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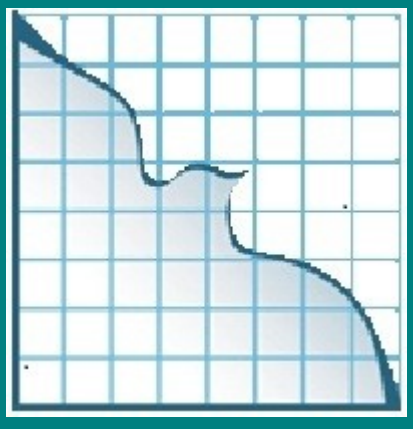

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Symposium introduction: European defense from the perspective of the Ukraine war

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From ancient Greek philosophers to Chinese military leaders and American presidents, the Roman adage *Si vis pacem, para bellum* has been a source of inspiration. The underlying reasoning is that you can only strive for peace if you are prepared for war in order to deter aggression. After the cold war however, European countries have completely disregarded this old wisdom and significantly decreased military spending. The Russian invasion of Ukraine in February 2022 hence constituted a wake-up call as Clausewitzian war made its comeback on European soil, even if not directly on EU territory, Europe was not prepared. As demonstrated by the EU's *Strategic Compass,* adopted last year but having been in preparation since 2020. European states had been aware of rising international tensions for about a decade but lacked a sense of urgency and expected to have time to adapt their military capacities. The conflict in Ukraine was a reminder that conflicts tend to occur faster than expected, with armed forces usually surprised by a rapid intensification of international tensions.

While European countries are not directly involved in the Russian-Ukrainian war with boots on the ground, they support Ukrainian forces in all other possible ways. As supply of weapons is not always possible due to national capacity constraints, the conflict seems to reveal a low level of preparedness of European armed forces with regard to the possibility of high-intensity conflict to keep such threat at bay. NATO statements had suggested concerns that military strength needed to be restored, but it was not considered urgent. The Ukraine war has reintroduced a sense of urgency and necessitates an objective assessment of the true abilities of European armed forces. In the wake of the Russian invasion, European countries have felt that they might have underinvested in their international security. However, building up a relevant military tool, whether to increase forces or to acquire equipment, takes time. This is not only a question of military spending but also of the ability to set up an effective military tool that is able to deliver expected outcomes, that is, deter potential aggressors from testing Europeans' ability to counter such threat. Returning to the Latin adage *Si vis pacem…*, there is no means to secure peace without a credible military force, which requires resiliency and thoroughness.

Individual national decisions can contribute to improve the military strength of European countries and since February 2022, a whole range of European countries have announced major changes. These changes range from significant increases of military spending, e.g., the EUR 100bn special fund set up in Germany, to long-term planning to secure the effectiveness and sustainability of armed forces, e.g., the forthcoming Defence Programme Law in France or the refresh of the Integrated Review in the United Kingdom. While these decisions appear necessary to strengthen national capacities, they are not sufficient to address the challenges posed by the evolution of international relations and rising risks of Clausewitzian wars in Europe. Collective action would seem essential to deliver the expected outcomes in terms of international security.

NATO has introduced new initiatives to assist collective action and coordinate efforts, namely the NATO Innovation Fund and DIANA (Defence innovation accelerator of the North Atlantic), but still face difficulties, as highlighted by the decades-long debate about burden sharing between member states. The recent changes result mainly from the change in external threat and have had limited success in common capability projects. Individual countries own most of capabilities on which the Atlantic Alliance relies.

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This all makes the lack of defense integration in Europe a concern. EU defense policy has been repeatedly kept out of European Union control since the Treaty of Rome in 1957, when its predecessor, the European Economic Community was created. At the EU Versailles Summit in March 2022, member states requested that the European Commission proposed ways to achieve intergovernmental cooperation. This represents a major change in the defense landscape in Europe and could be the first step to a collective European Union and possibly European defense policy. While analysts and academics have written extensively on how the European stakeholders might act in a sustained manner, it is only now that effective implementation of such transformations are taking place. A key issue is whether cooperation and integration will succeed given the specificities of the European defense market on both demand and supply sides.

This symposium considers this issue, the situation of European defense and how it could evolve in in the wake of the Ukraine war and other rising international tensions. In "Strategic competition: Toward a genuine step-change for Europe's defense industry?", Daniel Fiott considers the institutional evolution of the EU as it adapts to today's challenges but also the more profound transformation of relations between states and the European Commission in the field of defense. This evolution has consequences for the defense market and the way states organise it. Two articles explore this. Josselin Droff and Julien Malizard in "50 shades of procurement: The European defense trilemma in defense procurement strategies" consider procurement policy and Laurens Vandercruysse *et al.* focus on industrial policy in "Governing defense procurement: strengthening the E.U.'s defense technological and industrial base". Most of the literature deals with Western European countries and little is known about the evolution of the post-communist countries' Eastern European defense industries and in light of the Ukraine conflict this does seem an oversight. As Bohuslav Pernica *et al.* in "Defense industrial bases (DIB) in six small NATO post-communist countries", provide an analysis of developments in Czechia, Slovakia, Estonia, Latvia and Lithuania and find considerable changes have taken place, with Czechia and Hungary the main players, focusing upon expansion of the defense industry, but with governance concerns. While the Ukraine war has a major influence on decision-making in the short term, it is also necessary to understand the long-term evolutions that could influence European defense. Keith Hartley in "The future of the European defense firm" considers the changing nature of the firms and Renaud Bellais in "The future of cooperative programs in Europe, paradox of a hybrid market" questions the functioning of European armament markets.

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Strategic competition: Toward a genuine step-change for Europe's defense industry?

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Abstract

Since 2016 the European Union has embarked on a step-change in the way it financially supports and incentivizes defense-industrial cooperation. The year 2022 will go down as another important moment in this process with the EU announcing a series of measures, such as joint defense procurement and joint planning and programming. Russia's war on Ukraine has only underlined the importance of such steps, but it has also exposed the vulnerabilities of the European Defense Technological and Industrial Base. This article provides an account of the development of EU defense-industrial policy since Russia's war on Ukraine and it critically engages with some of the challenges that have emerged for Europe's defense industry, EU Institutions and EU Member States. In so doing, the article asks whether the war on Ukraine will lead to a genuine step-change in EU defense-industrial cooperation.

The EU's Strategic Compass is the first time the Union and its Member States have produced an all-encompassing security and defense strategy.[1] The Compass, which can be likened to an EU version of France's *Le Livre Blanc* or Germany's *Weißbuch*, brings together the EU's operational, capability and industrial ambitions in a single document. By comparison, the 2003 European Security Strategy did not refer at all to defense-industrial issues, and the 2016 EU Global Strategy merely referred to the importance of the defense sector. While it is true that the 2013 European Council special summit on defense—the first of its kind in the EU's history—called specifically for Europe to develop "a more integrated, sustainable, innovative and competitive defense technological and industrial base to develop and sustain defense capabilities"[2], the European defense sector has tended to be treated as a sectoral policy area best dealt with by European Commission communications and European Defence Agency studies and papers. Thus, the way in which the EU Strategic Compass integrates defense-industrial matters into the EU's broader security and defense interests and objectives is somewhat of a watershed moment—at least in terms of how the narrative of EU security and defense is framed.

In addition to the Strategic Compass, however, the European Commission has maintained its momentum in defense-industrial matters. Building on the 2016 European Defence Fund (EDF), which is now investing roughly EUR 1.5bn a year into defense research and prototyping, the Commission has announced its intention to create two new defense-industrial policy tools. First, to respond to the war on Ukraine and to assist Member States replenish their armaments inventories, the Commission has proposed a short-term European Defence Industry Reinforcement through a common Procurement Act (EDIRPA) that will invest EUR 500mn from 2023–2025 to help fill critical capability gaps. Second, beyond the EDIRPA the Commission wants to create a European Defence Investment Program (EDIP), which will see an undisclosed amount of money go toward joint common armaments procurement. Thus, beyond strategy papers the EU is seeking to make a tangible difference to the European Defence Technological and Industrial Base (EDTIB).

1 Council of the EU (2022a).
2 European Council (2013, p. 7).

This article aims to analyze the defense-industrial implications of the Strategic Compass and the so-called "Versailles Agenda", which gave political impetus for initiatives such as the EDIRPA and the EDIP following a meeting of Heads of State and Government in Versailles on 10–11 March 2022 to discuss Europe's response to the war on Ukraine. It does so by asking whether the EU's defense-industrial policy efforts since the war on Ukraine point to a genuine step-change for the EDTIB. It does this by first detailing the defense-industrial provisions of the Strategic Compass and critically engaging with them. The article then provides an analysis of some of the challenges facing the Union in developing policy related to common and joint armaments procurement and ensuring its strategic autonomy in defense. In so doing, the article draws on the consequences of Russia's war on Ukraine for Europe's defense industry.

The European Union has embarked on a step-change in the way it financially supports and incentivizes defense-industrial cooperation. Russia's war on Ukraine has exposed the underlying fragilities of Europe's defense market and underlined the importance of a series of measures, such as joint defense procurement, planning, and programming. However joint defense funds are too low and hampered by disagreement over economic policy, and whether the Union should be able to collectively borrow off international capital markets for defense.
In fact, the move towards common defense funding and planning may be too soon given that funding of defense research has only just begun. Further challenges are a reluctance to upset the transatlantic status quo and the need for Europe to match international subsidization of other growth technologies.

The strategic compass and defense investment

The Strategic Compass is the first EU strategy document that comprehensively draws together all strands of EU security and defense. In this sense, the Compass can be seen as somewhat of a milestone in the way the Union thinks about its security and defense. The Strategic Compass is the culmination of a process that began in the 2010s where the EU started to more comprehensively define its security and defense in terms of operations and missions, capability development, and the defense industry. Until at least the dedicated European Council Summit on defense in 2013, these aspects of EU security and defense were separated—albeit artificially—on the basis of policy and legal competences that derive from the EU Treaties. For example, EU operations and missions have been seen as an intergovernmental policy domain and so dominated by the EU Member States, whereas defense-industrial questions increasingly fell under the responsibility of supranational bodies such as the European Commission.

