulnerable into the 2010s. Second, in parallel, since the end of the Cold War, the Hungarian defense industry has been steadily losing, not gaining, production capacity, technological know-how, expertise, and skilled labor, such as technicians and engineers. This downward spiral was driven by the very limited modernization of the HDF until the late 2010s, off-the-shelf procurement from foreign companies whenever any modernization took place, and the lack of incentives to develop the production and innovation capacities of national companies, which limited their activities mostly to maintenance services. Third, as the innovation infrastructure and management in Hungary remained underdeveloped in general and, in particular, with regard to defense innovation, the defense industrial supply chains were degraded, with small and medium-sized enterprises (SMEs) only marginally involved in supporting defense production and innovation. Most importantly, even the most capable national defense firms remained maximum Tier 2 suppliers which were only weakly integrated into European defense industrial cooperation.

This downward trajectory was changed by the Zrínyi Homeland Defense and Armed Forces Modernization Program, which was launched in 2016. It is not only the largest modernization program of the HDF since the 1980s but also a comprehensive program to strengthen military capabilities as well as the system of homeland (territorial) defense and the revival of the defense industry. The goal is to rebuild and develop the defense industry on the basis of both a national pillar and international cooperation with leading defense innovators in order to push the key players of the Hungarian defense industry to excel in defense industrial competition. After decades, Zrínyi is the first defense modernization program that includes a decisive defense industrial element – at the same time, this is to be done on the basis of the remaining Hungarian defense industrial capacities, with the aim of launching a rapid, large-scale industrialization and modernization program with an innovation edge by the early 2030s. This is quite an ambitious goal, supported by large medium-term procurement programs driven by a record defense budget, a redesigned institutional, legal, and innovation framework, and an integrated long-term national industrial development program. The transitional phase makes it difficult to provide credible data, as even long-established companies are undergoing transformation, new actors in the defense industry have yet to be established, and transparency is a general feature of the Hungarian defense sector.

In sum, the next decade of the Hungarian defense industry could be characterized as an attempt to grow from a backward, garage-based SME to a well-established national and, in some areas, internationally recognized company with an innovative edge and significant arms export potential. This evolutionary leap places the Hungarian defense industry in a unique position and creates unique requirements for the coming years.

Industries/ RTO: What are current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

As of March 30, 2022, a total of 525 companies were registered in Hungary for defense-related activities, of which 169 had production capacities (while others provided security and defense-related services and/or had such an export portfolio).[23] This included dual-use technologies and services as well. The Hungarian Defense Industry Association currently

23 Based on the registry of the Government Office of the Capital City of Budapest, Department of Trade, Defense Industry, Export Control and Precious Metal Assay.

has 40 members (only):[24] While it includes the "old" large MoD-controlled companies (such as Currus, Arzenál, Armcom or EI), it does not include the newly established/acquired national and international joint ventures (such as Rheinmetall Hungary, Hirtenberger Defense Systems, Aero Vodochody). Of these 40 companies, 23 list both production and R&D capabilities in their portfolios (not the same subsets), 19 list maintenance, and only 7 list existing test laboratories. In terms of services provided, 13 listed manufacturing, engineering, and test equipment, 13 engineering services, training, and R&D, 9 companies produce military and special vehicles, 7 military vehicle parts and spares. 8 companies provide services related to IT, computing, and software, 7 companies provide C4I, and 7 companies provide communications systems and equipment, sometimes in cross-cutting subsets.[25] Most of these companies are SMEs, and even larger companies have limited resources, know-how, and manpower.

Overall, the number of employees directly involved in the defense industry is currently estimated at less than 2,000 people. The Ministry of Innovation and Technology plans to increase this number to 5,000 to 8,000 employees by 2030, driven by ongoing investment projects involving large-scale production and the associated production chain.[26]

Furthermore, the Hungarian defense sector is expected by the Ministry of Defense to generate an output of HUF 500 billion (€1.35 billion) by 2030, becoming "one of the decisive defense industrial hubs of the region." This would be a gigantic leap from the €40 million annual average of defense exports in the 2010s, and a significant increase even compared to the approximately €900 million dual-use export value.[27] The latest available data (for 2019) show that arms exports consisted mainly of ammunition, land vehicles and parts, radio and communication systems, CBRN equipment, and personal protective equipment. Total trade amounted to €231.45 million, of which exports accounted for €53.39 million – resulting in a negative balance.[28] Hungary's major defense export partners were Germany, Switzerland, the United States, and Canada, with smaller/occasional shares from Malaysia, Austria, France, Italy, and Slovakia.

The Defense Industrial Strategy (adopted in 2021, not publicly available) has identified six clusters around which investment, partnerships, and development will be focused over the next decade. These clusters and their flagship projects are as follows:

- IVF, APC production, and military vehicle production in Zala and Somogy counties (SW Hungary). As the most important element, the joint venture Rheinmetall Hungary will supply Lynx infantry fighting vehicles (218 vehicles, of which 172 will be produced in Zalaegerszeg) equipped with the StrikeShield active protection system, including Israeli LR-2 Spyke anti-tank missiles. Future innovation projects may include the integration of the Israeli Trophy active protection system and Rheinmetall's Oerlikon Skyranger anti-aircraft system into the Lynx. The cooperation with Rheinmetall also includes the procurement/manufacture of 300 armored personnel carriers, 40 of which will be purchased from the Turkish company Norul Makina in the original design (Ejder Yalcin), while the remaining 260 will be a Hungarian configuration called Gidran, equipped with a wide range of sensors and flexible in functional equipment (produced in Kaposvar). This cluster also includes a test area (ZalaZone) and validation laboratories to support innovation, particularly for autonomous vehicles, based on the example of Rheinmetall's Mission Master XT. The design and development of a new next-generation 8x8 hybrid combat vehicle in cooperation with Rheinmetall and Krauss-Maffei Wegmann is also an option, which could even serve as a long-term replacement for the BTR-80 IFV in the HDF (currently unresolved).

- Aviation industry in Békés County (SE Hungary). A rather small but high-value presence of Airbus Helicopters will ensure the production of engine parts in Gyula. The Brazilian company Embraer – from which HDF is purchasing 2 KC-390 military transport planes – has announced the establishment of a research and development center in Hungary.

24 Defense Industry Association of Hungary.
25 Hungarian Defense Industry 2023, https://t1p.de/tdt1h pp. 84-185.
26 Hecker, Flórián: Magyaraországot választhatja a NATO, https://t1p.de/o2itq
27 Biztonságpiac Évkönyv 2018, p. 64.
28 2019 Report on the Activities of the Department of Trade, Defense Industry, Export Control and Precious Metal Assay, https://t1p.de/uf2gi pp. 24-25.

- Small arms production in Bács-Kiskun county (S Hungary). Based on the license of Ceská Zbrojovka, MoD Arzenál assembles small arms in Kiskunfélegyháza together with Unique Alpine machine guns and the development of the Hungarian designed Gestamen small arms family. Dynamit Noble Defense and MoD Arzenál will produce reactive armor (possibly DND ERA to be integrated into the Lynx IFV) as well as anti-tank weapons for light infantry.

- Ammunition and explosives production in Veszprém and Fejér counties (central Hungary). Rheinmetall Waffe Ammunition is developing two facilities near Várpalota: one for the production of 30-, 120- and 155-mm artillery shells (for the Leopard 2 tank, Lynx IFV and PzH-2000 artillery), the other for the production of hexogen/RDX explosives. In the long term, part of the production capacity of Hirtenberger Defense Systems (mortars) may be transferred to this area.

- Production of radio and satellite communication systems in Budapest. In the field of defense information technology, communications, and space, 4iG – a joint venture of Rheinmetall AG (51 percent), 4iG Ltd. (39 percent) and MoD EI Ltd. (10 percent) – is the leading player, also acting as a systems integrator for network-based C4 functions. In addition, in 2022, 4iG acquired an initial 20 percent stake in Israeli company Spacecom, with an option for a further 31 percent over the next three years, subject to political approval by the Israeli government. Starting in 2024, the orbital slot currently leased by Hungary to Spacecom for space-based telecommunications will be occupied by CarpathiaSat, a 4iG joint venture. The slot is expected to be used for the launch of Hungary's first commercial satellite in approximately five years.

- Radar and locator production in Szabolcs-Szatmár-Bereg County (NE Hungary). As part of the procurement of ELM-2084 multi-mission radars (11 units) for the HDF, Rheinmetall Canada is outsourcing the production of such equipment to Nyírtelek.

How does your country assess the impact of cooperation, dependencies (import/export), and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

Due to the underdeveloped situation of the Hungarian defense industry, as briefly assessed above, a two-pronged approach was used to develop the sector. In the case of highly complex products, where Hungarian companies have no chance of competing on any scale, renowned international Tier 1 companies with strong market positions were to be involved in joint projects, and an industrial presence – including both production and R&D – was to be established in Hungary. In this way, the high costs of market entry would be reduced to a certain extent. These flagship projects, mainly IVF, APC production, aviation industry, and ammunition/artillery production, involve new multinational partnerships from Europe, notably German, French, and Turkish companies. The first stage of defense modernization in the Zrínyi program, the procurement of modern equipment, has been designed and implemented in such a way as to attract European manufacturers to participate in a long-term cooperation model of production plus innovation and to locate new facilities in Hungary. In a general sense, there is a strongly "networked" feature to these developments: Hungary has bought into German, Czech, Austrian, Turkish cooperations with the prospect of acquiring technologies and know-how that can be combined and further innovated into new high-tech marketable products. Of course, there is a certain risk in this approach due to the lack of combat experience (Lynx, Gidran). For less advanced products and services, where Hungarian companies have a better chance of participating, national companies receive tailor-made support from the government to improve their position and develop their capacities to be able to join advanced production chains. Starting in 2021, SMEs will be able to compete for resources from a HUF 50 billion (€130 million) defense industry supply chain venture fund.

Participation[29] in the European and NATO defense innovation cooperation is an important element in the development of Hungarian capabilities, although current limitations make it difficult to compete. Innovation in emerging and disruptive technologies in Hungary focuses on four aspects (out of eight identified by NATO): big data, AI, autonomous systems, and quantum computing. NATO DIANA has accepted two test centers from Hungary (related to autonomous systems). EDF is currently supporting six defense innovation projects with Hungarian participation, while Hungary leads one PESCO project (EUROSIM) and participates in eight others.

Due to the transitional nature of the Hungarian defense industry, many background enabling processes, such as the stable supply of raw materials and specialized parts in international supply chains, are currently unclear. This aspect is present in strategic considerations and has contributed to the choice of mostly European products for procurement and European partners for enhanced manufacturing and R&D cooperation (rather than US or Asian). However, Hungary has limited diplomatic, political, or economic capacity to influence such international processes on its own. In this respect, relying on the influence of European (especially German) partners would be an asset. Similarly, participation in the international arms trade together with German companies or through joint ventures is expected to be particularly valuable since a more restrictive German arms export policy could offer windows for exports via Hungary (even to crisis areas).

In sum, cooperation is strongly focused on EDTIB, and dependence on European companies is seen as an opportunity (access to technology and international markets that would otherwise not be open to Hungarian defense products) rather than a risk.

Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for its development?

When the Zrínyi Program was launched in 2017,[30] its defense industrial pillar was to be built around the 2016 long-term national re-industrialization strategy (Irinyi Plan[31]), which identified defense industry ("personal defense equipment, small arms, light armored vehicles") as a possible breakout area for Hungary among seven areas to be developed. Currently a new Research, Development, and Innovation Strategy for 2021-2030[32] serves as the base for initiating new defense industry projects through investment and partnership. The confidential Defense Industrial Strategy (2021), referred to earlier, is based on four pillars to achieve the ambitious goals of the government: 1) Actors, Structures, Processes; 2) Innovation; 3) Human Resources; 4) Management.

The exact development areas and projects, as well as the respective partners cooperating in them, with a view to 2030, have been outlined above. On the basis of the agreements sealed during the first major phase of the Zrínyi Program (2016-2023), it is possible to outline the main projects until the 2030s, meaning that actors, structures, and processes have been identified.

However, there is one general feature that can now be recognized as a crucial shortcoming which could hinder progress (and long-term success): Hungary's poor performance as an innovator. The European Innovation Scoreboard lists Hungary among the "emerging innovators," 22nd among the 27 EU member states in 2021, with an innovation output of 67.9 percent compared to the EU average. Based on 2018 data, only 9.5 percent of (all) industrial enterprises in Hungary were engaged in continuous innovation activities (compared to the EU average of 29.6 percent), and only 28.4 percent were engaged in occasional innovation (compared to the EU average of 53.1 percent). This is insufficient to achieve the ambitious goals set for 2030. Attracting high-tech defense companies with an innovation edge (such as Rheinmetall) to Hungary has been successful, and the government has introduced funding programs tailored to the needs of SMEs to develop the national actors of the supply chain.

To ensure a skilled and qualified workforce, closer and deeper cooperation programs with universities, innovation hubs, and research centers have also been initiated. These will, of course, show their first results in the coming years, and the competitiveness of the defense sector as an employer will also remain an issue.