Therefore, in a sense, , the Strategic Compass was a way of creating an overarching narrative for EU security and defense that overcame the long-standing, but artificial, separation between operations, capabilities, and industry. This itself is an interesting development that, at least in theory, can be interpreted as a way of "re-constitutionalizing" EU security and defense policy without rewriting the EU Treaties. However, in reality the situation is different as the Strategic Compass has done little to re-engineer the governance of defense-industrial matters at the EU level.[3] Thus, although the European External Action Service were responsible for drafting the Compass, and while the High Representative/Vice-President of the European Commission drives forward the deliverables contained in the document, it is the European Commission that is effectively in charge of defense-industrial policy.[4]

The European Commission has emerged as an important actor in Europe's defense industry, not least because a number of larger EU Member States have encouraged such a role. Today, the Commission is home to a dedicated Directorate-General for Space and Defense Industries (DG DEFIS), which has not only raised the profile of defense in the EU Institutions, but also empowered the Commission with direct management of the EDF and the EU Space Program. In this respect, the Commission is already responsible for managing one of the most potent symbols of the Union's autonomy—the global positioning system called "Galileo".[5] Under the direction of European Commissioner

3 Angelet (2022).
4 Haroche (2020).
5 Fiott (2022).

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Thierry Breton, it is also seeking to further develop its role in space and defense with flagship programs such as the secure communications satellite constellation IRIS[2] that the Union will develop by 2027. Such efforts should be seen in the context of the Commission's wider efforts related to ensuring a supply of critical raw materials[6] and foreign investment screening[7], among other initiatives.

It is interesting to dissect the defense-industrial elements of the Strategic Compass. Clearly, responding to the war on Ukraine has become the overarching strategic imperative for the EU, but the Compass makes clear that the Union and its Member States "must resolutely invest more and better in defense capabilities and innovative technologies [and the EU] must be bolder and faster in filling critical capability gaps, overcoming fragmentation, achieving full interoperability of our forces and strengthening a resilient, competitive and innovative European Defence Technological and Industrial Base throughout the Union".[8] In addition, while strategic autonomy is only mentioned briefly in relation to the EU's decision-making capacities, the Compass nevertheless calls for "technological sovereignty in some critical technology areas [while] mitigating strategic dependencies in others". In this respect, the Compass echoes the Union's growing interest in securing and developing critical technologies and ensuring the resilience of supply chains.

To take stock of the major technological and military trends underway, it is clear that the Union needs to refurbish its capability development processes—as they are perceived as being too cumbersome and complex without necessarily leading to genuine prioritization.[9] In addition to underlining the importance of evolving the Union's existing capability, planning, and development structures, the Compass outlines key capability priorities until 2030 including: Soldier systems, main battle tanks, patrol class surface ships, remotely piloted air systems, future air combat systems, air defense, secure satellite communications, space tracking capacities, and cyber defense. Beyond simply naming capability priority areas, the Compass lists a series of measures designed to enhance the EDTIB. These include the establishment of a Defense Innovation Hub (HEDI) in the European Defence Agency, the creation of an Observatory on Critical Technologies, the application of the EU's foreign direct investment screening mechanism in the defense sector, calling for more defense spending, and holding an annual defense ministerial meeting on capability development. While such measures are unlikely to alter the deep structural challenges facing the EDTIB today, the Compass will be subject to a yearly review and a European Council summit, which will ensure some degree of political pressure is maintained.

Therefore, we should not view the Strategic Compass as an answer to the challenges facing the EDTIB—it is more of a diagnosis of the problems facing the European armaments sector, rather than the medicine required. In this sense, the Compass even puts its finger on a core problem facing the European defense sector by recognizing that any EU defense initiative must become embedded in national defense planning if it is to have any real effect.[10] Accordingly, this is an explicit admission that EU Member States are still largely responsible for the fragmentation of the EDTIB and that national defense planning may not yet be responsive to EU-wide capability and technological needs. If indeed national and NATO defense planning priorities have traditionally trumped EU needs, it is also interesting to note that the Strategic Compass broadens the meaning of EU security and defense beyond Common Security and Defense Policy (CSDP) missions and operations. Instead, the Compass seeks to re-tool and prepare the Union for an era of strategic competition and geopolitical rivalry where air, space, maritime, and cyber capabilities will be required.

One of the consistent complaints about EU security and defense is that it has too often been focused on modest civil-military missions overseas, and that this has been of little interest to a majority of EU Member States and

6 European Commission (2022a).
7 European Commission (2022b).
8 Council of the EU (2022a, p. 29).
9 Fiott *et al*. (2021, p. 50).
10 Council of the EU (2022a, p. 31).

European industry.[11] In many respects, the EU has not even been able to meet its stated capability targets in the CSDP either.[12] By reframing the strategic context to one where the Union must engage in the defense of Europe and to deter external threats[13], there is more chance that EU Member States will increasingly see their own national defense planning priorities mirrored in EU initiatives and structures. This is more likely to be the case at present given the shift away from predominately crisis management operations (e.g., Europe's military extraction from the Sahel and Afghanistan) toward the defense of Europe (i.e. working with NATO and the United States to deter Russian military aggression). Yet even here we must acknowledge that there "is no golden recipe for moving from national to multinational planning and programming"[14], and that intervening issues such as national industrial politics can also scupper EU-level defense planning.

The Versailles moment?

Even if the Strategic Compass does not in itself fix the deep-seated problems facing the EDTIB, it is noteworthy that it insists on the importance of the EDF and calls for joint procurement and new financing solutions, such as a VAT waiver and a bonus system under the EDF, for jointly developed capabilities.[15] As many scholars have argued, EU-level incentives for defense-industrial cooperation are not only imperative, but also the only realistic way of responding to structural fragmentation in the European defense market.[16] Indeed, even before Russia's invasion of Ukraine on 24 February 2022, the European Commission was delivering on a direct tasking from the European Council (given on 25–26 February 2021) to assess the critical military gaps facing the EU. The ultimate aim was to assess areas where the EU had strategic dependencies in critical technologies and value chains. As a consequence, the Commission's roadmap (presented on 15 February 2022[17]) made clear that the Union's dependencies in autonomous systems and semiconductors were particularly acute.

On the very same day, the European Commission also published a communication detailing its overall contribution to EU security and defense.[18] The document was a way for the Commission to officially present its contribution to the Strategic Compass (adopted in March 2022). It came to the conclusions that: More ambitious investments in defense research and capabilities at the EU level is required, joint procurement in defense is essential, national export control practices need streamlining, and that the EU needed to step up its efforts in cyber-defense and space. Taken together, both the communications on critical technologies and the Commission's contribution to security and defense were a step toward defining the agenda of the Versailles Summit, which took place on 10–11 March 2022.

At Versailles, Heads of State and Government had to redouble their efforts on security and defense following Russia's invasion of Ukraine. As leaders acknowledged, "Russia's war of aggression constitutes a tectonic shift in European history".[19] Yet, the Versailles Summit was about more than just Europe's war effort. In fact, the Versailles Declaration underlined the importance of reducing energy dependencies and building a more robust economic base, as well as bolstering defense capabilities.[20] There was also a political dimension to the Versailles Summit that should not be overlooked. Indeed, one of the major lessons drawn from the Union's response to the pandemic was the need for collective borrowing in the form of the Next Generation funds. Given that this was the first time in history that the EU Member States had agreed to mutual debt, and that France (a country generally in favor of common borrowing

11 Zandee (2022, p. 2).
12 Major and Mölling (2020, p. 45).
13 Biscop (2021).
14 Zandee (2022, p. 5).
15 Council of the EU (2022a, p. 38).
16 See Bellais (2018); Fiott (2017); Sabatino (2022).
17 European Commission (2022c, p. 5).
18 European Commission (2022d, p. 3).
19 European Council (2022, p. 3).
20 European Council (2022, p. 3).

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for strategic purposes) held the Council of the EU Presidency, the meeting in Versailles was billed as an opportunity to extend common debt issuance for other strategic areas such as defense and energy.[21]

The Versailles Summit can certainly be viewed as an historic moment that almost certainly rivals the 2013 special European Council meeting on defense. Indeed, whereas in 2013 Heads of State and Government underlined the importance of prioritizing capabilities (such as air-to-air refueling, cyber-defense, drones ,and satellite communication), the 2022 Versailles Declaration set a pathway toward developing capabilities jointly at the EU level. Despite suffering the consequences of the Covid-19 pandemic, at Versailles the EU turned toward a more robust pursuit of bolstering defense capabilities, reducing energy dependencies, and building a more robust economic base. Interestingly, the defense sector was seen as a fully integrated part of the Union's overall response to Russia's aggression. This included another pledge to substantially boost defense expenditures, further stimulate collaborative defense investments, invest in strategic enablers, and to strengthen the EDTIB.[22] On this basis, the Versailles Declaration tasked the European Commission and the European Defence Agency (EDA) to provide an analysis of defense investment gaps in the EU and to create new financial tools to help incentivize EU-level collaborative investments in capabilities.

The European Commission and the High Representative of the Union for Foreign Affairs and Security Policy / Vice-President of the Commission (HR/VP) followed up on this tasking with a joint defense investment gaps analysis on 18 May 2022.[23] Although this analysis did not reveal anything new in terms of the challenges facing the EDTIB, it did put into sharper focus the more immediate need to replenish stockpiles of ammunition and munitions, phase out Soviet-era legacy capabilities, and invest into a multilayer air and missile defense system. For the longer term, the analysis called for greater collaborative investments in remotely piloted air systems, air-to-air refueling, air defense, multi-role fighter aircraft, main battle tanks, armored fighting vehicles, frigates, submarines, patrol corvettes, satellite communication, military mobility, and cyber-defense capacities. A close reading of the EU's efforts since February 2022 will reveal that this list of capability gaps simply mirrored those already known to both governments and observers.