The Ministry of Technology and Industry, the successor to the Ministry of Innovation and Technology, will oversee the implementation of the strategies, rather than the Ministry of Defense, which is considered to lack the necessary management expertise. As the Hungarian defense industry is in a unique situation in many respects, this element also needs to be tested before its efficiency and results can be assessed.

29 5G COMPAD (Saab – BHE Bonn Hungary Electronics Ltd.) – 5G communications for peacekeeping and defense; EuroHAPS (Thales – C3S Elektronikai Fejlesztő Ltd.) – high altitude platform systems demonstration; FaRADAI (Ethniko Kentro Erevnas Kai Technologikis Anaptyxis – Certh Számítástechnikai és Automatizálási Kutatóintézet) – frugal and robust AI for defense advanced intelligence; iFURTHER (Hellenic Aerospace Industry SA – BHE Bonn Hungary Electronics Ltd.) – high frequency over the horizon sensors' cognitive network; NOMAD (Equipos Móviles de Campana Arpa, S.A.S. – F4STER–FUTURE 4 Co.) – Novel energy storage technologies at military deployments in forward operating bases; ALTISS (Magellium S.A.S. – SAGAX Communications Ltd.) – highly automated swarm of affordable ISR lond endurance UAVs for force protection

30 Government Decree No. 298/2017, June 2, 2017

31 Drafted by the Ministry of Economy, endorsed by the government on February 5, 2016.

32 Government Decree No. 1456/2021 (July 13, 2021), replacing the R&D&I Strategy for 2013-2020 (Gov. Decree No. 1414/2013, adopted on July 4, 2013).

Italy

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THE ITALIAN INDUSTRIAL LANDSCAPE

In 2021, the Italian DTIB achieved a turnover of 17 billion euros – 66 percent from exports – and employed about 52,000 workers directly and about 210,000 indirectly. 86 percent of the companies are small and medium enterprises (SMEs), but the large companies employ 96 percent of the sector's workforce.[33] The DTIB covers the entire spectrum of conventional capabilities, either through system integrators or by providing key components and technologies. With regard to the former, Italian industry is the design authority for complex platforms such as helicopters and warships as well as a number of army vehicles; it is co-leader of the Eurofighter multinational cooperation for combat aircraft and of the Samp-T bilateral cooperation for missile systems. In terms of dual-use space capabilities, Italy is one of the few countries in Europe to cover both upstream and downstream sectors, including launchers.[34]

The largest company is obviously Leonardo, which according to SIPRI 2021 data ranks 7th in the world in terms of revenue, and second in Europe after BAE System.[35] Its main divisions focus on helicopters, fixed-wing aircraft, defense electronics, and multidisciplinary armament systems. Leonardo is the Italian shareholder of European missile champion MBDA, with MBDA Italy representing the Italian leg, working on both seekers and interceptors.[36] Leonardo also forms the so-called "Space Alliance" with Thales through joint ownership of Telespazio (67 percent of shares) and Thales Alenia Space (33 percent of shares), and holds a stake in Avio, the small launch vehicle manufacturer.

Fincantieri is the premier shipbuilder in the DTIB and the home of the Italian navy's capabilities, from the Cavour aircraft carrier to various classes of warships and submarines. It built the Orizzonte and FREMM frigates as well as the Vulcano logistic support ships in cooperation with the French Naval Group.[37] Fincantieri also produced the U212 submarines as junior partner of the German TKMS.

Elettronica is a major supplier of defense electronics and electromagnetic and cyber solutions in several operational areas. In the land sector, Iveco Defence Vehicles is a major player in Italy and internationally with a range of wheeled vehicles, while Beretta supplies individual soldier weapons and equipment to the Italian Army and abroad. Rheinmetall is also present and active in the Italian DTIB through its subsidiary Rheinmetall Italia. Avio Aero, a GE company, is the Italian engine manufacturer. Finally, a number of SMEs are active in the defense sector, often with dual-use technologies, such as STAM.

COOPERATION PARTNERS AND EUROPEAN PROJECTS

The Italian DTIB traditionally cooperates with both European and transatlantic partners. Within the EU, France is the most important partner in the space and naval fields. The German partnership was crucial for the Todaro class submarine. Rome has been working with Paris, Berlin, and Madrid on the Euromale project since its inception. Italy also participates in or leads a number of PESCO projects with significant industrial implications, such as the European Patrol Corvette and the Space-based Early Warning for Missile Defense (TWISTER). Italian companies have been part of numerous successful consortia bidding for the 2021 and 2022 EDF calls, although rarely in a leading role. Regarding the next generation of helicopters, Italy is involved in both NATO and EU initiatives. Last but not least, the presence of Italian companies in the Polish DTIB is noteworthy, as well as Leonardo's recent acquisition of 25 percent of the German Hensoldt.

In Europe, but outside the EU, the United Kingdom has been an important partner for Italy since the 1980s when it comes to fighter aircraft, helicopters, missile systems, and defense electronics. Leonardo

33 Intervento Presidente AIAD-Ing. Giuseppe Cossiga Commissione Esteri e Difesa Senato. (2023, 14. February) – https://t1p.de/3wny2

34 For an in-depth analysis of the Italian space sector, see Karolina Muti, Ottavia Credi and Giancarlo La Rocca https://t1p.de/902c5

35 Diego Lopes da Silva et al., "The SIPRI Top 100 Arms-producing and Military Services Companies, 2021", in SIPRI Fact Sheets, December 2022, p. 9, https://t1p.de/vwczm

36 For an in-depth analysis of missile defence in Italy, see https://t1p.de/ltizh

37 On the Franco-Italian naval cooperation, see https://t1p.de/7c58l

UK has a significant presence across the Channel. It is no coincidence that Rome joined the Tempest project in 2019 and launched the Global Combat Air Program (GCAP) with the UK and Japan in December 2022. In April 2023, the Italian and British governments signed a memorandum of understanding aimed at strengthening cooperation in defense and other areas.[38]

At the transatlantic level, by far the most important cooperation concerns the F-35, in which Italy has been involved since the late 1990s. Italy's DTIB builds the central fuselage and wings of the aircraft, provides a number of key components through the involvement of Leonardo and other companies, and hosts the only US Final Assembly and Check-Out (FACO) facility at Cameri (Piedmont). The Cameri factory will also serve as a Maintenance Repair Overhaul Upgrade (MROU) site, ensuring a flow for the next three to four decades. Dutch F-35s will be assembled there, and Italy aims to promote this facility as the hub for FACO/MROU of European F-35s. In addition, there is significant transatlantic cooperation in space, and Leonardo owns the American company DRS.

DTIB STRENGTHS AND WEAKNESSES

Within this broad landscape, the DTIB's strengths generally lie in sectors where major national and/or international procurement programs are underway in which Italian industry plays a leading or significant role. Fighter aircraft, helicopters, warships, space equipment, and some defense electronics are examples of this. On the other hand, there is a clear weakness regarding main battle tanks, where Italy is looking for a solution to replace the Ariete platform built in the 1990s by Leonardo and Iveco Defence Vehicles.

In terms of production capacity, the Italian DTIB is facing similar challenges and opportunities as other major European countries due to the war in Ukraine. So far, Italy's military supplies to Kiev amount to more than one billion euros and require the replenishment of stocks of armored vehicles, short-range air and missile defense systems, ammunition, etc. The increase in defense budgets throughout Europe requires an increase in production capacities for Italian companies, too, but bottlenecks in the supply of components, raw materials, factory infrastructure, and skilled human resources also affect Italy.[39]

In this respect, an important and peculiar weakness is the uncertainty about medium and long-term investments by the Italian Ministry of Defense (MoD). In fact, the MoD, which has a multi-year procurement plan, does not have a multi-year legally binding budget allocation, and this discourages companies from investing in facilities, personnel, and suppliers. There have been initiatives to introduce a multi-year financial planning law, but they have not been successful so far.

Moreover, the national defense budget is not increasing at the same pace as other European countries, as Italy's defense spending will not reach two percent of GDP until 2028, which is another weakness. In fact, the planned budget increase will be absorbed by the replenishment of the stocks used to support Ukraine, leaving little room to invest in new capabilities and/or multiply the units to be acquired under the planned procurement programs.

A third related issue is the DTIB's reluctance to take the risk of private investment outside the comfort zone provided by national or multinational procurement programs. There are several deep-rooted reasons for this, and it has a negative impact on both the innovation process and the ability to ramp up production capacity. The complexity of MoD procurement rules – including certification – and the constraints imposed by export regulations further hamper the innovation and competitiveness of the Italian DTIB.[40]

ITALY'S OUTLOOK ON INDUSTRIAL COOPERATION, COMPETITION, AND DEPENDENCIES

In general, Italy remains strongly in favor of international cooperation in procurement: First, because most capabilities are beyond the reach of national programs. Second, to pool investments and increase the domestic markets for the new capabilities by generating economies of scale. Third, there is a convergence between Italian foreign and defense policy priorities and the DTIB footprint and partnerships at the European level and beyond, which favor

38 https://decode39.com/6592/meloni-sunak-new-beginning-italy-uk-mou/

39 For a comprehensive analysis, see Industrial Production in Support of European and Transatlantic Defence, https://t1p.de/7sx4g

40 On the weaknesses and disadvantages of the Italian export regulations, see https://www.affarinternazionali.it/italia-riforma-esportazioni-militari/

whole-of-government support for international cooperation. This cooperative attitude is counterbalanced by the military and industrial will to maintain and/or increase operational sovereignty over equipment as well as the DTIB's capacity to design and produce complete platforms or at least significant components. The balance between these two opposing rationales is achieved on a case-by-case basis, depending on a number of variables.

For example, the Italian industry was co-leader of the Tornado and Eurofighter procurements. Then they were given a junior role in the US-led F-35 project as the only way to participate in the development of a 5th generation aircraft. Now, with the GCAP, Italy is again seeking a co-leadership role on an equal footing with the UK and Japan, also in terms of Leonardo's design authority, systems integration, technological sovereignty, etc. Similarly, in the naval domain, Fincantieri acted as a system integrator during the Cold War, then had a junior role in the U212 cooperation with Germany, and now seeks an autonomous lead in the recently launched national procurement program for Near Future Submarines (NFS). The Italian Navy's requirements will differ from those of the German Navy, and the next class of four NFS boats will carry more Italian technology than current submarines.[41]

In general, Italians assess dependencies with a great deal of pragmatism. If it is a trusted supplier and/or if it is possible to transform a dependency into an interdependency through a partnership, it will be managed in a win-win perspective. At the same time, if there are conditions for the domestic DTIB to reduce dependencies by leading, co-leading, or at least enhancing its role in the supply chain, Italy is likely to invest in it within the given budgetary constraints. In some cases, the military-industrial will to lead may entail more competition with other large European companies.

This dynamic balance between cooperation and competition is deeply rooted and here to stay. But market conditions are changing in light of the international security environment. The aforementioned increases in defense budgets in Europe and the shift toward high-intensity, large-scale conflict scenarios will have an important impact. Italy seems to have recognized the geopolitical watershed caused by the Russian invasion of Ukraine but not yet its industrial implications. In fact, no meaningful initiative has been taken to increase production capacity and/or rebalance the quality and quantity of assets to be procured.

Against this backdrop, individual leadership also play a role. In May 2023, the government of Giorgia Meloni appointed Roberto Cingolani as the new CEO of Leonardo.[42] In line with his professional background, Cingolani is interested in emerging disruptive technologies and cybersecurity. Lorenzo Mariani, former CEO of MBDA Italia, will take on the powerful role of Director General of Leonardo, leveraging his long experience and understanding of the defense sector.[43] Therefore, the Italian prime contractor is likely to undergo an adjustment process – but not a revolutionary one – toward a new balance between core business and novel areas of investments.

41 https://www.iai.it/it/pubblicazioni/underwater-environment-and-europes-defence-and-security

42 https://t1p.de/gzj5n

43 The new CEO of MBDA Italia will be Giovanni Soccodato, senior manager in Leonardo with decades of experience in the defence sector, marking a certain continuity in this regard.

Lithuania

Margarita Šešelgytė, Director, Institute of International Relations and Political Science at Vilnius University

The development of the national defense industry has not been a priority for Lithuania since the restoration of its independence. First of all, due to the small size of the economy and the lack of previous experience in the defense sector, Lithuania did not have any state enterprises (except for one), and private enterprises were too small and did not produce sophisticated defense systems. Therefore, for the development of national defense needs, Lithuania had to rely on procurement from other countries.

Today the situation is changing, the war in Ukraine and the shortage of weapons and ammunition have shown the importance of closer supply chains and self-sufficiency. In addition, growing defense budgets, new instruments for financing the defense industry, and the increased presence of allied troops are creating windows of opportunity for the defense industry to expand, and the use of modern technology and innovation in warfare is allowing for greater involvement of SMEs producing dual-use products. These changes were the catalysts for long-awaited changes to make the national defense industry a priority. On May 25, 2023, four ministries (Ministry of National Defense, Ministry of Foreign Affairs, Ministry of Interior, Ministry of Economy and Innovation) signed the Guidelines for the Development of the Lithuanian Defense and Security Industry.

Industries/ RTO: What are current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

The Lithuanian defense industry could be defined as very small, relatively young, niche oriented, and essentially private. The state owns only one defense company – AB Giraitė – which produces ammunition. The Lithuanian defense industry consists of about 80 companies specializing in areas such as laser sights, communications, intelligence, surveillance, target detection, cybersecurity, civil security, production of transport, ammunition, equipment, and the provision of services. The defense sector also has a growing number of innovative start-ups. Only a few of them are exclusively dedicated to the production of products and services for defense and security applications. The majority are dual-use companies.

One of the key competencies in Lithuania is the ability to provide high-end photonic solutions for defense and security applications. In addition, the Lithuanian defense industry is also strong in providing various ICT and engineering solutions.

How does your country assess the impact of cooperation, dependencies (import/export), and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

For the development of its national defense needs, Lithuania since the restoration of its independence has had to rely on procurement from other countries. Lithuanian defense procurement is implemented on the basis of capability-based, threat-based, resource-based, but most importantly, "opportunity-based" methods. The latter is determined by a number of factors: the size of the budget, the needs of the armed forces, the availability of products at a certain price on the market, and political decisions. For a number of years, the key factor influencing Lithuanian defense procurement decisions was a very small defense budget, which meant that there was a lack of money for acquisitions. In the 1990s, most of the equipment for the armed forces came in the form of donations from other NATO and EU countries. Later, procurements were mostly focused on second-hand production, with price being one of the most important criteria for acquisitions. Most of the procurements were individual weapons (guns, antitank weapons, transport vehicles). Political decisions were also important in the choice of contracts. The United States is one of the largest suppliers of various defense systems, and a large part of these purchases were made within the framework of US military aid (Foreign Military Fund and, as of 2015, European Reassurance Initiative Fund). The relations with the US companies are considered to strengthen the bilateral relations with the US decision makers, which are very important for the Lithuanian security policy.

There are two main documents regulating defense procurement in Lithuania: the Law on Public Procurement and the EU Directive 2009/81/EC. 21 The former establishes the lowest price rule,

while the latter aims to ensure fair competition. When implementing defense procurement projects, the Lithuanian Ministry of Defense must comply with both laws. In many cases, however, the exceptions allowed by Article 346(1)(b) of the Treaty on the Functioning of the European Union (TFEU) are applied due to the presence of "essential security interests" regarding the procurement projects. This exception allows to disregard fair competition and lowest price rules. In these cases, direct government-to-government procurement agreements are applied. This type of agreement was used for the €386 million contract with the German manufacturer ARTEC for the purchase of 88 Boxer infantry fighting vehicles. Government-to-government contracts are considered beneficial to national defense interests because they allow for the acquisition of the best product at the best price and with the most appropriate technical specifications. For example, Boxers are used by the German Armed Forces as Armed Personnel Carriers (APCs), but the Lithuanian Armed Forces needed them an Infantry Fighting Vehicle (IFV), so the contract included other companies from Israel and the United States, which provided the necessary additional equipment.

In recent years, the deteriorating security situation in the region has affected both the size of the defense budget and the demand for procurement. Since 2014, Lithuania's defense budget has been growing steadily, reaching 2.52 percent of GDP in 2022. According to the new inter-ministerial guidelines, 2.5 percent will remain the minimum for 2023-2027. Since 2015, at least 20 percent of the budget has been spent on acquisitions. Major defense modernization projects for 2023-2027 include: infantry fighting vehicles, self-propelled artillery systems, armored all-terrain vehicles, mine countermeasures and search and rescue vessels, multi-purpose helicopter platforms, mobile medium-range radars, unmanned aerial vehicle systems, and volley fire systems. Up to six percent of the defense budget is earmarked for investment in infrastructure. The vast majority of products are purchased from foreign manufacturers. The Lithuanian Armed Forces in most cases do not use the production of the national defense industry companies. Most of the production of Lithuanian defense industry companies (70 percent) is exported to NATO and other countries. The United States is one of the main partners in a number of production categories. Other export markets include EU and NATO countries, Ukraine, Georgia, Moldova, Israel, Egypt, UAE, India, Australia, and New Zealand. For the companies that produce ready-to-use systems or various services, it is imperative to reach the end users, while component manufacturers are trying to participate in the value chains of the global defense industry. For a number of years, these companies have been operating mostly on their own, as there have been few efforts to mediate between Lithuanian business and foreign contractors at the state level.

Lithuania plays an active role in the European Union's security and defense policy (PESCO, recent use of the European Peace Facility to finance military assistance to Ukraine, but it is a somewhat pragmatic skeptic. In recent discussions on the participation of non-EU countries in EU security and defense projects, Lithuania has actively defended the right of countries such as the United States or the United Kingdom to participate in these projects and also be eligible for EU funding. Lithuanian defense companies are not very active in EU programs or EDF calls. First of all, there is still no network. Second, there are cumbersome bureaucratic procedures that consume a lot of administrative resources. Finally, direct interaction with, for example, US contractors is more profitable.

However, it is worth mentioning that there are companies participating in EU programs. Two Lithuanian institutions – the Baltic Advanced Technology Institute (BATI) (€620 million) and the Lithuanian Naval Force (LNF) (€100.000) in 2020 participated in the PADR project OCEAN 2020 (€34,5 million). In the same year, the same BATI, ELSIS, ELSIS PRO, and NRD CS also participated in six projects in the framework of EDIDP. BATI was also the coordinator of the "CYBER4DE" project (€9.7 million). The total amount of funds attracted by Lithuanian institutions and entities amounts to more than 1.5 percent of the value of the PADR program. Lithuanian business and research institutions participate in nine EDF projects (BATI, ADOS - Tech, Fizinių ir technologijos mokslų centras, and Aktyvus Photonics). Some of the programs are led by European defense industry giants such as Leonardo or Indra Sistemas. Multinational projects involving both SMEs and large industrial companies are a good basis for further cooperation, and both PESCO and EDF are seen as a great opportunity for networking and fostering new cooperation. State aid for the initial stages of implementation of these projects (as EDF money usually comes at a later stage) becomes key.

Table 6: Top 5 Lithuanian defense industry companies

COMPANY NAME	REVENUE IN MILLION EUR	EMPLOYEES	PRODUCTS, SERVICES OR PROJECTS	EUROPEAN PROJECTS
KONGSBERG NANOAVIONICS	14.8	231	Kongsberg NanoAvionics is a small satellite mission integrator focused on delivering new generation satellite buses and their mission services for the satellite applications market.	EDF – 2 projects
BROLIS SEMICONDUCTORS	12.3	38	Brolis Semiconductors develops cutting-edge electro-optical and laser systems for defense and security applications. Their products range from dismounted soldier systems and border surveillance solutions to OEM projects for airborne and naval applications.	N/A
NT SERVICE	4.7	86	NT Service primarily works on the construction of greenfield or building collocated telecommunication site infrastructure, building antenna masts, equipping power supply and environment condition infrastructure. However, the company also develops defense and security solutions, for example, counter UAV solutions that allow early drone detection and mitigation.	N/A
NOVIAN SYSTEMS (EX ELSIS PRO)	3	51	Novian Systems (ex ELSIS PRO) provides information systems and software development services.	• EDIDP – 2 projects
BALTIC INSTITUTE OF ADVANCED TECHNOLOGY	0.4	54	Baltic Institute of Advanced Technology (BPTI) is a private, high tech-oriented research institute. BPTI focuses on creating and developing new technologies and providing R&D services. In the defense space BPTI focus on R&D in RF, AI and AR/VR for military UX/UI solutions	• PADR – 3 projects • EDIDP – 4 projects • EDF – 20 projects

Source: Innovation Agency, Lithuania 2023

As NATO is also developing its own ecosystem aimed at promoting innovation and progress in the defense industries of NATO members, new opportunities for international exposure and innovation are opening up for Lithuanian companies. Lithuania participates in both NATO DIANA (Defense Innovation Accelerator for the North Atlantic) and NATO Innovation Fund (NIF). So far, Lithuania has proposed to host six NATO test centers, which could also be used by Lithuanian companies. It is worth mentioning that last month the Lithuanian Armed Forces also invited companies to test their products.

Future Avenues: How may the national DTIB evolve over the next decade? What are the important trigger points for one or the other development?

The development of the national defense industry was not a priority for Lithuania for a number of years, but geopolitical developments and technological progress are creating pressure to put more emphasis on the development of national resources.

Due to the lack of prioritization for the defense industry, operating conditions for national companies were quite poor. One of the main obstacles is an outdated and overly bureaucratized legal environment (e.g., outdated ammunition law) and a cumbersome licensing system. Another challenge is the weak governance, with various responsibilities scattered

among different institutions (MoD, EIMIN, MoFA, MoI) which creates problems for both the defense industry operators and new players wishing to enter the market. Other issues that need to be addressed are: a lack of government support for Lithuanian companies in finding new partners; insufficient promotion of the domestic industry at international military exhibitions; and not enough information for companies operating in the defense sector about future state and foreign defense needs. Lithuania does not actively use offset opportunities and does not articulate the need to acquire know-how by ensuring adequate stocks and local service, including local manufacturers, in contracts.

Although it must be admitted that there have been some efforts by both business and government to change the existing environment, reforms have been slow. However, two recent steps deserve closer attention. First, the Ministry of National Defense and INVEGA (a state-owned financial institution) established the Defense Investment Fund (DIF) in 2020. The Defense Investment Fund will finance MILInvest, a venture capital instrument for investments in defense and security companies. The Fund will receive up to €15 million from Lithuania's state budget (including management fees and/or management costs payable to the fund manager and the financial intermediary of the financial facility) for a period of ten years, with the possibility of extension. The second important step was the signing of the Guidelines for the Development of the Defense and Security Industry 2023-2027 by four ministries operating in this field: Ministry of Defense, Ministry of Foreign Affairs, Ministry of Economy and Innovation, and Ministry of Interior. The guidelines address the above-mentioned problems of the Lithuanian defense industry environment and provide for joint steps to solve them. If these guidelines are properly implemented, it is likely that the national defense industry will expand in the coming years. What is Lithuania's advantage? According to Invest Lithuania, there are several advantages to developing the industry in Lithuania: a high economic performance, the country's strategic location and accessibility, a business-friendly environment, young and highly qualified talent, fast, reliable, and affordable infrastructure, a focus on the future, and a relationship of cost to quality.

Poland

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Even after Poland's accession to NATO (1999), its defense industrial policy was characterized by a lack of large-scale programs that could serve as a tool for developing new technologies and increasing the competitiveness of the Polish defense technological and industrial base (DTIB). Instead, the focus of the DTIB was mainly on the maintenance and modernization of post-Soviet systems. New technologies were transferred in the form of offsets or license production, but there were relatively few such programs, at least compared to needs. At the same time, there were several national R&T/R&D projects aimed at developing a new generation of systems, but few resulted in acquisitions.[44] As a result, Poland's DTIB relied entirely on the domestic market, and its exports were small ($300-400 million annually).[45] What also made Poland stand out in the EU was its non-participation in the flagship European arms programs of the early 2000s, such as the Eurofighter "Typhoon" or the A400M.

The long-awaited change was expected to come with the acceleration of the transformation and modernization of the armed forces, which gained new momentum after the 2016 Strategic Defense Review. The resulting 2017 Concept of the Defense of the Republic of Poland[46] declared the intention to both increase the size of the armed forces and thoroughly rearm them. To that end, several initial flagship programs were launched between 2017 and 2021, with the acquisition of F-35 multi-role fighters (2020) or M1A2 tanks (2021) being the most significant.

The Russian invasion of Ukraine in 2022 served as a spur to these plans, accelerating the timelines and increasing the scale of the planned acquisitions. In terms of threat perception, it is now widely understood in Poland that if Russia does not suffer a clear defeat in Ukraine, it could escalate hostilities against NATO, specifically against Poland and the Baltic states, once it has rebuilt its military capacity. In terms of defense industrial policy, one lesson Poland has drawn from the conflict is the critical role of an unrestricted access to a DTIB which is ready and able to both maintain/repair weapon systems in a timely manner and ramp up ammunition production.

As a result, Poland launched some very large armament programs throughout 2022 and sharply increased its defense spending (three percent of GDP for the basic defense budget from 2023 onward, augmented by an off-budget fund to a total of over four percent of GDP, or approximately $30 billion).[47] These decisions will have a lasting impact on the Polish DTIB.