However, where the gap analysis came into its own was in its proposal for joint defense procurement. Not only did the Commission and the HR/VP immediately call for the establishment of a Defense Joint Procurement Task Force[24], but they also tabled two new financial instruments designed to reinforce the EDTIB. First came the EDIRPA, where the Commission signaled its intention to invest EUR 500mn from 2023–2025 to finance collaborative purchases of ammunition, munitions, and other military equipment. Second was the EDIP, which is seen as a longer-term replacement of the EDIRPA beyond 2025. The EDIP, which presently has no financial envelope and still needs to be negotiated with Member States, seeks to help the EU develop projects of major strategic relevance. However, what is interesting and bold here is that the Commission has not simply sought to finance new capabilities beyond the EDF. Instead, it has called for a new approach to EU defense investments that includes support for maintenance, repair and overhaul (MRO).[25]

In fact, what is most of note in the new approach outlined in the defense investment gap analysis is the space given to the question of "programming and procurement". It is clear from the analysis that the Commission and HR/VP do not believe that joint defense procurement can sustainably occur without more collaborative defense planning. As it states, as "Member States will start adapting their planning processes to take into account the new security landscape,

21 Smith-Meyer (2022).
22 European Council (2022, p. 4).
23 European Commission and HR/VP (2022).
24 European Commission and HR/VP (2022, p. 9).
25 European Commission and HR/VP (2022, p. 10).

it is paramount to set-up a more structured approach—a joint EU strategic defense programming and procurement".[26] Should EU Member States agree to more EU level defense programming, this would be nothing short of a Copernican moment in EU security and defense. As the 2022 Coordinated Annual Review on Defense (CARD) report makes clear, "national defense planning remains mainly focused on repairing the past through satisfying urgent and previously deferred requirements, rather than winning the future by investing in innovative, and possibly common capabilities".[27] Breaking this traditional pattern of behavior, however unexpected, would certainly unlock greater potential for the EDTIB.

A response to deep-seated challenges?

Sceptics of the EU's recent push for a more effective European defense industry may point to countless past statements on the need to support the EDTIB. As one Commission communication from as early as 1996 made plain, "the state of health of the defense-related industries is such that unless action is taken in time, there is a danger that whole sectors of the economy involved in defense-related activities could disappear". This is tacit proof that the challenges facing the European armaments sector have not just emerged on the back of Russia's war on Ukraine. It is also evidence that efforts since 1996 have not really led to any tangible success—otherwise there would be no need for all of the initiatives developed since the Versailles Summit. Accordingly, the past three decades could be seen as a wasted opportunity and the war on Ukraine has dramatically exposed the extent of Europe's armament challenges; production capacities are low for even basic material such as ammunition, and weapons exports rather than European made solutions are favored. In short, there are doubts as to whether the latest round of EU defense-industrial initiatives will overcome the deeply ingrained differences of interests and strategic outlook between EU Member States.

The war on Ukraine's increased demand for military equipment in Europe has led to several European defense manufacturers reporting difficulties in meeting government demands. The combination of high commodity prices because of the Covid-19 pandemic, and a need to reorient supply chains after the sanctions imposed on Russia, has meant that many European contractors have been unable to increase production capacity rapidly enough. The European defense sector has been used to a situation of modest demand, relatively low unit numbers per system, and long lead times for development. This was accepted in the post-Cold War era where firms not only downsized or merged but were driven by a need to reduce procurement costs, price competition, a search for export markets, and greater links between commercial and defense business. The war on Ukraine imposes a substantially different paradigm, where high ammunition usage rates and off-the-shelf military equipment (e.g., drones) are making their way to battlefields. As has already been remarked by commentators, Europe must prepare for a wartime economy rather than for a continuation of a relatively benign strategic outlook.

In this respect, the proposed EDIRPA is unlikely to make much of a difference to the manufacturing capacities of defense firms in Europe. To be clear, more demand and clear priorities are to be welcomed by industry, but the structural issues facing the industry will take more time and resources—and the time-limited EDIRPA worth EUR 500mn is a very modest contribution. In any case, we have already seen industry itself adapt to the new strategic reality. For example, Rheinmetall (Germany) has already acquired Expal Systems (Spain) for USD 1.24bn to enhance their production capacity of artillery and mortar ammunition. State-owned conglomerates are also having to adapt to increased demand, with ROMARM recently announcing that it would invest in new and more energy efficient manufacturing equipment to offset the additional costs of high energy prices and outdated manufacturing technology.

Furthermore, the assumption that defense-industrial cooperation is a silver bullet for the EDTIB can also be challenged, as the principle of *juste retour* may conspire to lead to additional costs; as was the case with the A400M,

26 European Commission and HR/VP (2022, p. 10).
27 European Defense Agency and EU Military Staff (2022, p. 2).

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the Tiger helicopters, or the FREMM frigates, which are all symbols of European defense-industrial cooperation. In this sense, it is positive that the governments of France, Germany and Spain have agreed to further develop the Future Combat Air System (FCAS) by unlocking EUR 3.2bn for the next phase of the program that should eventually lead to a first test flight in 2028. As the major weapons system program among EU Member States, the FCAS is an important test case in how far governments have altered how they balance *juste retour* with the need to produce a sovereign European military capability.

Yet the chronic under-investment in defense over the past three decades, and the inability to consistently develop a European approach to capability development, has taken its toll on the EDTIB. Russia's war in Ukraine, for example, has led European governments to rapidly fill capability gaps through off-the-shelf solutions. In August, Poland signed a USD 5.8bn contract with South Korea for 180 K2 tanks, howitzers and 48 light FA-50 fighter aircraft. Due to the lack of a credible European alternative, Germany has also approved a EUR 10bn contract for 35 nuclear weapons ready F-35 stealth jets from U.S. producer Lockheed Martin to be able to uphold its role in NATO's nuclear sharing agreement. Yet questions have been raised about whether the EUR 100bn "special fund" announced by Chancellor Scholz in late February 2022 for Germany's armed forces can contribute to an era-defining reordering of the European defense sector. Indeed, only a small proportion of the special fund appears to be dedicated to European armaments programs such as the FCAS. Taken together, Europe's initial response to the war on Ukraine may have actually increased its strategic dependencies on external partners.

Clearly then, the EDIRPA and EDIP are likely to have a minimal impact on the current needs of the European defense sector. Even the EDF is unlikely to be able to substantially address the pressing needs of the defense sector in Europe. Thus, the Union's recently agreed defense-industrial initiatives should be seen as a part of a structural re-shaping of the European defense sector, the benefits of which may pay off in a decade or two—perhaps long after the war in Ukraine has ended. Nevertheless, what is being proposed at the EU level—joint defense procurement, programming and planning—is extremely sensitive and difficult for all Member States to swallow. Any structural reshaping of the European defense market is bound to meet resistance by governments. The first major hurdle is ensuring that there is enough financial firepower in the EDIP moving forward, but this is a major point of contention between Member States. In fact, in some respects the EDIP could be emblematic of the disagreement between European states on the issue of common debt issuance. As we have seen, the Versailles Agenda failed to build on the common debt paradigm, introduced during the pandemic, in areas such as energy and defense.

One logic sees the need to replicate the EU's behavior during the pandemic, with collective borrowing managed by the Commission for the benefit of all. Another logic is pushing back a major hesitation to collectivize debt for European defense or strategic sectors. As noted, financing under existing tools such as the EDF is already too low, but joint defense procurement speaks to a different order of financial magnitude—without ambition, the EDIP risks being just a good idea on paper but without much effect on the EDTIB. As European Commissioner Thierry Breton has remarked, "the EU instrument on common procurement [presented] in July to reinforce European defense industrial capacities—while an important step—is admittedly of small magnitude in terms of budget […] we need to put our money where our mouth is and mobilize a much more significant budget".[28] With the mid-term review of the Multi-annual Financial Framework (MFF) on the horizon, there are likely to be many political battles ahead on fundamental questions for EU defense—such as whether the EDF should be increased above its current EUR 8bn envelope or whether the EDIP should mirror Germany's "special fund" of approximately EUR 100bn.

Finally, even without debates about the size of the EDF or the EDIP there will be political contestation over the regulatory nature of EU defense-industrial tools. One of the main lines of political friction will be how regulatory changes brought in under the EDIRPA may affect the regulatory lines already taken under the EDF regulation. For

28 Breton (2022).

example, in early December 2022 the Council of the EU agreed its position on the EDIRPA regulation and it called for certain exemptions to the common procurement rules. Specifically, Member States were keen to ensure they can use the EDIRPA to continue to collaborate with non-EU industrial firms and for this purpose at least 70% of the costs of components must come from within the EU. In some cases there will be no EU manufactured alternatives, so the flexibility is warranted. Given that the EDIRPA is only worth EUR 500mn over two years, the financial costs of this approach are negligible. However, if this new approach were accepted by the Commission and European Parliament, it could be used to argue for similar flexibility in the EDIP or to retrospectively reengineer the EDF to allow for the participation of more non-EU based industries. This would raise serious questions about the EU's ambition to ensure the viability of the EDTIB.

Conclusion

An optimistic reading of events since 2016 would argue that the EU has come some way in its defense-industrial ambitions, and that the strategic landscape since the mid-1990s has fundamentally changed for Europe. This is now an era marked by the return of war and shifts in the global balance of power. There can be no doubt that the EDF has marked a paradigm shift in terms of European-level armaments cooperation, even though the EUR 8bn assigned until 2027 is too low. Yet the very fact that the Member States have agreed to finance defense research and prototyping at the Union-level is extraordinary. The same can be said of the steps since the Versailles Summit to develop common EU defense procurement. While more intense negotiations for an EDIP will emerge in 2023, the fact that the EU is entertaining the idea of supporting joint defense procurement through a mixture of financing tools and VAT exemptions is more than noteworthy. Additionally, linking the financing of joint armaments programs with more collaborative defense planning and programming is a potentially revolutionary step forward for the EU.

Yet this article has also highlighted some of the ongoing challenges associated with EU efforts to support the EDTIB. One major issue is the fundamental disagreement over economic policy, and whether the Union should ever be able to collectively borrow off international capital markets for defense. Without such capital, it will be up to EU governments to come up with the additional financial support, but this gives Member States a veto over the ultimate level of EU ambition. The stark reality is that many Member States are still keen to ensure the EU's continued adolescence in defense in order to not fundamentally challenge the transatlantic status quo. With Russia becoming a fundamental threat, many Member States will be reluctant to develop the EDTIB if it means incurring resistance from the United States. This is an understandable, although perhaps short-sighted, approach.