POLAND'S DEFENSE INDUSTRIAL AND TECHNOLOGICAL BASE

Structurally, the majority of Polish defense companies remain consolidated in the Polish Armaments Group (PGZ), a state-owned holding company that owns over 50 different companies, controls over 30 other companies, and directly employs over 18,000 people. Recently, PGZ has been included in both SIPRI's Top 100 and Defense News' Top 100 lists, ranking 76th and 70th in the world, respectively (with $1.28 billion in revenues in 2021, according to Defense News, and $1.4 billion in arms sales in 2021, according to SIPRI).[48] PGZ controls almost all the land systems and military shipbuilding industrial bases in Poland. PGZ offers a wide range of products, including armored vehicles, missiles, sensors, small arms and light weapons, as well as ammunition and individual soldier equipment. In terms of production volume, the most prominent systems are "Rosomak" 8x8 APC[49] (over 900 vehicles built and more on order) and "Krab" SPH (over 80 built and around twice

44 Compare: M. Terlikowski, Defence Innovation: New Models and Procurement Implications. The Polish Case, "ARES Policy Paper" no 73, March 2022, https://t1p.de/5mpnj

45 Ibid.

46 See: "Defence Concept of the Republic of Poland", June 13, 2017, https://www.gov.pl/web/national-defence/defenceconcept-publication

47 Wiceszef MON: musimy dozbroić polskie wojsko po donacjach dla Ukrainy [Deputy defence minister: we need to arm Polish military following the donations for Ukraine], Polish Press Agency, October 10, 2022, https://t1p.de/v82am

48 L. Béraud-Sdreau, X. Liang, D. Lopes da Silva, N. Tian, L. Scarazzato, The Sipri Top 100 Arms Producing And Military Services Companies, 2021, SIPRI, December 2022, www.sipri.org ; Defense News Top 100 for 2022, https://people.defensenews.com/top-100 .

49 "Rosomak" 8x8 APC is licensed version of Finnish Patria's AMV. Production started in 2003 and gradually involved specialised versions, for instance a platform for a 120mm mortar "Rak". More: J. Wolski, Rosomak wczoraj i dziś w SZ RP [Rosomak yesterday and today in Polish Armed Forces], "FragOut Magazine" no 30, 2020, https://fragoutmag.com/frag-out-magazine-30/

as much on order). "Piorun" MANPADS and "Grot" standard service rifles have also been produced in large quantities and exported (to Ukraine and some NATO customers).

The aerospace industry, unlike the land sector, is almost completely privatized, with three subsidiaries of the world's leading prime contractors: Airbus Group (owner of PZL Warszawa-Okecie), Lockheed Martin (PZL Mielec), and Leonardo (PZL Świdnik). These companies employ between 1500 and 3000 people each and produce components, subsystems, and some completed platforms (such as the S70i) as part of their owners' global supply chains. A group of private companies, mostly in the small and medium enterprise (SME) category, are mainly active in the field of military electronics and UAVs. Perhaps the best known of this group is WB Electronics, which has been successfully supplying military electronics and UAVs to the Polish military. Since 2022, the company's flagship systems ("Flye Eye" drone and "Warmate" loitering ammunition) have also been successfully used by Ukraine.

Poland's DTIB is currently facing an investment of historic proportions. It is estimated that Poland will spend at least EUR €140 billion on investments in new capabilities by 2032.[50] Most of the programs will be developed in cooperation with foreign partners – the United States, South Korea, and the United Kingdom. However, some important programs will be run as purely national efforts.

In the land systems sector, which clearly dominates recent investments, there are two tank programs. One concerns the United States and provides for the acquisition of approximately 350 M1 "Abrams" (115 M1A1 SA by 2024 and 250 M1A2SEPv3 by 2026; the latter contract is worth $4.75 billion).[51] The second involves South Korea and the purchase of 180 K2 tanks in the current "Korean" version by 2026 (contract worth $3.37 billion[52]) with further 800 to be produced in Poland in a modernized "PL" version after 2026. There are also two rocket artillery programs – Poland will purchase 218 K239 Chunmoo systems from South Korea (contract worth $3.55 billion[53]) and 468 HIMARS launchers (contract worth about $10 billion) for a total of over 500[54]. There is also a barrel artillery program – 212 K9 SPHs will be procured from South Korea (contract worth $2.4 billion), while more than 460 will be produced in Poland after 2026 in a "PL" specification.[55] At the same time, production of the indigenous "Krab" SPH will be increased to meet new contracts involving Poland and Ukraine (54 vehicles). The planned acquisition of more than 1400 "Borsuk" tracked APCs (a result of the national R&D program) may be worth up to $10 billion, making it the largest program implemented by the Polish DTIB on its own.[56]

Poland is also investing in aerospace technologies. The F-35 program will result in 32 aircraft being delivered to Poland by 2030 (contract value $4.6 bn), but the participation of the Polish DTIB has not yet been negotiated. Another program, again with South Korea, involves the purchase of 48 FA-50 jets (about $3 billion), and the transfer of technology will allow Polish companies to maintain this platform. Smaller contracts concern helicopters: 32 AW149s will be purchased for about $1.7 billion as well as an unspecified number of S70 Blackhawks (in addition to the eight already procured). Potentially the biggest program, however, will involve AH-64 helicopters, as Poland seeks to acquire 96 machines which could be worth more than $7 billion.[57]

In the area of air and missile defense, Poland is implementing the "Wisła" program with the mid-range US Patriot air defense systems in a "Polish" version ($4.75 billion for the first two batteries, the next six may cost up to $15 billion) and two programs on short- and very short-range systems: "Narew" and "Pilica+," both based on the CAMM missile supplied by the United Kingdom (the first contracts signed so

50 Informacja ministra obrony narodowej na temat polityki uzbrojenia [Information of the minister of national defence about the armaments policy], Hearing of the National Defence Commission of the Senate of the Republic of Poland, 25 October 2022, https://t1p.de/7sx4g

51 Polska kupiła Abramsy za 20 miliardów [Poland bought Abrams for 20 billion], „Defence24", 5 April 2022, https://t1p.de/7bs7k

52 Kolejna dostawa czołgów K2 dla polskich czołgistów [The next shipment of K2 tanks], Press information of Polish Armed Forces, 19 May 2023, https://t1p.de/gvljz

53 Pierwsze K239 Chunmoo w przyszłym roku w Polsce [First K239 Chunmoo next year in Poland], Press information of Polish Armed Forces, 4 November 2022, https://t1p.de/k8k08

54 The first 20 HIMARS systems were procured in 2019 and delivered in 2023. More: Błaszczak: Polska chce kupić wszystkie HIMARS-y [Błaszczak: Poland wants to buy all HIMARS], Defence24, 13 February 2023, https://t1p.de/285sw

55 Kolejne haubice K9 i czołgi K2 trafiły do Polski [The next K9 howitzers and K2 tanks arrived in Poland], Press information of Polish Armed Forces, 22 March 2023, https://t1p.de/1ermy

56 M. Szopa, Poland Announces an Order for 1000 Borsuk IFV - and a New, Heavy Vehicle, Defence24, 1 March 2023, https://t1p.de/b3rxs

57 U.S. Security Cooperation With Poland, Fact Sheet Bureau Of Political-Military Affairs, 31 October 2022, https://www.state.gov/u-s-security-cooperation-with-poland/

far are worth approximately $2.7 billion, but the main contract could be much larger, as the Narew system alone is planned to include 23 batteries).

COOPERATION, DEPENDENCIES AND COMPETITION

As Poland's threat perception – even before 2014 – was increasingly focused on Russia and the threat of a Russian escalation against NATO, the Polish approach to DTIB was primarily shaped by the primacy of the operational needs of the armed forces, defined by a perspective of crisis and war. As a result, Poland remained concerned about dependence on foreign defense industry partners. Such an approach implied an effort to ensure the national capacity to maintain, service, and repair weapon systems purchased abroad. Technically, licensed production was a primary way to address these concerns.

The Russian invasion of Ukraine prompted Poland to double down on its approach to dependence on external partners for life-cycle support of foreign-acquired systems. As a result, Poland has managed to reach an agreement with the United States to establish an M1 Abrams tank service and maintenance center in one of the PGZ companies (WZM Poznan)[58]. It also successfully negotiated the integration of Polish-designed wheeled platforms with the HIMARS launcher system and is seeking a joint venture with South Korea to develop a family of missiles for the K239 Chunmoo system.[59] Finally, there is the joint development of a K2 "PL" MBT or K9 "PL", which will lead to setting up a service, maintenance, and repair capacity of the Polish DTIB.[60].

Poland's focus on non-EU partners – the United States, the United Kingdom, and South Korea – can be seen as an illustration of Polish skepticism about the overall capacity of the European Defense Industrial and Technological Base (EDTIB), the willingness of EU partners to share technology as part of defense industrial relations with Poland, and – more broadly – the willingness of Poland's partners to provide material support to Poland in times of crisis and war. The German approach to arms transfers to Ukraine has significantly deepened these concerns, although they have been expressed before, for example in the context of a difficult experience with Polish-German cooperation on Leopard 2 modernization or the rejection of the Polish offer to join the Franco-German MGCS program. As a result, Poland welcomes competition between EU and non-EU industries on the European market, as it gives governments more options for investing in new capabilities and contributes to strengthening the transatlantic link and relations between EU and non-EU NATO allies.

THE FUTURE OF POLAND'S DTIB

With a historic increase in defense spending and a very ambitious investment program, Polish DTIB has a clear growth perspective. It is safe to assume that in the coming years, sales will increase, production will increase, and employment will increase across the sector. PGZ, for example, is expecting strong growth in its revenues as early as 2022 - from approximately €1.35 billion in 2021 to €1.78 billion, an increase of about 31 percent; employment will also increase, albeit by about two percent for the time being.[61]

Obviously, the long-term effects of the recently launched programs in terms of technology, skills, know-how, or competencies of the Polish DTIB are yet to be seen. Nevertheless, what will decide the growth path of Poland's DTIB is its ability to use the current programs as a springboard to expand outside the Polish national market, even if it looks very lucrative in the medium term. This could be done by firstly integrating into the global supply chains of Poland's defense industry partners – US, UK, and Korean prime contractors – and then by developing new products based on transferred technologies and effectively marketing them abroad. Thus, the extent and conditions of technology transfers from foreign partners, followed by the ability of Polish companies to absorb and, most importantly, further develop and market these technologies, are critical to the sustainable growth of Poland's DTIB.

58 D. Ratka, Abrams Center of Excellence - serwis czołgów Abrams w Polsce [Abrams Center of Excellence – a service of Abrams tanks in Poland], Defence24, 29 May 2023, https://t1p.de/d6bn0

59 J. Palowski, Rakiety i transfer technologii z Korei dla Polski [Missiles and technology transfers to Poland], Defence24, 5 June 2023, https://t1p.de/6vqsm

60 Polski wkład w budowę K9 i K2. Szczegóły porozumienia [Polish share in production of K9 and K2. Details of the deal], Defence 24, 25 February 2023, https://t1p.de/n4nrr

61 J. Palowski, PGZ zwiększa sprzedaż. Kraby lokomotywą eksportu, [PGZ increases sales, „Crabs" a powertrain of exports], "Defence24", 19 July 2023, https://t1p.de/v1re0

At the same time, building a domestic capacity to produce, maintain, service, and repair foreign-acquired systems will not be sufficient to strengthen the competitiveness of DTIB in the long run. It would also be difficult if the share of Polish companies in the flagship programs were limited to the production of basic subsystems. Such a growth path will reach natural limits, especially with regard to the long-term export competitiveness of the Polish DTIB.

These considerations strongly influence the Polish approach to defense industrial partnerships. In particular, South Korea is now seen in Poland as the partner that can enable a technological leap in Polish DTIB because of its declared willingness to share many technologies with Poland and its flexibility in terms of contracts.[62] With regard to the United States, the level of ambition is perhaps lowered to finding a place for Polish companies in the global supply chains of US companies' foreign partners.

What may also help the export prospects of the Polish DTIB is the need to build regional – meaning Eastern Flank – interoperability. By default, this process will have to take into account Poland's choices regarding key weapon systems, thereby opening a path for Polish DTIB to produce for the broader region. Finally, there is the national R&D effort, which – if increased – can provide robust results as the cases of the „Krab" SPH, „Borsuk" APC or „Grot" rifle prove.

Interestingly, the potential of European armament cooperation within the frameworks provided by the EU (European Defense Fund, ASAP or the upcoming EDIRPA and EDIP instruments), is not widely discussed in Poland in the context of strengthening the long-term competitiveness of its DTIB. As of 2022, Poland participates in 13 PESCO projects, with the ESSOR project (related to the new generation of software-defined radio) being the main R&D effort in this pool (in the EDF, Polish entities are represented in over 20 projects, including PADR and EDIDP).

FUTURE OF EDITB

Traditionally, Poland has been one of the most skeptical EU member states when it comes to developing autonomous European military capabilities or building a „European strategic autonomy" in the defense field. It has been a well-established Polish principle that EU military capabilities must remain complementary to NATO and strengthen NATO's defense and deterrence rather than compete with the alliance's force structure or missions.

The EU's efforts to stimulate the development of the EDTIB have been viewed more favorably by Poland as a way to strengthen European military capabilities. However, the focus of EU instruments on consolidating the European defense market and the industrial logic behind these initiatives were considered problematic in Poland. The first reason was the relative weakness of the Polish DTIB, which was not able to compete effectively with the largest arms producers in the EU that dominated the market. The second was Poland's willingness to complement its strategic and military cooperation with the United States with a defense-industrial relationship. With such an approach, Poland was widely considered an outlier in the debates on the future of the EDTIB and EU policy in this regard.