Any move toward joint EU defense procurement and planning is unlikely to bear fruit in the near term, but it is a worthwhile investment for an uncertain future. Here though, we must recognize that the EU is opening itself up to criticism with the various initiatives it is seeking to develop. For example, some may wonder why the Union is moving rapidly toward common defense procurement and planning when it has only just started to fund defense research and capability development through the EDF. This may be a case of the Union trying to run before it can walk. Accordingly, there is a need for more time to promote the relevance and added-value of EU initiatives such as the EDF. Even though time is not on the EU's side in this regard, the forthcoming review of the MFF provides an opportunity for stock-taking the impact of the EDF on the European defense market. Through a convincing analysis of the benefits of the EDF, it may be easier to make a stronger case for the EDIP and associated defense-industrial initiatives.

Ultimately, a core challenge for any coherent EU defense industrial strategy rests on the broader politics of the Union's economy. As an example, we have seen how recent steps by the United States to invest in green subsidies under the Inflation Reduction Act has given rise to a revision of the EU's state aid rules and lent greater weight to common investments in green technology in the EU. Yet again, unilateral actions by the United States have spurred the EU into action to maintain its own economic competitiveness. Such developments have only lent greater weight

to the idea of greater European sovereignty in economic affairs, especially with regard to investments in critical technologies, security of supply and the reshoring of strategic manufacturing capacities. Yet a major question is whether there will be any spillover from this logic from the broader EU economy to the defense sector. Given the important technological and industrial linkages between economic sectors in Europe, this would seem an almost natural progression were it not for the continued political fragmentation of Europe.

In this respect, any meaningful and useful EDTIB must proceed from a political bargain between the major defense industrial powers of Europe. A basic, if difficult, question needs to be asked, "What type of defense industry does Europe need in the next few decades?" Of course, any response to this question will include political discussions about the military capabilities Europe requires for the future, but any response will have to contend with financing measures and export rules. Common borrowing for defense is a tall order, but a modest step can already be made by allowing the European Investment Bank to finance common defense capabilities. For exports, European countries will face fierce international competition on export markets. In this sense, any EDTIB will have to be developed with greater domestic demand in mind and not on the assumption that exports will support the EDTIB alone.

Although it is painful to admit, Russia's war on Ukraine has provided the EU with an opportunity to rethink and reorganize its defense market. Issues such as security of supply, armaments production, critical technologies, arms transfers, and more have been put under the spotlight as Europeans move to assist Ukraine. The war has exposed in the starkest terms the underlying fragilities of Europe's defense market. While no one can predict how the war will end, and without profiting from the misery of the conflict, Europe may only have a limited period of time to seriously reorganize and consolidate the EDTIB. Should the war on Ukraine end anytime soon, then European politicians may seek to downplay this need. Doing so, however, will only help to bury the very structural issues that would weaken Europe in case of any future war in Europe or beyond.

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50 shades of procurement: The European defense trilemma in defense procurement strategies

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Abstract

This article examines the strategic choices of countries regarding their acquisition of defense equipment, given the strategic and economic constraints that they have faced since the end of the Cold War. As Augustine's laws make it increasingly complicated to develop and produce all the necessary weapons for a single country, countries must balance the wishful thinking of preserving industrial strategic autonomy with the cost of doing so under the constraint of meeting the needs of their armed forces. European countries' procurement strategies are mapped against a trilemma of autonomy, manageable costs, and economic spinoff. Several procurement alternatives are analyzed, including national production, European cooperative production, licensed production, off-the-shelf purchase, leasing, and capacity abandonment. Maximizing both strategic and economic advantages is a myth; there is no "silver bullet" in terms of acquisition choice, and the returns on investment depend on countries' preferences, goals, and markets.

Defense procurement is the process whereby "states acquire goods and services required by their armed forces".[1] Deciding on the appropriate mode of procurement is a complex process combining strategic anticipations, planning, and industrial–economic imperatives. The long story of France with unmanned aerial vehicles (UAVs) with its twists and turns, is illustrative. France deployed its first UAVs during the first Gulf War in 1990–1991 and then in the former Yugoslavia.[2] However, it was not until the commitment to temporary platforms in Afghanistan at the end of the 2000s, that the country was truly convinced of the need for UAVs in military operations. Specifically, in the medium-altitude long endurance (MALE) UAV segment of the market, France has thoroughly questioned the most appropriate procurement model that should be adopted after having unsuccessfully launched and then abandoned several projects, such as the EuroMale, Advanced UAV, Talarion, Telemos, and F-Heron TP.[3] In 2013, after this long trial journey, the country decided to purchase the American Reaper UAVs from General Atomics, first for Intelligence, Surveillance and Reconnaissance (ISR) missions, and then starting in 2018, for bombing missions. Finally, in 2022, the collaborative Eurodrone (Gryphon) program was officially launched. Eurodrone entails that a minimum of 60 UAVs should be bought by the states cooperating on the project (France, Italy, Germany, and Spain) for a total value of EUR 7.1bn. The first objective of this UAV is to replace the Reaper UAVs in service in the French, Italian, and Spanish air forces. This more-than-15-year-long story shows how different modes of procurement (from national programs to off-the-shelf purchases, including cooperation, along with a still pending leasing option[4]) were envisaged by a country with industrial skills, significant operational needs, and a strong desire

1 Uttley (2018, p. 72).
2 Zubeldia (2012).
3 Faure (2020).
4 It is of note that in 2020, General Atomics proposed to the French Ministry of defense a leasing option for Reaper or SkyGuardian drones, based on the model of cars or trucks fleet leasing.

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for sovereignty.

This article aims to understand how the different acquisition choices made by a country can evolve according to economic criteria, such as the increase in R&D costs, production costs, Augustine's laws and constrained budgets, the existence (or not) of a defense industrial base (DIB), and finally strategic criteria, such as alliances or operational needs. It is therefore useful to question the different dynamics at work since the end of the Cold War that can explain the current choices of the European countries. In this respect, the economic and budgetary stakes relative to the costs of programs, and when compared with previous generations, play a strong catalytic role. In addition, while they are not in the scope of this article, political frictions are a significant feature.

Since the end of the Cold War, European countries have had to cope with many different constraints on their procurement processes. However, the way they deal with them depends on their preference for sovereignty-related issues such as maintaining (or developing) industrial capabilities. Their procurement strategies are mapped against a trilemma of autonomy, manageable costs, and economic spinoff—upon which, several procurement alternatives are analyzed, including national production, cooperation, licensing, off-the-shelf purchase, leasing, and capacity abandonment. The lack of coordination regarding defense procurement has severe consequences for the industrial fragmentation of Europe. The war in Ukraine modifies the trilemma such that acquisition costs are less critical because the European response to the war requires weapons procurement at an accelerated rate.

The main trilemma is that the solution of "a national production by a national firm", which gives the highest level of sovereignty and industrial strategic autonomy, as well as generating the highest level of technological and economic spinoffs, is also the more expensive option. Here, for a given country, industrial strategic autonomy can be understood as the situation of not being dependent on foreign actors—but even more, as the capacity to manufacture, produce, sell, and use defense equipment without constraints other than those that the country has set for itself under its regulations and the treaties it has signed. Thus, in the quest for industrial strategic autonomy, European countries have to balance dependency and the economic costs and benefits calculus of procurement. A wide spectrum of possibilities seems to arise between a costly choice of national production with limited (or even no) foreign dependency on the one hand, and a leasing option with a high level of foreign dependency on the other.

The article further seeks to put together all the reasons that influence a country's choice in order to illustrate the plurality of situations in terms of the "model of procurement". Faced with the increasing cost of equipment, countries are likely to implement different procurement strategies. Some of them can be novel in the "procurement landscape" (e.g., leasing options), but all of them imply renouncing some strategic advantages. These different strategies are reviewed and the fundamental trade-offs underlying each of them are highlighted. The following areas in the related literature are studied: the historical dimension of industrial choices; the problems of cooperation as a way to solve the trilemma; the economics or international relations cost issues in terms of production; and the issues relating to the variety of capitalism in political science. The article highlights that there is no unique model of acquisition but only "models" that fit a country's needs at a given moment in its history, and in a given institutional context.

The first part of this article outlines the major issues of fleet management in the European context. Then, an examination is undertaken of the fundamental trade-off between maximum sovereignty and foreign dependence as seen in the literature. The article introduces the idea of a "trilemma" to map where procurement options lie versus three "ideal" criteria—the lowest cost, maximum autonomy dividend, and maximum economic and technological advantages (spinoffs). Several cases of public procurement involving trade-offs are presented as illustrations to support this framework.

Fleet management fleet issues

According to the existing literature, three main categories of factors influence the procurement process (Table 1): the external strategic environment (i.e., the threat); the internal strategic environment (i.e., the political situation); and the economic constraints, including budgetary ones.

Table 1: Main factors influencing the procurement process

External strategic environment	*Internal strategic environment*	*Economic constraints*
External threats. Alliance network.	Domestic political agenda. Presence and size of the defense industry.	Level of wealth. Defense budget. Cost escalation.

First, external strategic considerations (i.e., the existence and intensity of a threat) justify the need for states' procurement. In the event of a common threat, countries may cooperate more easily to either develop and produce their own aircraft or buy off-the-shelf from allies (notably, the United States, and to a lesser extent, the European Union). Besides, the changing nature of the threat may require adaptability to a diversity of missions rather than specialized equipment for a specific mission. Combat aircraft constitute a good example to substantiate this point—during the Cold War, these aircraft were specialized for specific air missions (air-to-air combat, and air-to-ground strikes, and ISR), while their latest generation (produced since 2000) encompass the entire scope of air missions.[5]

Second, the internal environment is related to the presence of firms within the DIB that are capable of building and supporting the required equipment. This is a critical industrial constraint as states may be reluctant to give up industrial capabilities on the grounds of sovereignty or because recovering lost industrial skills is both uncertain and costly. In this regard, Kluth shows the extent to which the procurement process may suffer from a "national bias"[6]; countries tend to favor their national DIB for both sovereignty-related and economic reasons. This constitutes a major reason that explains industrial fragmentation in Europe.