In the aftermath of the Russian invasion of Ukraine, Poland continues to present what could be called a threat-perception and capability-driven approach to the question of the EDTIB's future. Accordingly, the core task of the EDTIB should be to provide the European allies in NATO with the capabilities that are crucial from the perspective of the alliance's operational plans (adopted at the NATO Summit in Vilnius in 2023) and the next iterations of the NATO Defense Planning Process. In Poland's view, the European allies must significantly increase their share of the defense and deterrence against Russia if the US commitment to the defense of Europe is to remain credible, especially in view of the increased American focus on the Indo-Pacific region and the limits on US military capabilities. The competitiveness of the EDTIB, its further consolidation, or the building of a European capacity to act autonomously in military operations are seen in Poland as secondary goals of the EU's defense-industrial policy.

After the Russian invasion of Ukraine, such an approach became more popular in the EU and is now visible in all major debates on the future of the EDTIB. As a result, it seems inevitable that some of the basic assumptions that have shaped the development of the EU's defense-industrial toolbox will need to be updated. In particular, it may be necessary to allow more cooperation with non-EU actors in the

62 Compare: J. Sabak, Polski przemysł w programie K2. Wyzwania i szanse [Polish Industry in K2 program. Challenges and Opportunities], "Defence24", 23 September 2023, https://t1p.de/d19lz

framework of EU initiatives, if this is beneficial from a capability development perspective.

Another factor that is likely to affect the future of EDTIB is support for Ukraine. Regardless of how the invasion ends and what the final place of Ukraine in the European security architecture will be, the Ukrainian military will need of NATO-standard weapon systems. The development and European response to this requirement is both a security and an economic issue. Consequently, EDTIB will have to respond not only to an "internal" EU demand, but also to the specific needs of Ukraine, which will involve types of weapon systems that have not been produced in large quantities in Europe for a long time. That Ukrainian companies will seek partnerships with their European counterparts is more than likely and brings back the issue of enabling EU defense industrial tools to involve non-EU (at least candidate) countries.

Romania

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Industries/ RTO: What are the current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

After the end of the Cold War, the Romanian defense industry went through a transition that can be defined as a period of partial reform and decline under the impact of economic integration and privatization. From a macroeconomic point of view, this sector had been shaped by the communist regime according to a model of autarky that sought horizontal and vertical integration into the national economy.

In the communist economy, the Romanian army was equipped with systems that had Soviet or Romanian licenses. In addition, the production of arms for export was aimed mainly at the markets of Asia, the Middle East, Africa and, to a lesser extent, other Warsaw Pact countries.

After 1990, the development of Romania's defense industry was marked both by the macroeconomic transition of Romania and by the reform of the Romanian Army.

First, the sector shrank as a result of economic reforms, including the impact of privatization. Second, the reduction in numbers and the restructuring of the army to allow it to integrate into NATO drastically reduced arms orders for the defense industry. The introduction of NATO interoperability requirements, which could not be met by an industry struggling to adapt to NATO standards, also contributed to this decline.

At present, the center of gravity of the defense industry is represented by the National Company ROMARM S.A., which includes 15 production units. This holding company, subordinated to the Ministry of Economy, was established in 2000 and has 100 percent Romanian capital. ROMARM S.A. includes the following arms and ammunition factories Tohan S.A. Zărneşti, Carfil S.A. Braşov, Uzina Mecanică Plopeni S.A., Metrom S.A. Braşov, Uzina Mecanică Cugir S.A., Mija Mechanical Plant S.A., Sadu Mechanical Plant S.A., Automecanica Plant Moreni S.A., Arsenal Resita S.A., Uzina Mecanică Bucureşti S.A., Special Products Plant Dragomireşti S.A., Fabrica De Praf S.A. Făgăraş, Pirochim Victoria S.A., Electromecanica Ploieşti S.A., Cugir Arms Factory S.A.[63]

From the above list, four companies have significant economic performances: Mija Mechanical Plant S.A., Electromecanica Ploiesti S.A., Cugir Armament Factory S.A., and Metrom Industrial Parc S.A..

In the private sector, the most important company is AEROSTAR S.A. Bacau, a former jet fighter repair plant specialized in aeronautics, which was privatized in 2000. Another private company, DAMEN Shipyard Galati, is the largest shipyard of the fifty-five shipyards, repair yards, and other shipbuilding companies of the Damen Group worldwide. Finally, ELMET International Ltd. is an Israeli subsidiary of ELBIT Systems. The analysis of the six selected companies shows that private companies are successful because they benefit from investments, business strategies, modern management, and access to global markets. They have chosen a portfolio that has a greater impact on major acquisition programs.[64] Most state-owned enterprises are unprofitable, and the few that are profitable are struggling to cope with the current economic challenges. [65]

A major constraint is the lack of coordinated government investment plans in this area. Existing plans are based on an annual budget, without multi-year planning and clear long-term financial commitments. For 2022, the investments made by the Romanian state do not exceed two hundred million RON and are mainly intended for the establishment of a new powder and explosives factory.[66]

63 S.N. ROMARM. S.A., "Sucursale ROMARM | 15 Fabrici de armament sustin industria de aparare," https://romarm.ro/informatii-despre-companie/filiale-romarm/

64 AEROSTAR S.A., "Raport Anual 2022," https://www.aerostar.ro/docs/financiar/RAnual2022RO.pdf

65 Violeta Stanciu, "„ROMARM este inexistent in a da direcția industriei de apărare!", Jurnal de Dâmbovița, May 18, 2023, https://t1p.de/hruqa

66 Mariana Bechir, "Greva de la Cugir," February 17, 2022, Mariana Bechir, "Greva de la Cugir," February 17, 2022, https://t1p.de/vhhmr

How does your country assess the impact of cooperation, dependencies (import/export), and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

Romania has two objectives in the defense sector: First, to ensure that its armed forces are equipped according to NATO standards and in compliance with the interoperability criteria, according to several strategic documents, including the National Defense Strategy of the country. To this end, Romania envisages cooperation with external partners involved in industrial partnerships that develop domestic production units. Second, these production units should ensure economic development while reducing external dependency for production, maintenance, and repair services. Ideally, the entire supply chain for the designated strategic economic units should be located in Romania. Ideally, the Romanian Army, using the newly acquired weapon systems, should not be dependent on services outside of its borders, and at the same time, the government should ensure the transfer of technology and know-how.

Implementation of this ambitious goal will be a long way, for several reasons: It is difficult to use high-tech weapons programs to build a national industrial base in the short term without benefitting from foreign direct investment and partnerships with international companies. Another reason is the lack of investment programs at the national level that would allow state-owned enterprises to become more competitive. Even if there are funding opportunities through NATO and EU programs, the participation and absorption of state companies in Romania is modest, as they barely meet international standards.

At the same time, the national offset legislation is outdated and unreformed, which contributes to the lack of attractiveness for potential partners. In the area of legislation, there are also difficulties in organizing and conducting tenders, which has led to many bottlenecks and delays. Due to this competitive context, the current approach of the Romanian government is to purchase directly through G2G contracts to satisfy short-term objectives regarding, for example, air defense, naval defense, and infantry combat weapons. The Government has pledged to develop a strategy for the defense industry sector by December 2022, but the official release of the document has been delayed amid negotiations to form a new coalition government.

Table 7: Leading Romanian companies in the Armaments Sector

COMPANY	REVENUES AND EMPLPYEES	CURRENT MAJOR PROJECTS	ROLE IN THE SUPPLY CHAIN/ PRODUCT PORTFOLIO	COOPERATION-PARTNERS
AEROSTAR S.A. BACĂU	**REVENUES:** €12.181.933 (2021) **EMPLOYEES:** 1531	• AEROSTAR has a maintenance center for F-16 aircraft used by the Romanian Air Force. In the future, this maintenance facility will be able to serve other countries that have F-16 planes. Equipment, assemblies, and parts produced by AEROSTAR are part of many commercial aircraft: Airbus A320, A321, A330, A350, Boeing B737, B787, B767, Gulfstream G 650, Dassault F7X, Bombardier Challenger series 600 and Global series. • 5000/6000 and parts for the European Ariane 6 rocket. • AEROSTAR S.A. has a significant footprint in terms of business volume in the field of Civil Aviation MRO, being an independent provider of maintenance services at the industrial level for commercial aircraft in the family. • Airbus A320 ceo&neo and Boeing B737 300-900. • In 2022 the AEROSTAR Maintenance Base was authorized EASA Part-145.	• In civil aviation, the company supplies aerostructures, components, and assemblies to the global aviation industry. • It holds authorizations for the maintenance of commercial aircraft, being currently authorized to perform type A, B, C and D work on the types of aircraft Boeing 737 series 300-900, Boeing 737 MAX, Airbus 320 family of aircraft, ceo & neo, as and for components. • The company has a maintenance center for the F-16 aircraft of the Romanian Army and is part of the national defense industry by law 232/2016.	• ELBIT SYSTEMS LTD • LOCKHEED MARTIN • AIRBUS • BOEING

COMPANY	REVENUES AND EMPLPYEES	CURRENT MAJOR PROJECTS	ROLE IN THE SUPPLY CHAIN/ PRODUCT PORTFOLIO	COOPERATION-PARTNERS
DAMEN SHIPYARD GALATI (DAMEN GROUP)	**REVENUES:** €389.182 (2021) **EMPLOYEES:** 1700	• Combat Support Ship (CSS) Den Helder for the Royal Netherlands Navy. • Two Offshore Patrol Vessels for the Pakistan Navy. • Two Damen Stan Patrol 5009 emergency response vessels for the Romanian Government's General Inspectorate for Emergency Situations.	**Production:** • Multi-Purpose Combat Ship F126 • Air Defense and Command Frigates • M Frigates • SIGMA Frigates & Corvette Series • Crossovers & Amphibious Series • Patrol Ships • Support Ships	ARCELORMITTAL
ELMET INTER-NATIONAL LTD (ELBIT SYSTEMS)	**REVENUES:** €1.099.150 (2021) **EMPLOYEES:** 241	• The main product is the Spear - an autonomous, computerized 120 mm recoil mortar system for mounting on 4x4, 6x6 or 8x8 medium armored vehicles. The Spear provides immediate, accurate fire support for special forces according to NATO standards. • In 2023 Elmet International Ltd was awarded a $120 million follow-on contract from General Dynamics European Land Systems (GDELS) for the supply of remote-controlled turrets, remote-controlled machine guns (RCWS) and mortar systems for the armored personnel carrier of the Romanian Armed Forces. The work will be conducted in Romania for three years. • Under the contract, Elbit Systems will supply the UT30 MK2 turrets, RCWS and SPEAR mortar systems, all fully integrated aboard the GDELS "Piranha V" APC.	• In 2018, Elmet International, a subsidiary of Elbit Systems Land, opened inside Magurele's industrial platform a new production and integration plant for defensive terrestrial systems. The facility functions as a production and integration center for the turrets and weapon stations contracted by Elbit for local projects and as a regional hub that intends to cover similar demands for other countries.	• GENERAL DYNAMICS EUROPEAN LAND SYSTEMS
MECHANICAL PLANT MIJA S.A.,	**REVENUES:** €638.761 (2021) **EMPLOYEES:** 416	• Anti-tank grenades • Military grenades • Products for maintaining public order. • Products for practice and training shooting. • Decommissioning and demilitarization services for anti-tank grenade strikes, military grenades, artillery and infantry weapons, tanks and armored personnel carriers	• Production of ammunition.	NO INFORMATION
ELECTRO-MECHANICS PLOIESTI S.A.,	**REVENUES:** €2.959.592 (2021) **EMPLOYEES:** 381	• Short-range, self-propelled anti-air missile complex. • ATT-01 M targets aircraft for training. • Target missile RT-3 for training. • Maliutka M2T anti-tank missile • PRN-80 Unguided reactive projectile	• Production of ammunition.	NO INFORMATION

COMPANY	REVENUES AND EMPLPYEES	CURRENT MAJOR PROJECTS	ROLE IN THE SUPPLY CHAIN/ PRODUCT PORTFOLIO	COOPERATION-PARTNERS
CUGIR ARMS FACTORY	**REVENUES:** €304.167 (2022) **EMPLOYEES:** 900.	• AK-47 infantry weapon and civil modified version.	• Production	NO INFORMATION
S.C. METROM S.A.	**REVENUES:** €70.330 (2020) **EMPLOYEES:** N/A.	• S.C METROM SA is the sole manufacturer of copper and brass sheets and strips and is a military manufacturer of ammunition components (cups/cartridge case cups/bullet cups for small ammunition, discs for artillery ammunition)	• Production of ammunition components. • NATO caliber: • 5,56 x 45 mm • 7,62 x 51 mm • 9 mm Parabellum • In different variants and EST "calibre": • Cartridge case cup 7.65 mm. • Bullet cup 7.65 mm • cartridge case cup 23 mm	NO INFORMATION

Source: The information in the table was identified with the help of the database from www.risco.ro and the website of Societatea Nationala ROMARM S.A. https://romarm.ro/

In terms of procurement practices, the current government may tend to use G2G contracts with the United States as a strategic partner. At the same time, Romania's European partners seem more inclined to establish industrial partnerships or local branches in Romania and are willing to make long-term investments (France, Netherlands, Germany, Italy). Recently, the government decided to develop the strategic partnership between Romania and South Korea in the field of defense and security. Romania has expressed interest in cooperating in the acquisition of South Korean combat systems (artillery, tanks, and combat vehicles) and in the joint development of a new plant for powders and explosives.[67] The government is trying to reduce the dependence on imports, because the powder factory in Făgăraș was closed several years ago and Romania has been importing the powder for the production of ammunition from the Republic of Serbia.

Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for its development?

The state sector of the defense industry is likely to continue its economic decline due to the lack of contracts, government investment, and the exodus of skilled workers. There could be a revival of ammunition companies and maintenance and repair centers for the newly purchased equipment if the government increases investment and ensures efficient, competitive management. The private sector will continue to develop, but the number of successful Romanian companies will remain small. The development of this sector will depend on foreign markets. Local subsidiaries of international companies are more likely to grow, as they benefit from a business strategy that integrates them into global markets.

The Romanian defense industry sector will depend on the launch of large procurement programs that generate offset contracts with a positive impact on the national economy.

67 Tudor Curtifan, "Unde vor produce în România pulberi sud-coreenii? Fabrica din Făgăraș nu mai produce pulberi din 2004," DefenseRomania.ro, June 2, 2023, https://t1p.de/lulkc

Annex: Romania defence budget indicators

INDICATOR	2020	2021E	2022F	2023F	2024F	2025F	2026F
DEFENSE EXPENDITURE, RONMN	21,430.9	23,723.0	26,240.8	28,007.7	29,776.8	31,678.2	33,734.3
DEFENSE EXPENDITURE, RON, % Y-O-Y	9.7	10.7	10.6	6.7	6.3	6.4	6.5
DEFENSE EXPENDITURE, RON PER CAPITA	1,114.0	1,240.2	1,378.8	1,478.4	1,578.9	1,687.4	1,805.6
DEFENSE EXPENDITURE, % OF GDP	2.0	2.0	2.0	2.0	2.0	2.0	2.0
DEFENSE EXPENDITURE, $ MILLION	5,049.7	5,702.1	5,978.3	6,517.3	7,146.4	7,761.8	8,260.6
DEFENSE EXPENDITURE, $, PERCENT Y-O-Y	9.6	12.9	4.8	9.0	9.7	8.6	6.4
DEFENSE EXPENDITURE, $ PER CAPITA	262.5	298.1	314.1	344.0	378.9	413.5	442.1

Source: FitchSolutions, "Romania: Crime, Defence & Security Report," (Fitch Solutions Group Limited, May 2022, https://store.fitchsolutions.com/crime-defence-security/romania-crime-defence-security-report

Spain

Author: Félix Arteaga, Senior Analyst, Royal Institute El Cano

Industries/ RTO: What are current strengths in production and technologies (top 5-7 companies, revenue, employees, current major projects (timelines), role in the supply chain/product portfolio, cooperation partners, involvement in European projects)?

That same year, the sector generated 1.4 percent of national GDP and 6.3 percent of the industrial GDP while directly and indirectly accounting for 202,500 jobs in Spain. The Ministry of Defense estimates that by 2020, the TEDAE's companies and the rest of the Spanish Defense and Technology Industrial Base (DTIB) produced €6,489 million income, of which €5,290 million (81.5 percent) came from exports to 63 countries. This placed Spain in the seventh place among exporting countries in 2021 (9th in the period 2021-2027). In 2020, the DTIB consisted of 380 companies generating 1.01 percent of the GDP and accounting for 55,397 jobs (22,797 directly). Aeronautics generated 64.1 percent of revenues, followed by naval technology (13.5 percent) and land vehicles (8.1 percent) sectors.

Spain currently is trying to consolidate and expand its three main industrial corridors to provide a big picture of the defense industrial sector:

- North: Northeast Spain, Basque Country, Ferrol naval pole (Navantia), Urovesa (Santiago de Compostela) and Santa Barbara (Asturias)
- Central-Mediterranean: Madrid, Murcia, Ciudad Real and Albacete. Cartagena (Navantia) and helicopter aeronautical hub in Albacete (Airbus, ITP...)
- South, Cadiz (naval hub) and Seville (aeronautical hub).

Table 8: Main Companies of the DTIB

RANKING	NAME	REVENUES 2020 (MILLION €)	DTIB'S PERCENTAGE	JOBS
1	AIRBUS DEFENSE AND SPACE	2,306	34.3%	13.000
2	AIRBUS MILITARY	1,370	20.4%	-
3	NAVANTIA	868	12.9%	15.600
4	INDRA SISTEMAS	329	4.9%	56.000
5	AIRBUS HELICOPTER ESPAÑA	267	4%	-
6	SANTA BARBARA SISTEMAS	242	3.6%	640
7	INDUSTRIA AUTO PROPULSORES (ITP)	171	2.5%	4.300

Source: Infodefensa (IDS), "Spain defense & security industry", 2023, p.38.

Table 9: Main Companies of the DTIB

NAME	PRODUCTS	ACTIVITY AND PRESENCE
AIRBUS	• **Mission and Transport Aircrafts:** A330MRTT, A400M, C295 • **Combat:** FCAS; Eurofighter • **Space:** Paz, Ingenio, Spainsat NG, Copernicus, Quantum, Arian 5/6, Vega • **Helicopters**: NH90, H135, Super Puma, Tiger • **UAS:** Eurodrone, SIRTAP, Zephyr, Aliaca, Tracker 120, DVD 200 ER	• Design, certification, manufacturing and maintenance of aircrafts and space satellite, launchers, and infrastructure. • Avionics, engineering consultancy, RPAS (UAV), air navigation systems, ground support.
NAVANTIA	• F-110 frigates • S-80 submarines • OPVs • AORs • LHDs.	• Design, manufacture, integration and life support of naval systems and propulsion plants. • Presence in Australia, Norway, Saudi Arabia, India, Türkiye. • Maintenance, simulation, engineering, optronics and command and control.
INDRA SISTEMAS	• **Aircraft:** Eurofighter, A400M, AWACS, national coordinator for FCAS. • **Space:** Copernicus, Galileo, Sateliot. • **Helicopters:** NH90, CH-47F Chinook, Tiger	• Presence in 46 countries and commercial operations in 140 countries. • Specialist in radar, electronic defense, command and control, and communications, cyberdefense, simulators. • Maintenance, simulation, engineering, optronics, and command and control.
SANTA BARBARA SISTEMAS	• ASCOD/Pizarro, • 8X8 Piranha • SIAC 155/52	• Part of General Dynamics European Land System. tracked and wheeled armored vehicles, artillery systems. engineering, maintenance, modernization.
INDUSTRIA AUTO PROPULSORES (ITP)	• **Aircraft:** Eurofighter Typhoon (EJ200), A400M • **Helicopters:** Tigre HAD, NH90.	• Life cycle of the aviation engines from R&D to in service support. • Presence in Spain, United Kingdom, India, Mexico, Malta. • Structures, systems, equipment, engines, engineering consultancy, maintenance.

Source: Infodefensa (IDS), "Spain defense & security industry", 2023, p. 96-134.

Table 10: EDF projects with Spanish participation (2021 call, published in July 2022)

EDOCC, Q-SING, NAVGUARD, ACTING, ENGRT, ADEQUADE, NANO SHIELD, IFURTHER, INDY, RF SHIELD, SHOLFEA, LODESTAR, NOMAD, NAUCRATES, P2P-ESO, SEAWINGS, EPW, ACHILE, EUROHAPS, HEGAPS, HEROIC, DTHOR, COMMANDS, ROLIAC, KOIOS, EICACS, FAMOUS 2, NEUMANN, 5G COMPAD, EPLIC, POWERPACK, NEWHEAT

Source: Data compiled by the author

Around 60 companies of the DTIB take part in 32 EDF projects integrated into European consortia so far. [68]

How does your country assess the impact of cooperation, dependencies (import/export) and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver needed output (quantity/quality)?

All Spanish governments and defense ministers, regardless of the government in power, have declared themselves to be in favor of international cooperation, especially with EU and NATO member states, the United States, and the United Kingdom. Spain holds a relevant position among the world exporters and does not want to be sidelined in the process of consolidation of the defense industrial sector, be it at European or global level.

The fact that the European Commission is pushing for economies of scale is perceived as an opportunity and a challenge for the DTIB. Government and companies are aware that their future competitiveness depends on their integration into the European and global value chains. Challenges are more tangible on the European side because of the great differences of size between Spanish and European companies. However, Spain is not in a strong position to set the restructuring of the defense industrial sector in motion. This is true even at the national level, where it has failed to achieve economies of scale due to the high number of SMEs companies in the DTIB, much less at the European or global ones. Any transformation of the EU based on European companies' comparative advantages will harm most of the Spanish DTIB. However, it is not clear yet if the EDTIB is focused on enabling fair competition within the EU or on consolidating European champions to compete for global markets. Such ambiguity prevents a more transformational approach in Spain toward the consolidation of the DTIB.

However, and despite the need to align the national defense planning with the EU Coordinated Annual Review on Defense (CARD) and the NATO Defense Planning Process (NDPP), Spanish investments mainly benefit the DTIB, as in the rest of the self-declared countries as supporters of international cooperation.[69] Spain does not have national champions of the size of other European or allied countries, but it tries to reinforce the DTIB's ability to survive and above all to strengthen great companies like INDRA, Navantia, and Airbus, which are controlled by the state through the Sociedad Estatal de Participaciones Industriales (SEPI).

Table 11: Spanish Industry in PESCO as of May 2023

- AS LEADER: NGSR, EUMILCOM, AEA, 4E
- AS MEMBER: Co-Basing, FSRM, NGHM, AMIDA-UT, COHGI, DOSA, TIGER MARK III, EMC, EPC, UGS, CSIP, , DM-DRCP, EOF, ECOWAR, EURAS, MALE-RPAS, ESSOR, FMTC, MUSAS, MM, TWISTER, EU TMCC, EDA-TA, ROLE 2F, EU CAIH, EUFOR-CROC, MAC-EU, NetLogHubs, UMS.

EU Permanent Structured Cooperation, https://www.pesco.europa.eu/

At the same time, Spain is a firm supporter of European strategic autonomy. Together with Germany, France, and Italy, Spain is one of the four countries driving PESCO. It takes part in 33 of the 68 PESCO projects launched since 2018 as Table 4 shows. Of these 33, four are led by Spain: 4E (Essential Elements of European Escort), Next Generation Small RPAS (NGSR), Strategic C2 System for CSDP Missions and Operations (EUMILCOM), and Airborne Electronic Attack (AEA). Similarly, Spain has participated in the research and development programs financed by the European Defense Action

68 The full list and the funds allocated to Spanish companies can be consulted at Infodefensa (IDS), "Spain defense & security industry", 2023, p. 73-75.

69 The contradiction between the different national, European, and transatlantic autonomies is explained in terms of complementarity because what contributes to national autonomy contributes to the others two as well. In practice, such logic favors the national interest of the DTIB over international cooperation.

Plan, and the Ministry of Defense has encouraged the participation of the DTIB in European cooperation projects (see Table 3). The Spanish participation in the FCAS/NGWS program on an equal footing with Germany and France confirms Spain's interest in anchoring its DTIB into European chains of supply.[70]

The availability of European funds for cooperation encourages but does not determine the Spanish interest in cooperative projects. For the country's armed forces, international cooperation is instrumental for developing military capabilities which still await funding or that are outside the top priorities of the government's military capabilities goal. For the DTIB, international cooperation is critical to be able to join European consortia and reduce R&D expenditure. Participation, however, depends on the availability of national funds for co-financing, which is difficult to plan because of the current annual budgeting system. Therefore, Spain is interested in common funding (EDF, EDIP…) either for research or for development. Looking to the future, Spain has received with interest the new European instruments for joint acquisitions such as the European program of ammunitions, which is managed by the European Defense Agency and funded by the European Peace Facility, as well as the European Commission's new financial instrument (Supporting European Defence Industry Through Joint Procurement Act, EDIRPA) through the EDA or the OCCAR.

Cooperation with non-EU partners such as the United States or United Kingdom is another priority for cooperation, be it within a European or a transatlantic framework. In fact, Spain has always supported an "open" concept of autonomy to bring NATO's non-EU countries closer to the European DTIB. Spain is also interested in multinational procurement within NATO's High Visibility Project: Land Battle Decisive Munitions (LBDM), the Air Battle Decisive Munitions (ABDM), Maritime Battle Decisive Munitions (MBDM), and Multinational Ammunition Warehousing Initiative (MAW). It contributes to the NATO Innovation Fund and the Defense Innovation Accelerator for the North Atlantic (DIANA).

Anyway, and despite the increase in defense investment,[71] the low percentage of investment in research and innovation by the government and the DTIB puts at risk the competitiveness/quality of its future output.[72] Regarding quantity, there are many obstacles to increasing national production because demand over the coming years remains uncertain. Spain's National Security Strategy of 2021 called for the establishment of strategic autonomy and strategic reserves. So far, however, there has been neither a plan elaborated toward that goal, nor has funding been secured to compensate for DTIB expenditures.

Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for such a development?

The increase of the defense budget will facilitate a new cycle of investment in the DTIB over the next decade. While the government desires to reach the spending goal of two percent of the GDP in 2029, more realistic studies show that this will be difficult.[73] However, even within the revised forecasts, there will be a substantial amount of extra money available for investment, allowing Spain to respect NATO's investment target of 20 percent of the defense budget.