Third, budget constraints are stringent; thus, defense budgets are widely used as expandable lines (especially just after economic crises, such as after the 2008 subprime economic crisis). According to SIPRI data, the increase in defense budgets in Western European countries since the end of the Cold War is 7% and is the least among all the regions of the world. Christie shows that "fiscal space" is a major determinant of the European defense budget, and more recently[7], Droff and Malizard conclude that economic factors remain crucial in determining the demand of defense spending.[8] Moreover, the economic crisis after 2008 dealt a huge blow to defense procurement budgets; according to the European Defence Agency (EDA) database, defense procurement budgets decreased by 22% between 2008 and 2014. Budgetary constraints include inflationary pressure. Given that defense equipment requires high-level technology, defense inflation is higher than civilian inflation[9], and the purchasing power of governments for defense equipment decreases over time for a constant budget. Bongers and Torres evaluate the quality-adjusted fighter aircraft cost in the United States and conclude that the technological process constitutes the main explanation for defense inflation (an 80% increase in aircraft cost).[10]

Countries require defense equipment to fulfill their strategic needs. Before considering procurement choices, one may also consider fleet management to maintain a certain level of defense capability. Some countries may suffer a lack or shortage of capabilities due to budget constraints. For those with capabilities, streamlining the fleet is considered a way of preserving operational skills. Three options are identified below.

The first option, "being under a capability shelter" can be considered when a country has certain needs but cannot afford to purchase the required military equipment. In this case, the option is to benefit from the capabilities of an alliance; for example, the Baltic States received main battle tank capacities from the NATO forces. This can also be a temporary solution when the capability gaps have been identified but the corresponding program has not yet been

5 Droff, Malizard and Noël (2020).
6 Kluth (2017).
7 Christie (2019).
8 Droff and Malizard (2022).
9 Hartley (2020).
10 Bongers and Torres (2014).

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finished, or the country has not decided on a preferred option—as with the end of NIMROD, a domestic program in the United Kingdom, where France and other NATO countries helped the United Kingdom in maritime surveillance missions. Eventually the United Kingdom opted to buy the American Poseidon aircraft "off-the-shelf".

The second option is that a country can either abandon a given capacity or optimize and rationalize the existing capacity. In this vein, Neuman identifies several paths, such as retaining the old-generation equipment, reducing the size of the fleet, and at the extreme, giving up capabilities.[11] Abandoning capabilities is simple and tempting because the resulting short-term savings are often significant. Important examples of countries that have adopted this approach include the following: Denmark with its submarine capability; New Zealand with combat aircraft capabilities in 2011; Belgium, Canada, and the Netherlands with their main battle tanks; and the United Kingdom, which gave up the air component of its nuclear deterrence at the end of the 1990s. France has decided not to maintain coastal batteries and to abandon short and medium-range ground-air defense systems (in the mid-2000s). All these choices imply a renunciation of sovereignty. Important to such decisions is that it is difficult and very costly to turn back the clock, given the loss of required knowledge and know-how.

The third option is that optimizing and rationalizing capacity is possible, for example, by modernizing fleets or improving their maintenance efficiency. This approach is evident in France in the ambitious policy to modernize the maintenance of military aircraft in 2018. However, this strategy has time limitations because eventually the cost of capability ownership increases (due to aging equipment), which by definition is not at the technological frontier—investment will again be required. The countries experiencing this situation include Germany, which has decided to extend the life of its Tornado aircraft, and France, with its Mirage 2000 modernization program. For both these countries, modernization with new equipment will be inevitable; the F-35 in the case of Germany and the Rafale fighter at the F4 standard in France.

Trilemma in the procurement process

There are different possible procurement strategies, ranging from national preference (and autonomy) to international preference (and dependence). Several intermediate strategies lie in-between these poles—including international cooperation in its various forms, extending from a collaborative program (with, for example, shared development costs) through to licensed production.

Figure 1 represents these possibilities by postulating a fundamental trade-off between sovereignty and costs, while accounting for the economic and technological advantages countries may benefit from. On the x-axis, is the degree of external dependence of an acquisition modality, and on the y-axis lies different economic and technological spinoffs, unit cost and strategic autonomy dividends that can be associated with the same modality/degree of dependence.

For example, with the option of a national program (number 1 in the graph), a country supports a large cost of R&D and production, but its dependence on foreign partners is low.[12] Toward the other end, when a country purchases off-the-shelf equipment (number 4 in the graph), it benefits from a lower price, given the economies of scale of the foreign producer; however, its dependence on foreign partners is very high.[13]

11 Neuman (2006).

12 Note that the approach is based on the main platform and does not account for the "value chain" inside the platform. The issue of dependency would also require investigating the systems, sub-systems, and components for a more in-depth analysis that goes behind the scope of this article.

13 Often the United States but also Russia or even China or Turkey for some markets, such as that of UAVs)

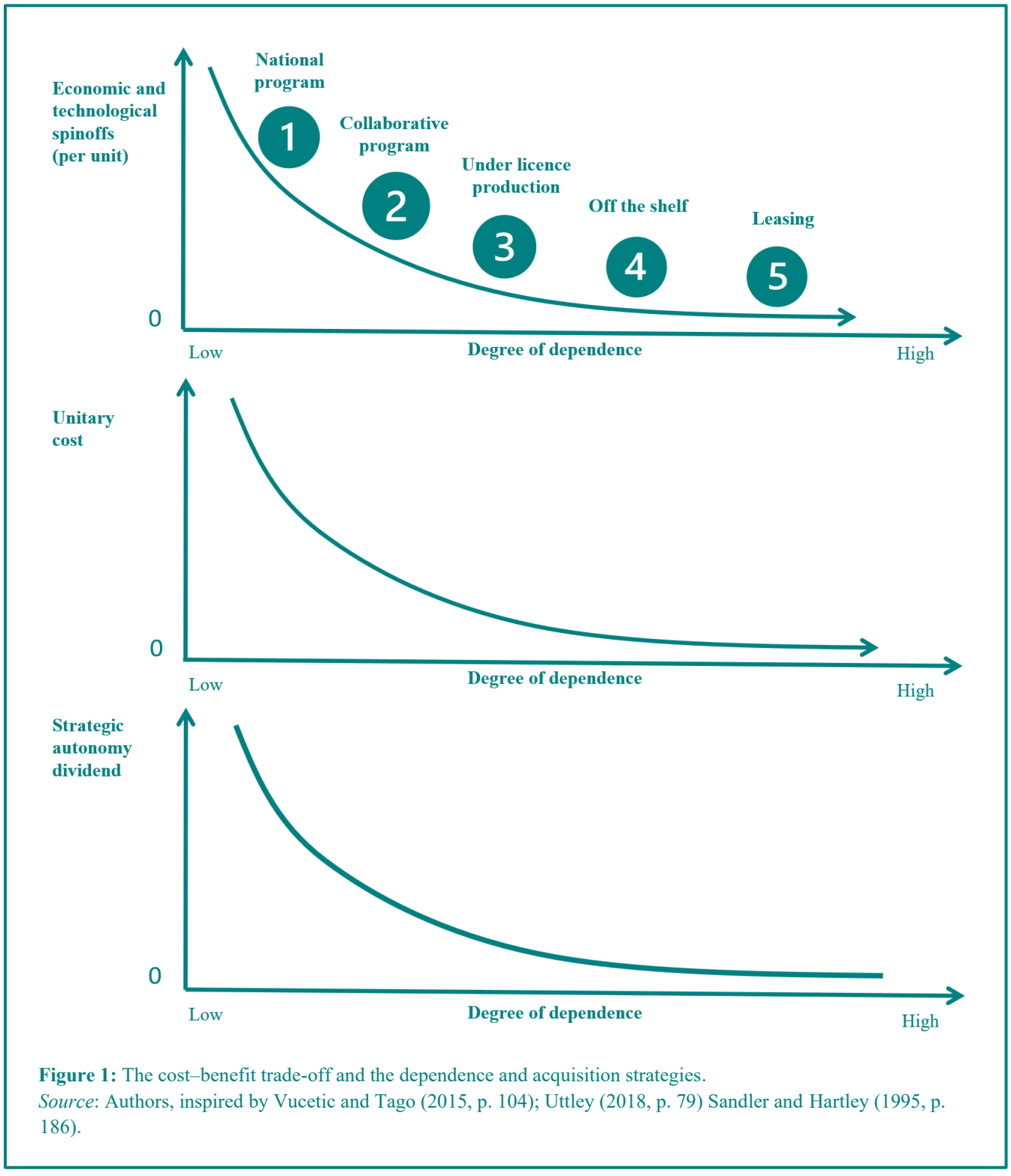

Figure 1: The cost–benefit trade-off and the dependence and acquisition strategies.
Source: Authors, inspired by Vucetic and Tago (2015, p. 104); Uttley (2018, p. 79) Sandler and Hartley (1995, p. 186).