The government is currently preparing a new Industrial Defense Strategy to replace its obsolete 2015 strategy. Its objective is to strengthen and consolidate the national industry and to provide the armed forces with the equipment and systems they need to carry out their tasks while reinforcing the STDIB. Unlike previous strategies drawn up by the Ministry of Defense, this one is being elaborated by a broad array of ministries including Industry, Foreign Affairs, Economic Affairs, and the Presidency of the Government.[74] With this enlargement of interagency cooperation, the government recognizes that new actors must be integrated to achieve synergies between military and civil projects, especially for dual use technologies.

The Strategy is still under elaboration, and only a few generic details are known about its basic goals:

70 he program is coordinated by INDRA. It will create more than 1,200 qualified jobs, with Spain committing to spending €2,500 million until 2027. €421 million are due to be spent in 2023.

71 The Secretary of State for Defense is in charge of managing a spending increase of 60.9 percent in 2023, which corresponds to an extra amount of €2,000 million. This is due to an overall increase of 26 percent of the budget, which has benefited investment to a greater proportion.

72 Spain only devoted €115,9 million to defense R&D in 2021, with €23,8 million going toward cooperative programs. The figures for R&T were €64 million and €23 million respectively (the total defense expenditure was €12.546 million).

73 Antonio Fonfria and Carlos Calvo, "El futuro de la financiación: ¿una odisea política", Real Instituto Elcano, May 11, 2023.

74 Spanish Government, "Reunión del Gobierno con la industria de Defensa", January 2023, https://t1p.de/197rr

- The Strategy is still under elaboration, and only a few generic details are known about its basic goals:
- Support the growth of the DTIB in scale, global ranking, volume of exports, employment, and territorial cohesion.
- Enable national champions to compete internationally.
- Increase strategic autonomy to reduce dependence on third-party technologies and materials.
- Integrate Spanish companies into European value chains to be able to compete in major future markets at the European and global level.
- Promote the integration of industries into national and European consortia.
- Take advantage of cooperation opportunities within the EU and NATO.
- Strengthen the European defense industry's ability to compete with those of the United States, Japan, or South Korea.

To reach these goals, the Government will accompany the Strategy with an Industrial Participation Plan for every sector. The contribution to international programs depends on the consistency of the work packages with the operational and industrial priorities of the Strategy. Procurement from third parties is made conditional on national industrial participation in priority areas, such as maintenance of systems. The Strategy should enable the DTIB to produce more companies that are able to lead, push forward with the consolidation of the sector, and create consortia capable of competing with the giants in the sector through the integration of SMEs and start-ups. It also will promote a collaborative culture of dialogue within the DTIB to help companies increase in size, competitiveness, innovation, and investment.

The new Strategy is aspirational in the sense that it tries to: a) widen the number of governmental stakeholders; b) break the defense silo and integrate the DTIB into a wider national industrial and technological framework; c) push the DTIB to achieve consolidation and escalation so that national companies can join European and international consortia; and d) provide additional funds for investments.

To become transformational, however, the Strategy will also need to address the following structural obstacles:

- The priority of the investments must not be based on obsolete military planning but on future warfare capabilities and disruptive technologies (most of the last acquisitions were approved before the COVID-19 impact on supply chains, the NATO's Strategic Concept, the EU Strategic Compact, and the war in Ukraine)
- Despite the increase of the defense budget, there is a lack of certainty over future investment because Spain does not have a multiannual financial programming (annual investments are contingent upon the overall state of the economy and cooperative projects while consortia require stable funding)
- Even with an improved leadership, the competitiveness of the DTIB is limited by complex and obsolete regulations. The excess of bureaucracy and security requirements prevents synergies with civil innovation (national stakeholders could find better conditions in many other European or international ecosystems).
- The Ministry of Defense will remain the key interlocutor for the industrial sector, but effective industrial management requires specialization (military education and careers do not guarantee managerial skills for conducting modern acquisition and procurement programs).

Accordingly, elaborating the new Strategy will not suffice to trigger the creation of a new environment for the DTIB; effective implementation is needed. The huge increase of the coming defense budgets for investments will improve the equipment and readiness of the Spanish armed forces and guarantee new commitments vis-à-vis the DTIB for as long as this commitment lasts. Another push factor for the DTIB is a new communication strategy that tries to change the narrow public perception of military spending to a broader perception in which economic, technological, educational, environmental, and gender elements accompany the traditional security and defense benefits. In brief, Spain's strategy must take advantage of the Ukraine momentum to shape its post-Ukraine defense industrial sector.

United Kingdom

Trevor Taylor, Professorial Research Fellow, Royal United Service Institute (RUSI)

Government: How to describe the armaments policy/priorities of our country – to what extent are policies/priorities changing due to the changing geopolitical circumstances?

Since the 2011 Levene Report, the United Kingdom's system of defense management has devolved much of the responsibility for prioritizing armaments programs to the individual commands, each of which has its own plan. However, in principle, and to some extent in practice, the UK government seeks to maintain and develop the UK defense industry, partly as a way of generating operational freedom in the use of the UK armed forces. This means that some projects need to be awarded in a timely manner.

The war in Ukraine has not (yet) significantly changed the priorities of the equipment commands. The increasing economic/political importance of East Asia and the growing assertiveness of China are trends that will have a visible impact on UK programs for at least a decade. However, the war in Ukraine has caused the Army in particular to focus much more attention on Russia and to work on relearning how to fight a sustained war dominated by armored units.[75] Even before 2021, it had major programs for modular tracked vehicles (Ajax) and wheeled vehicles (Boxer). Third, there was a commitment to a new tank (Challenger 3). Ukraine has reinforced the importance of these programs.

An unresolved but recognized challenge for UK defense is how to deal with the prospect of a sustained conventional conflict in Europe with all that implies for weapons stocks and any industrial capability to surge production. Even during the Cold War, there was reluctance in the UK, as in many continental states, to hold large stocks of munitions that might never be used and had a limited life. This is something that will need to be addressed but for which there is not yet any clear conclusion.[76]

Industries/ RTO: What are current strengths in production and technologies (top 5 companies, current projects, role in the supply chain, cooperation partners)

The UK defense industry has one dominant company, BAE Systems, whose growth was shaped significantly by the desire of the government in the late 1980s to privatize the Royal Ordnance Factories and by the choices of other firms (notably the former GEC) to leave the defense sector. With a lack of other UK or European bidders for firms, BAE Systems stepped in. In particular, it bought GEC to keep its avionics and airborne radar supplier out of US hands. These acquisitions were followed by some disposals, not least to what is today Leonardo of Italy.

There are only three other major defense companies that are beneficially owned in the UK. One is Babcock International, an engineering enterprise with extensive civil work, which both builds and supports surface ships and submarines, which maintains a stock of land equipment, which is part of a consortium delivering flying training, and which is moving into military communications and mission systems. A second is Rolls Royce, which develops gas turbines for military aircraft and warships and also develops and manufactures the nuclear reactors that power British submarines. Its civil businesses are much larger than its military work, but it is a key player in the UK capability to deliver its own combat aircraft and naval vessels. The third is QinetiQ which is a privatized spin-off from the former Governmental Defense Evaluation & Research Agency (DERA). QinetiQ addresses a wide area of technology, and frequently acts as a customer friend to the Government in terms of guidance on technology matters. It also has a long-term contract to manage the UK's missile ranges in Scotland. In Defense News Top 100 Defense Companies in 2022, BAE Systems was ranked 7th by turnover, Rolls Royce was 27th, Babcock International was 43rd, QinetiQ was 64th, and Serco was 53rd.

More widely, defense industry in Britain has a very strong Western European flavor as a result of inward investments, encouraged rather than prevented by

75 'From now the Army will have a singular focus – to mobilise to meet today's threat and thereby prevent war in Europe'. Speech by Chief of the General Staff, General Sir Patrick Sanders, RUSI, June 28, 2022.

76 Trevor Taylor, Implications of the Ukraine War for Munitions Supply Arrangements', RUSI, April 19, 2023, Implications of the Ukraine War for UK Munitions Supply Arrangements | Royal United Services Institute; Trevor Taylor, 'One Year On: Supply and Industrial Implications of the Ukraine War', RUSI Newsbrief, February 22, 2023.

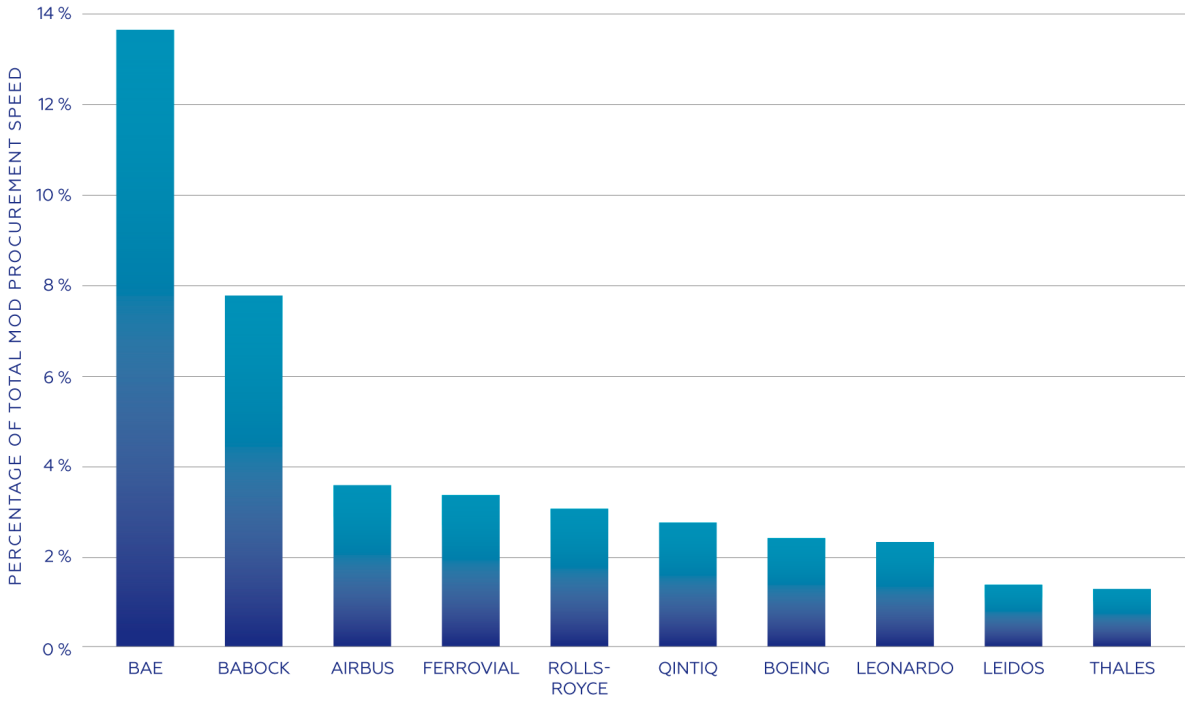
governments over the years. Leonardo, Thales, and Airbus have extensive operations in the UK, and the UK's predominant missile enterprise is MBDA, a joint venture involving France and Italy. These firms have a track record of doing development, production, and support work in the UK in important sectors. Leonardo has taken over Westland, the UK's helicopter company, and is the airborne radar, avionics and defensive aids company at the heart of the Typhoon and Future Combat Air System (now known as the Global Combat Air Program with Japanese and Italian involvement). Thales, among other things, is central to the UK capability in sonars, including for the nuclear submarine fleet. Airbus builds civil and military wings in the UK and is central to UK space capabilities. Most recently, BAE Systems put in place a joint venture covering its British land vehicles businesses (RBSL), which is building the UK's Boxer fleet and will deal with the Challenger 3 program. The above is a very brief and far from comprehensive summary.

It is perhaps ironic that defense industry in the UK is much more 'European' than that of France, Germany, Italy, or Spain with their largely national firms. British defense industrial involvement in continental Europe is more modest, but BAE Systems own Haaglunds in Sweden and Rolls Royce have bought MTU in Germany.

The UK is also home to a number of US company subsidiaries, not the least of which is General Dynamics (tactical communications and the Ajax armored vehicle). Raytheon are a long-established firm in the UK working in IFF and radar as well a Paveway bomb production and missile components. Lockheed Martin have a land systems business here although many of their UK activities concern support for their US origin products.

The figure below gives information about the top ten suppliers to the MoD. Ferrovial is an infrastructure company that looks after much of the MoD estate.

Proportion of MOD SPend with Top Ten Suppliers in 2021/22



Source/Note: MoD trade, industry and contracts 2022 - GOV.UK – BAE Systems PLC was by far the largest defence supplier in terms of annual spend made by MoD, a position wich has not changed for over a decade. This top spot was further reinforced after they recieved £157 million more in 2021/22 compared to the previous year, the largest nominal increase out of the top ten holding companies. In total, BAE Systems PLC recieved just under 14% (£3,991 million) of the total MoD spend in 2021/22.