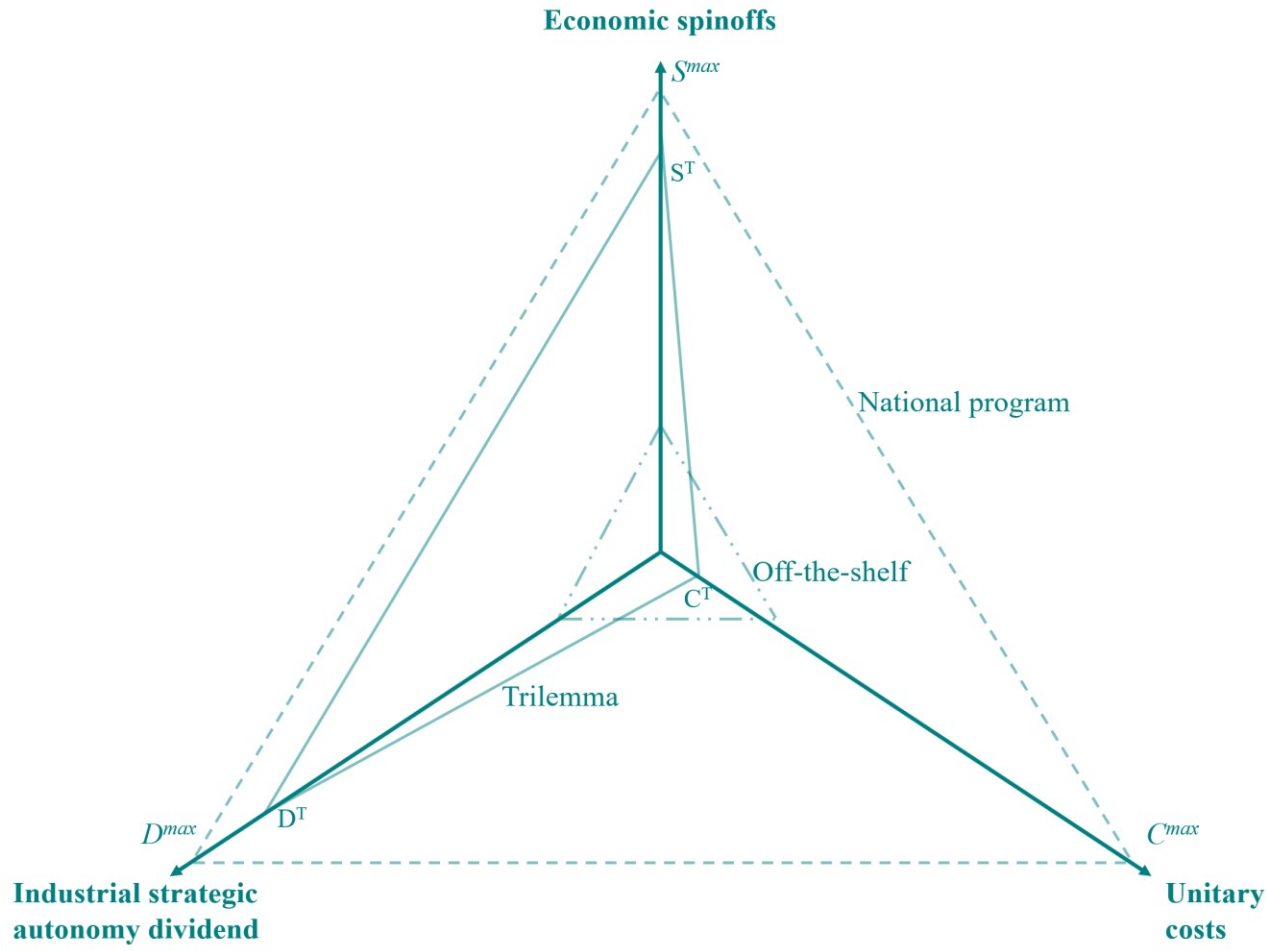

Figure 2: Spinoffs, industrial dividends, and cost nexus.

Furthermore, there is a form of trilemma between autonomy (independence), cost, and advantageous economic and technological spinoffs, in that no country can simultaneously obtain all the three "ideal" criteria—the lowest cost, total autonomy, and maximum economic and technological advantages. On combining the three dimensions of the trilemma, Figure 2 emerges, where all procurement options can be depicted along these dimensions.

For ease of reading only two procurement options (national program and off-the-shelf) are plotted, but all the five procurement options analyzed in this article can be represented with regard to industrial strategic autonomy dividends, economic spinoffs, and unitary costs. This article argues that a national program maximizes both industrial strategic autonomy dividend *(*D^{max}) and economic spinoffs (S^{max}), but it comes with the highest cost (C^{max}). Under these circumstances, the trilemma implies that there is no variant of the national program option in which the cost is dramatically reduced (C^T). Countries must form their procurement choices based on the trade-off between unitary costs, industrial strategic autonomy dividend, and economic spinoffs.

This being considered for European countries in the current context (high cost of systems, reduced size of the defense market, budgetary constraints, competition between budgets within states, etc.), procurement necessarily becomes an adjustment process with strategic trade-offs. Comparing the European and American markets (as is often

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the case in the literature[14]), only the United States can simultaneously meet the three objectives because of the size of its market, its economic and financial power, and its unified decision-making structure, which homogenizes demand and therefore favors scale and learning effects.

The inter-temporal dimension of the industry as well as the issues of path dependency must be accounted for; given the economic and technological barriers to entry, it is indeed very difficult to create industrial capacities out of nothing.[15] The countries that tend toward national production (1) and collaborative programs (2) generally have the highest strategic ambitions (3), whereas countries that tend toward off-the-shelf purchases (4) or leasing options (5) generally have less strategic ambitions and do not consider the defense industry as a priority or a political objective in need of support. What is interesting, however, is examining the trade-offs in terms of capacities and showing the extent to which some countries maintain a given capacity (i.e., by choosing options 1 or 2) at the expense of another capability (i.e., by choosing options 3, 4, or 5). What also complicates this analysis is that countries sometimes start their procurement process with off-the-shelf purchases or production under license (options 4 or 3) and move up the industrial chain and acquire the necessary skills over time. The following section details each strategy and illustrates them with examples, highlighting some of the strategic trade-offs observed.

National preference and the search for autarky

In the case of national preference, the defense *industrial* policy is a central element of defense policy enabling a country to technically design, produce, and provide operating support of systems. The country aims at maintaining and developing its DIB, which can be defined as the set of companies that enable the armed forces to conduct their operations, which include both the armament firms (production of weapon systems and lethal equipment) and those that supply all the goods necessary for the functioning of the armed forces (food, fuel, etc.).[16]

A national DIB offers numerous advantages. Initially, of course, there are issues of "strict sufficiency" to avoid depending on foreign actors[17], but today there are other major issues in terms of jobs (difficult to offshore) or value-added industrial activities. In France, for example, 90% of the value added of a strategic nuclear submarine (SSBN "Le Triomphant" class) is located on national soil;[18] and, given the French preference for nuclear deterrence, this result can be considered the upper limit of the value added associated with defense production.

National DIBs also help in mastering technologies that ensure spinoffs in various sovereign sectors connected to defense activities, such as computational capabilities, energy, electronics, materials, and so on.[19] At a more operational level, an autonomous DIB guarantees better reactivity and adaptation to changing needs.[20] This is the case, for example, with anti-IED vehicles—the fight against IEDs has become one of the largest public programs in U.S. history.[21] The mass production of mine-resistant ambush-protected (MRAP) vehicles can be seen in the American context as an attempt to solve a strategic problem through a technological response—mainly possible because of a national, reactive, and large American DIB.

14 Hartley (1983, 1987).
15 Apart from the inclusion of Chinese firms and name change, the main firms in the top 100 published by SIPRI are remarkably constant. This situation indicates that barriers to entry are a key feature of the defense industry, especially on major defense platforms such as aircraft, ships, and armored vehicles.
16 Dunne (1995, Chap. 14, pp. 401-402).
17 Dunne (1995, Chap. 14).
18 Hérault (2020).
19 Ruttan (2006).
20 DeVore (2017).
21 Goya (2007).

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There is a strong desire for strategic autonomy[22], which can be linked to the objective of autonomy from the outside world, in particular the United States and certain European countries. This desire can also be linked to operational needs that require a full capacity for action (for example, aircraft capable of carrying a nuclear weapon or being the first to enter a theater of operations).

However, national preference comes at a high cost, especially in terms of economic costs—costs inherent to all stages of the product's life cycle with regard to Augustine's laws must be supported (although being closest to the technological frontier is a strong driver). In addition, monopolistic situations created by the specificities of the defense market generate an extra cost required for preserving domestic activities; this is the "'sovereignty price'; that is, the profit a State agrees to grant to its defence firms to perpetuate their domestic activities".[23] The price is not only monetary but also includes an opportunity cost—for example, in France, preserving industrial capabilities in combat aircraft has consequences for other aircraft (helicopters, transport aircraft, and UAVs), which are developed and produced in cooperation even though France has a long history of firms' presence in these markets.

Note that autarky is very theoretical and often idealized in a world where trade has become greater in value than GDP and where value chains are largely globalized.[24] Even if the platform is produced domestically, the systems, subsystems, and components can be supplied by foreign companies. Interdependencies do not only concern components and equipment but also services, including industrial production services, such as expertise, engineering, and so on. For example, the Gripen Swedish combat aircraft is nationally produced in Sweden but many subsystems are obtained from the United States. In naval systems, the F-100 frigate, S-80 submarine, and future F-110 are nationally produced by the Spanish firm Navantia, but the combat systems are provided by the American manufacturer Lockheed Martin. The dependence is sometimes nestled in the smallest details of processes or products. For instance, in 2022, Lockheed Martin had to stop deliveries of the F-35 after an alloy of cobalt and samarium from China was discovered in a magnet used in a pump of the aircraft. This illustrates that even when developing and producing an entire system nationally, countries are often dependent on inputs (raw materials, parts, or subsystems) that can only be obtained from a very limited number of countries, which are sometimes not allied.

One may note that focusing only on the main platform is problematic, considering the modularity of defense equipment. For instance, Moura shows that France is specialized in the production of final defense equipment, but it relies on imports of intermediate equipment.[25] For some countries, national preference is associated with the "niche production" of such intermediate defense equipment.

While aircraft tend to be increasingly developed and produced in cooperation (especially for the latest generation of aircraft[26]), land and naval platforms remain widely supplied by national firms in Europe. For instance, in the main battle tank (MBT) market, France, Germany, Italy, and the United Kingdom have their national programs.[27] The situation is similar in the medium and light armored vehicles market, with the experience of cooperation limited to intra-country collaborations. In the European naval industry, the main submarine programs (France, Germany[28], Spain, Sweden, and the United Kingdom) are national; the same applies for frigates, except for cooperation (limited to development) between France and Italy for the class "Bergamini-Aquitaine" FREMM multipurpose frigate. This situation has severe consequences for defense industrial fragmentation for both the naval and land-based military

22 Note that even though European treaties favor competitive bids for public tenders, the case of defense is specific as argued by the article 296 of Rome Treaty (consolidated version Consolidated version 2002). Hence, for strategic autonomy reasons, some countries prefer over-the-counter bids.
23 Laguerre (2009, p. 305).
24 Hérault (2021).
25 Moura (2021).
26 See Droff (2017) regarding helicopters and Droff, Malizard and Noel (2020) regarding combat aircraft.
27 France (Nexter), Germany (KMW), Italy (Fiat-Leonardo), and the United Kingdom (BAe systems).
28 German designed T212 submarines have been produced under license in Italy.

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industries.[29]

On the other hand, there is the option of not maintaining industrial skills. Vertical take-off and landing (VTOL) naval combat aviation in the United Kingdom reveals the decline in industrial capabilities (not military capabilities) of the country. The Sea Hawk Harrier was developed and produced nationally, followed by the Harrier II, which was produced in cooperation with the USA, and finally, the F-35B to equip the Queen Elizabeth class aircraft carriers. However, the country has succeeded in being a tier 1 partner in the F-35 project, which means that technological spinoffs and jobs are assured in the medium term, but this is at the expense of long-term sovereignty. This example illustrates the shift of the country on the curve in Figure 1 from left to right.

The collaborative program: Sharing costs along with sharing problems

Next is the collaborative option. Between the policies of the 1960s–1970s and the 2000s, "collaboration moves from being a form of back-up organization in case of economic difficulties to a normative form of development."[30] Collaboration is therefore a kind of "club" whose advantages are led by economies of scale.[31] First, cooperation enables the sharing of R&D effort, along with its associated risk. This incentive to share costs is all the stronger as the literature shows that the weight of R&D in defense equipment has become intrinsically important (defense equipment as "tournament good")[32]. Scale effects are also observed in terms of the infrastructure and work force required for production, and in terms of raw materials and intermediate products. On adding a temporal dimension, the increase in the quantity produced also favors learning effects. This can be amplified through specialization effects as each country should theoretically specialize in the stages of production where it is relatively the most productive and competitive. Cooperative programs allow for a form of standardization of equipment, which promotes interoperability and provides "military value added".

Given the trilemma discussed above, cooperation can be theoretically viewed as a means to manage the procurement cost, while maintaining some economic and technological spinoffs at the expense of limited loss of autonomy. In this regard, choosing (rather than undergoing) collaboration is a manageable way of controlling dependencies.

Among the disadvantages of cooperation, specification changes contribute to increased total development costs, longer development and manufacturing times, and an overall increase in the complexity of the industrial supply chain. In some extreme cases, specification discrepancies can lead to cooperation abandonment. Setting up programs and monitoring their progress increase the administrative procedures, which tend to increase the costs of program coordination (cooperation costs and control costs).[33] Second, states can use cooperative programs to meet their national industrial policy objectives—particularly by acquiring technological and industrial skills during the development phases that they do not master or master poorly. Specialization is observed, but it is inefficient because it is mainly viewed as having access to technology and specific skills rather than pooling it.[34] European armaments cooperation is structurally characterized by the rule of "juste retour", which aims at ensuring that each participant in a program must have an industrial benefit equal to its financial participation or initial orders in the program. Following this principle leads to the multiplication of production sites, thus limiting economies of scale and learning economies.

Several aircraft programs have been developed and produced in cooperation with European partners. Calcara discusses three recent programs: NH90 (helicopters), Eurofighter (combat aircraft), and A400M (transport aircraft)[35];

29 Naval military industry, Bellais (2017). Land-based military industry, Klecza, Buts and Jegers (2021).
30 Hébert and Hamiot (2004).
31 Hartley (2019).
32 Hove and Lillekvelland (2016).
33 Matthews and Al-Saadi (2021).
34 Hébert and Hamiot (2004).
35 Calcara (2020).

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each partner has different reasons for cooperation in line with the trilemma: Italy, and to a lesser extent, Germany, wants to maximize economic spinoffs; France favors projects with a higher level of autonomy, and the United Kingdom prefers "best value for money". In helicopters and combat aircraft programs, Italy views cooperation as a way of improving its industrial capabilities while acknowledging its inability to run a national program. On the contrary, the United Kingdom supports cooperation owing to its belief in savings in the total costs of the program while defense firms lobby for national production. France has accepted to cooperate in the NH90 program because both the firms and the government believe this would give them a high level of spinoffs after the British withdrawal from the program. The diversity in the point of view also reflects the "varieties of capitalism" as discussed by DeVore and Weis; France and Italy represent the statist approach with strong ties between industrial and governmental visions, while Germany and the United Kingdom symbolize the liberal approach with the government imposing its vision on the industry.[36] The lack of a common vision from an industrial viewpoint leads many countries to support the "juste retour" policy, despite this approach being highlighted as quite ineffective.[37]

It is of note, however, that "there is no evidence that efficiency as measured by development times is adversely affected by the number of partner nations".[38]

Licensed production: Accepting dependence with the hope of spinoffs

There are situations in which a country produces under-license systems designed by another country. Licensed production offers states defense equipment as well as an industrial package that includes production work and technological spinoffs. Contrary to collaborative programs, licensed production favors international collaboration via sharing production, but not design work, in a form of a co-production scheme. Generally, with licensed production (which are often American licenses), the foreign nation builds equipment only for its own orders[39].

Production capacity exists in the country hosting the licensed production, but this is characterized by a form of dominance by the country that designed the aircraft. In Europe, in the case of combat aircraft, the United States is usually the "dominant" partner, but some forms of collaboration very similar to Soviet-licensed production can be found in some countries, such as the Czech Republic.[40]

By acquiring this type of weapon system under-license, states see the opportunity to structure and develop their DIB. This is due to the upstream effects (R&D and suppliers) and the downstream effects (services, maintenance, updates, retrofits, etc.). An excellent example of such advancements in competence is provided by Italy with respect to the helicopter market. After World War II, the transfer of U.S. helicopter technology through licensing agreements (e.g., production of Agusta Bell helicopters in the 1970s and 1980s), progressively consolidated the Italian helicopter industry until the merger of Agusta (an Italian firm) and Westland Helicopters (a British firm) in 2001. This finally led to the creation of Leonardo Helicopters in 2016, a large company with major economic spinoffs for the country—capable of competing with Airbus in the European market and others in the United States and elsewhere.

Another relevant example includes the countries that benefited from the F-16 memorandum of understanding signed in 1975 between Belgium, the Netherlands, Denmark, Norway, and the United States. Following this "deal of the century" concluded by the United States, two assembly lines were settled in Europe (in Belgium and the Netherlands).[41] Owing to this contract, Belgium (which is not a major traditional supplier with regard to defense platforms) has developed an aeronautics industry practically from scratch. For SABCA, the oldest Belgian aerospace

36 DeVore and Weis (2014).
37 Hartley (2008).
38 Hartley and Braddon (2014).
39 Hartley (1983).
40 Pernica (2020) ; Ženka, Pernica and Kofron (2021).
41 Hartley (1983).

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group, the F-16 contract enabled it to acquire tools (stripping and painting booths, non-destructive testing, test benches, etc.) and to develop specific skills. Finally, the contract has enabled SABCA to enter the defense market with maintenance and production of spare parts for many combat aircraft (A-10, F-5, Mirage F1, and F16) and helicopters (Seakings). SABCA has also seen a gradual diversification into the civil and space markets.[42] Another Belgian company, SONACA, created in 1978 to contribute to the assembly of the aerostructure of the Belgian F-16, has become a competitive company in the civil sector with 25 factories worldwide; it has also become highly specialized in metal and composite aircraft parts.[43] Finally, owing to the industrial and technological "push" for the F-16 contract, Belgium has established strong aerospace connections beyond its borders (e.g., France and Germany).

Off-the-shelf procurement: Assumed dependence and the best value for money

At the other end of the spectrum is the purchase of "off-the-shelf" equipment on the world arms market; the cost is often lower, but this entails certain technological or even operational dependence on the supplier (for example, the United States). For countries with no DIB or a DIB specialized in "niche" markets, the choice of importing equipment through purchase at a lower price from a third country is the only relevant option. The military protection of the United States and the perspective of being part of a strategic alliance (e.g., NATO) provide strong incentives for countries to buy U.S. military equipment. From an economic perspective, the United States is a particularly well-positioned supplier of combat aircraft owing to its scale cost competitiveness. These scale and serial effects explain much of the United States' dominance in the arms export market.[44]

Given this option, a country can benefit from global competition, although not all markets in the field of defense are competitive in the true sense. For example, Laguerre suggests a division of the global fighter aircraft market into four categories: "captive" markets, which are nationally protected for many reasons, including operational ones and the support of a defense industrial base; "outlaw" markets, which are prohibited by international laws and sanctions; "dilemma" markets, where a producer is prevented from selling defense products to two potential export customers that are the parties to military, economic, or political tensions; and "open" markets which are competitive[45]. He concludes that "there are few open markets."

Apart from scale effects, one alternative reason to procure from abroad is the hierarchical effect, as stated by Vucetic and Tago[46]. They suggest that the more integrated a state is in the U.S. economy and security hierarchies, the more likely it is to purchase U.S.-made military equipment. The U.S. dominance in both security and trade is crucial for the combat aircraft market.[47]

Both scale and hierarchical effects are relevant for explaining foreign procurement in Europe. This is the case in the aircraft market, where the United States provides a large chunk of equipment, even for aircraft-producing countries (such as the United Kingdom, Germany, Italy, and France) because they fulfill demand in areas where European supply is non-existent. This is particularly the case with naval aviation in the United Kingdom (with VTOL capabilities of the F-35), heavy helicopters in Italy, Spain, and the United Kingdom (Chinook), and UAVs (France, Italy, Spain, and the United Kingdom). In line with management fleet issues already discussed, many European countries decide to procure a single type of defense equipment to streamline their fleet. This is particularly the case with off-the-shelf procurement. In the aircraft market, for example, Finland, Norway, Netherlands, and Denmark have a single supplier of combat aircraft (the United States) with fleet regeneration in the commissioning of F-35s in

42 As a supplier to Airbus and, for example, supplying parts of the Ariane rocket.
43 Guilhem (2018).
44 Tocoian (2015).
45 Laguerre (2009).
46 Vucetic and Tago (2015).
47 Hellemeier (2019) and Willardson and Johnson (2021) reach similar conclusions.

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the mid-2010s. In the MBT market, Germany has gained a comparative advantage (Leopard MBT, first and second generations), and it is the main supplier for many European countries, including neighbors with strong economic ties (Austria, Denmark, Netherlands, and Poland).