BAE Systems dominates major projects but works extensively with UK partners and international collaborative projects. It leads on the development and delivery of Asture and Dreadnought submarines, with Rolls-Royce responsible for the reactors. These boats have an extensive and well understood supply chain, including some US content. It is the prime contractor for the Type 26 Global Combat Ship (whose power and propulsion system is also a Rolls-Royce responsibility). It is the UK partner in Eurofighter GmbH, which produces and develops the Typhoon. It is the UK lead, but alongside Rolls-Royce, Leonardo and MBDA, in what is now called the Global Combat Air Program, in which Italy and Japan are partners.

Rolls-Royce is the prime contractor for the pressurized water reactors that power the Astute submarine (PWR2) and will power the Dreadnought class (PWR3). General Dynamics Land Systems UK is responsible for the troubled Ajax armored vehicle program. RBSL, the joint venture between BAE Systems and Rheinmetall, is responsible for the Boxer and Challenger 3 programs.

MBDA (UK), under the Complex Weapons Portfolio, develops, produces, and supports a wide range of missiles for the MoD, many of which are joint projects. Thales's Northern Ireland facility produces the NLAW and Starstreak missiles, which are not financially significant but have proved very useful in Ukraine.

The latest report from the government's Infrastructure and Projects Authority lists 52 projects for which the MoD is responsible, some of which include infrastructure work and the provision of services.[77]

The UK does not have a formal industrial participation policy, and so purchases from overseas often have little involvement from UK business operations. There are some exceptions, such as the F-35 where the UK builds the rear of the aircraft (but is not involved with the avionics, sensors, or flight controls. There are a few sensitive areas where a UK contractor is doing work on a US system on cost and performance grounds.

As far as British equipment is concerned, this normally has a multinational supply base. Even for munitions, the UK no longer has a capacity for making artillery fuses or energetic materials. Major platforms normally include American items that are covered by ITAR.

How does your country assess the impact of cooperation, dependencies (import/export) and competition among Europeans but also vis-à-vis the United States and Asia on the future ability of the armaments sector to deliver output?

There is no single British view on many of the above questions with different stakeholders (the separate military services, the MoD, the Foreign, Commonwealth & Development Office, businesses, trade unions, parliamentary committees, regional governments, and others having interests to pursue).

In simple terms, UK defense policy has long stressed that the country should be able to use its armed forces as it sees fit. The latest phrase to capture this is that the government should enjoy operational independence. Collaborative projects linking peer countries are seen as compatible with this, not least because they give the UK a capacity to sustain and modify equipment once in service.

However, as the UK defense industry struggles to generate platforms and major systems that do not contain at least some US ITAR-list technology and, especially in the intelligence-collection, surveillance, and reconnaissance area, the British government, particularly the Royal Air Force, has opted for big platforms from a US factory. These include the P.8A, Rivet Joint, Wedgetail, and Predator/Reaper. The foreign exchange costs and risks associated with these programs are recognized.

Looking forward, there is certainly awareness in many elements in the defense establishment of the shortcomings of reliance on the United States and the effort that dealing with ITAR involves. As the damage to political relationships caused by Brexit has happily faded with the changes of regime in the UK, there is renewed interest in cooperating in the defense industrial space with other European states as well as with other peer countries that have suitable political, technological/industrial, and financial attributes. Japan and Australia would be in that category.

The Defense & Security Industrial Strategy of 2021 and other sector-focused strategy documents demonstrate not just the scope of government ambition but also confidence that British industry can

77 IPA_AR2022 (publishing.service.gov.uk), pp.67-72.

delivery in terms of the development and production of defense equipment that will enable the effective defense of UK interests.

Future Avenues: How will the national DTIB evolve over the next decade? What are important trigger points for such a development?

To make confident predictions about how the world will develop could be seen as a sign of stupidity.

To begin with, how will the experience of the war in Ukraine lead the UK and other European states to maintain larger stocks, to allow for some surge production capability in some areas, and/or to opt for simpler weapons that can be produced and stored in large numbers at an acceptable cost? The UK, like other allies, will have to address these questions in due course, and the answers will have to be linked to thinking about how to deter future Russian aggression.

In terms of projects, conspicuous delivery failures on major UK projects such as Tempest and Dreadnought could prompt a rethink about whether the country should continue to present itself as a significant international military player. Success is likely to have the opposite effect.

The trend toward increased internationalization of UK defense industrial structures is likely to continue, with companies realizing that they need to transfer and generate intellectual property in other states in order to gain acceptance. As noted above, continental European companies operating in the UK have done well in this regard, and the performance of RBSL as a recent example is not disappointing. Business is likely to drive restructuring rather than government diktat, but governments will have to agree.

Will established weapons firms including MBDA emerge as the dominant players in the emerging systems relying on directed energy, including laser weapons, when the capability for the sustained generation of electricity will replace (to some extent) ammunition storage facilities?

An open question concerns the place that the big computing/data firms, such as Amazon, Microsoft, Meta, and Palantir, will claim in the UK and European defense industrial ecosystem. Much depends on whether Artificial Intelligence and Multi-Domain Integration are pursued with seriousness by European Governments. Certainly, some such companies are pressing their capacity to offer cloud-based services for data storage and processing but UK military endorsement of rapid advances in the utility of AI have been measured so far. Currently, the increasing capability of surveillance systems in the air and space from crewed and uncrewed systems is generating pressure for computerized analysis of that data before it is passed to what would otherwise be an over-whelmed human.

Finally, to adopt an argument offered by Nassim Nicholas Taleb – that things that have been around for a long time must have significant resilience to have survived the 'shocks' that occur over decades[78] – it might be expected that the established defense majors on both sides of the Atlantic are likely to continue their dominance and will absorb rather than be overwhelmed by either the new data giants or dynamic SMEs.

78 Anti-Fragile, 2013

Türkiye

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By 2022, the annual turnover of the Turkish defense industry reached $12 billion. This marks an impressive 20 percent increase from 2021.[79] Remarkably, turnover per capita rose to $150 in 2022, 12 percent more than the previous year. Around $4.5 billion this revenue came from exports, translating to an annual increase of 36 percent. Imports accounted for approximately $2.7 billion of the total turnover. Between 2021 and 2022, R&D expenditure hit $2 billion, and financial initiatives for R&D projects increased by 21 percent. In 2022, the Turkish defense industry employed 81.132 people, 7 percent more than in 2021.[80]

The 2023 targets announced by the president of the Defense Industries (SSB), Ismail Demir, are much more ambitious. According to Demir, the export revenue target for Turkish military systems is $6 billion at a minimum, with prospects of a much higher annual turnover.[81] In one of his speeches in January 2023, Demir touched upon various highlights of the burgeoning Turkish defense industry. These included critical milestones such as the completion of critical projects such as the National Combat Aircraft (KAAN), the maiden flights of Kizilelma, the modernization of Türkiye's early batch F-16s under the OZGUR initiative, the entrance of TCG Anadolu into the Turkish arsenal and the finalization of the long-awaited ALTAY main battle tank project, which will polish Türkiye's reputation as a credible rising military power. Other important developments such as the serial production of the submarine torpedo AKYA, the first deliveries of the early warning radar system ERALP, and the integration of indigenous AESA radars and electronic warfare (EW) assets to F-16s and UCAVs such as Akinci are all expected to take place around 2024, providing the Turkish defense technological industrial base (DTIB) with a true force multiplier.[82]

Per official records, the number of ongoing projects in the Turkish DTIB is in the hundreds, if not thousands, with more waiting to be added to this extensive list shortly. Between 2016 and 2022, the number of personnel in the Presidency of the Defense Industries witnessed a significant upward trend, with the highest levels of employment being in project management, project engineering, defense industry expertise, and project support, all thanks to the increasing number of initiatives.[83]

In the coming period, funding in the defense industry will focus on initiating new partnerships between different stakeholders and increasing collaboration between different but related fields, including software development, weapons production, and electronics / electrical engineering. Türkiye is also investing heavily into developing its indigenous skilled workforce, particularly in the areas of systems and subsystems engineering, electronic warfare, electro-optics, and project management, to enhance the capabilities of the workforce employed in the Turkish DTIB. This initiative also contributes to reducing Türkiye's external dependence on the defense industry, the first critical pillar of Ankara's security agenda.[84]

With ambitious projects in space technologies, long-range precision strike systems, and autonomous weapons, Türkiye is rapidly catching up with trends that are shaping the future of warfare. Leading domestic companies, research institutions, and start-ups are increasingly active in space satellite technologies and small spacecraft for lunar missions. Such initiatives are providing Ankara with significant

79 https://t1p.de/9wmen
80 Ibid.
81 https://t1p.de/fu0ps
82 Ibid.
83 https://t1p.de/osgu2
84 Ibid.

momentum in space R&D and bringing Türkiye's space program to a competitive level. According to indigenous research centers, future projects in the Turkish DTIB will be developed in line with emerging disruptive technologies (EDTs) such as artificial intelligence, cyber warfare, 3D printing, robotics and autonomous technologies, and hypersonic systems.

Türkiye is also investing heavily into developing its indigenous skilled workforce, particularly in the areas of systems and subsystems engineering, electronic warfare, electro-optics, and project management, in order to enhance the capabilities of the workforce employed in Türkiye's DTIB (Defense Technological and Industrial Base).[85] This initiative also contributes to reducing Türkiye's external dependence on weapons systems procurement, the first critical pillar of Ankara's defense policy agenda.[86]

The 2018-2022 Defense Industry Sectoral Strategy document set the "sky is the limit" goal of "technology and subsystem ownership to facilitate a sustainable defense industry" to augment the nation's growing strategic autonomy efforts.[87] For the first time, the updated 2019-2023 strategic plan prioritizes elite workforce generation and technology transformation to enable future technological breakthroughs.[88]

The Turkish DTIB consists of a large number of manufacturers and suppliers, and some of the leading companies are Roketsan, Aselsan, Baykar, TUSAS and Havelsan. Among various high-end projects, Türkiye's success in unmanned systems stands out. With numerous combat-proven technologies, the unmanned systems industry is undoubtedly a fertile ground for innovation and R&D. The field is also experiencing a significant spillover effect, with the famous success of Turkish unmanned aerial vehicles (UAVs) spilling over into other domains, including unmanned ground vehicles (UGVs) and unmanned surface vehicles (USVs).

Another key area of recent improvement for the Turkish DTIB is the turbojet engine segment. Domestically produced, indigenous engines will boost Türkiye's export portfolio. In the turbojet engine segment, Kale-Aero's solutions, in particular the KTJ-3200 and KTJ-1750, stand out as significant examples.

Other important initiatives within the Turkish DTIB are mainly in the areas of cruise missiles, ballistic missiles, electronic warfare, and loitering munitions. Ankara is currently working on three fighter projects, KAAN (the fifth-generation fighter/multi-role aircraft), Kizilelma (Baykar's unmanned fighter), and the Anka-3 (Tusas' unmanned flying wing aircraft with low observability design philosophy). Similarly, Turkish cruise missiles, such as the ATMACA, are bearing the fruit of heavy R&D and funding with high success rates and popularity by gearing up for the international market.

Most manufacturers in the Turkish DTIB are ready to take orders for replenishment and offer off-the-shelf solutions. The ongoing war in Ukraine has shown the West that it cannot afford to have a DTIB running on overstretched production lines. The threat and aggression from NATO's geopolitical rivals are growing by the day, and NATO nations' supply chains and weapons stockpiles must be ready.

Türkiye has also frequently turned to non-NATO defense partnerships. Throughout the 1990s, for example, Türkiye's military ties with Israel facilitated major defense projects ranging from the modernization of the M60 main battle tank to the upgrading of the F4 Phantom aircraft and provided the Turkish government with staunch support against Hafez al-Assad's Syrian Baath regime. Nevertheless, strong ties with Seoul have yielded very fruitful results for the Turkish armed forces' land warfare capabilities, including the T-155 Firtina howitzers and Türkiye's forthcoming indigenous main battle tank, the Altay. At the time of writing, Ukraine is the rising star for Türkiye's defense sector. Kyiv brings late Soviet industrial know-how to the table, first and foremost aerial engines. Combined with Türkiye's cutting-edge smart systems and drone warfare assets, the Turkish-Ukrainian strategic partnership is a true source of synergy. The first batch of Akinci drones will be powered by Ivchenko. Similarly, the Kizilelma baseline will use two different Motor Sich engines in different variants. The first units will fly with AI-25 turbofan engines. Subsequent batches will be powered by AI-322 afterburner engines, which will transform the unmanned fighter into a transonic platform. These examples demonstrate the growing trust between the parties and pave the way for increased cooperation

85 https://t1p.de/xndbe
86 https://t1p.de/osgu2
87 T.C. Cumhurbaşkanlığı Savunma Sanayii Müsteşarlığı, 2018 – 2022 Savunma Sanayii Sektörel Strateji Dokümanı,
88 Can Kasapoglu, "Turkey's Defense Outlook for 2020s Very Promising", Anadolu Agency, 2020, https://t1p.de/bf547

amid the ongoing regional turmoil in Eastern Europe and the Black Sea.

Nevertheless, intra-war deterrence – that is, controlling escalation patterns within an ongoing conflict – is likely to remain a chronic problem for Ankara's defense posture. Given the proliferation of ballistic missiles and weapons of mass destruction in the Middle East, Türkiye will need Western cooperation (including MBDA) in the anti-ballistic missile role.

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