Leasing, new procurement for states, going downstream in the value chain for firms

Leasing defense equipment is an innovative and developing mode of procurement; however, it is not a very widespread practice in Europe. Leasing is developing with the evolution of business models of defense companies toward servitization.[48] This is a shift from product-oriented activities toward service-orientation. For example Babcock is a British manufacturer that now offers services in fleet management, maintenance, training, and simulation. However, more often it is a combination of complex products and services, such as the Rolls-Royce strategy in the United Kingdom.[49]

Leasing has several advantages. First, the price can be advantageous if resources are insufficient for the initial investment; such a strategy can be found in the combat aircraft market for countries with limited financial resources. For example, the Swedish Saab company leases the 14 JAS 29 Gripen to Hungary and the Czech Republic, with an all-inclusive service covering hardware modification and upgrade of systems, as well as several years of maintenance. In times of strong budgetary constraint, countries with relatively high defense budgets can also undertake leasing. For example, in the United Kingdom, Air Tanker is a consortium that provides the Royal Air Force with nine tanker aircraft. Examples of leasing are less numerous in other domains. Germany offered to lease submarines from its manufacturer TKMS to Poland, although the deal did not materialize.

Second, leasing offers flexibility; it provides fast access to ready-to-use equipment and crew training. Leasing is also available for equipment with short life spans, such as UAVs, which have a higher probability of being destroyed on the battlefield. In the mid-2000s, the United Kingdom leased a fleet of around 50 surveillance UAVs for military operations in Iraq. Drones are now frequently offered under leasing options proposed by defense manufacturers for a range of activities. Examples include the leasing of Heron UAVs by Greece for border surveillance missions and the Italian Leonardo's offers of leasing services with its Falco Xplorer UAV (a small MALE UAV).

The leasing option is also suitable for "in-between situations" that involve waiting for a delivery of a program. Recently, Bulgaria selected U.S. F-16 fighters to replace its aging Mig-29s, but it also considered a leasing option until the F-16s could be delivered. This solution was also proposed to France by the American firm General Atomics in 2020, with the possibility of leasing UAVs to fill the capability gap in terms of ISR solutions owing to the delay in the Eurodrone collaborative program (in the end, France chose to accelerate the program). In 2020, Germany operated six Heron 1s on a lease, waiting for their replacement by five Heron TPs. The French Navy currently leases H160 helicopters, which are the civil version of the future H160 military Guepard expected in the French armed forces in the 2030s.

Third, there is the so-called "test option". Leasing allows users to evaluate whether the equipment is suitable before buying (or further leasing). For example, Switzerland leased a C295 transport aircraft to test its capability and eventually to adjust its needs and switch to another aircraft. In the United Kingdom, the British coast guard leased Elbit Hermes 900s to test the contribution of UAVs to their missions. The French Navy leased a maritime patrol boat named Adroit (Gowind class) between 2012 and 2017; the vessel was finally sold to Argentina in 2018 with three other units planned for Argentina but none for France.

48 Vandermerwe and Rada (1988).
49 Smith (2013).

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Table 2: Summary of the main acquisition strategies

Acquisition strategy	*Strengths*	*Weaknesses*
1. National program	Strong strategic autonomy and large political freedom on the international scene. Large economic and technological spinoffs. Adaptability and reactivity of the industry to the armed forces' needs.	High R&D costs. Long-term planning issues and path dependency. Limited diversification of supply.
2. Collaborative program	Reduced unitary cost (compared to a domestic option).	Higher coordination and transaction costs. Important weight of constraints and political objectives (for example, the policy of juste retour).
3. Under-license production	Opportunity to acquire or maintain industrial skills and know-how.	Expected spinoffs depend on the absorptive capacity of the country (skills, training, and human capital). Costs of negotiation.
4. Off-the-shelves	Reduced unitary cost (compared to a domestic option).	Limited adaptability to the armed forces' needs. High dependence on foreign suppliers.
5. Leasing	Possible industrial and technological spinoff leading to the development of an indigenous industry.	Increased control of the manufacturer on the systems. Increased asymmetries of information.

Finally, leasing is an innovative market and a way of developing and diversifying the assets of firms, especially in services. In the Czech Republic, for the manufacturer Aero Vodochy, leasing is an option for maintaining aviation skills in a perhaps less technological but expensive market, such as aircraft pilot training or red teaming missions. The rising cost of operating modern combat aircraft is a major driver of this market based on the use of decommissioned aircraft and modern but lighter aircraft. For example, with their latest version of the L-159 T2X demonstrator, the firm offers a training aircraft for future pilots of fifth-generation aircraft such as the F-35. In 2022, Draken Europe signed a cooperation agreement with Aero Vodochody to use the L-159 as an aggressor in RAF fighter pilot training, including for the F-35 jet fighter. The European red teaming market is a growing and very competitive market, with about 10 European and four American companies (which constitute a large part of the market).

Table 2 summarizes the main strengths and weaknesses of each procurement option.

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Conclusion

Since the end of the Cold War, European countries have had to cope with many different constraints on their procurement processes. However, the way they deal with them depends on their preferences on sovereignty-related issues such as maintaining (or developing) industrial capabilities.

There is no "silver bullet" in terms of acquisition choice, and the returns on investment depend on countries' preferences, goals, and markets. A trilemma is inherent to any procurement decision process, and some trade-offs have to be considered. Only two of the three benefits can be obtained simultaneously: maximizing economic and technological spinoffs; minimizing procurement costs; and autonomy vis-à-vis foreign platforms. Among the arms-producing countries, the Cold War paradigm ensured autonomy and spinoffs, but budgetary constraints and Augustine's laws favor cooperation over minimizing costs. This situation may lead to tensions between partners as they often prefer national solutions. Among nonproducing countries, there exist "niche" defense industries supplying components or systems. Competition among suppliers leads them to authorize technology transfers and customer-local production, which, eventually, helps these European countries to develop their industrial capabilities.

The lack of coordination regarding defense procurement confirms the European state of "cacophony"[50]. This situation has severe consequences for the industrial fragmentation in Europe. Although defense firms in Europe are more productive than their American counterparts[51], they are less profitable and are relatively small with national bias preventing firms from reaching a critical size. MBDA is an interesting case of a successful European consolidation in the missiles market as a result of cooperative programs and exports[52].

The war in Ukraine constitutes another challenge for European procurement—the trilemma is modified such that acquisition costs are less critical in the decision-making process because the current strategic environment requires faster weapons procurement. It may be regarded as unfortunate that the latest decisions made by the European governments confirm reliance upon the United States (e.g., F-35 procurement and American anti-missile systems). Future research could look at the possibility of fostering cooperation to avoid the trilemma by focusing on comparative advantage rather than the *juste retour* policy.

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Governing defense procurement: Strengthening the EU's defense technological & industrial base

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Abstract

The regulatory framework concerning defense procurement has evolved considerably since the start of the millennium. In addition to the general Public Procurement Directive and the Defense Procurement Directive, the European Commission recently formulated a proposal for a Foreign Subsidies Regulation (FSR). Nonetheless, defense sector particularities continue to produce tensions in public procurement, and significant blind spots remain.

In view of policy objectives to strengthen the European Defense Technological & Industrial Base (EDTIB), it is necessary to first study the current state of EU defense procurement. To that end, we perform an analysis of 14,207 EU27-tenders spanning the period 2009-2020. In addition, a case study approach investigates six tender procedures by the Belgian military, establishing material points of note.

Key insights include: (1) the number of defense procurement procedures won by third country bidders is limited, (2) tenders won by non-EU27-tenderers are larger and less competitive on average, and (3) an overly strong focus on price efficiency in public procurement award procedures inhibits attaining EDTIB goals. In short, the data shows a chasm between stated policy aims of strengthening the EDTIB through positive action in public procurement on the one hand, and public procurement practices on the other.

Over the last ten years, political interest in growing and strengthening the European Defense Technological and Industrial Base (EDTIB) has steadily increased. The 2016 European Union Global Strategy, the European Defense Action Plan, the COVID-19 pandemic, and the invasion of Ukraine, all prompted European leaders to reconsider the desirability of dependency on third countries in the context of (defense) supply chains[1]. Price efficiency is confronted with (changed) strategic interests, and, after a relatively long reign of the former, the latter is now commencing to gain traction.

Currently, the EDTIB has two main challenges: (1) by most standards, the current defense industry in the European Union is still limited in size[2], while demand across the Union is heterogeneous[3], and (2) technological and industrial capabilities, along with strategic, political, and economic interests, vary widely among member states within the alliance.[4] Therefore, any strategy to attain EDTIB goals should include approaches to grow small and medium-sized defense enterprises and infant industries through positive action—flanked by offering support such as the necessary support systems in terms of logistics, mitigation of administrative hurdles, and the development of tailored financing

1 European External Action Service (2022); European Commission (2022a).
2 Finkbeiner & Van Noorden (2022); Roth (2017).
3 European Commission (2022f).
4 European Parliament (2022a); Roth (2017).

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schemes; as well as to foster the further integration of national defense industries with an eye on avoiding the unnecessary duplication of capabilities and to maximize interoperability.

There is a chasm between stated policy aims of strengthening the European Defense Technological & Industrial Base EDTIB through positive action in public procurement on the one hand, and public procurement practices on the other. Very few large contracts are reported on the EU datasets—they are likely to be more entangled with other policy objectives and thus involve unique local agreements.

Strategic public procurement, a prime demand-side instrument, is often propagated as an important potential lever for increasing defense sector independence.[5] Here we interpret defense sector independence as EU-suppliers being able to fulfill considerable proportions and varieties of EU defense sector purchasing. Of course, regulation of public procurement is in principle aimed at safeguarding free and fair competition[6], rather than the pursuit of strategic (security) objectives. But ensuring a good level of competition remains important even when strategic considerations become equally or more salient.

First, public procurement for defense in the European Union as such is mainly regulated by two directives: the general Public Procurement Directive[7] and the Defense Procurement Directive.[8] The former directive is horizontal in nature, while the latter was specifically conceived to govern defense public procurement.[9]

Second, in 2022 the European Parliament and the Council voted to institute a horizontal Foreign Subsidies Regulation (FSR).[10] The FSR targets financial contributions by third countries aimed at rendering their national companies more competitive in the EU market.[11]

In order to build a stronger EDTIB in a sustainable manner, it is important that legal instruments relating to public procurement are navigated and their principles respected. This article reviews past EU27-procurement practices to determine the status quo with respect to the EDTIB. Subsequently, based on the Belgian 2020 experience, we offer some telling points of attention. The analyses contained in this article allows the determination of both if and how public procurement practices measure up to the idea of strengthening the European defense industry, with an eye on improving strategic independence through demand-side policies in policy discourse. Specific attention is given to tender set-up compatibility with promoting participation of small and medium-sized defense enterprises, and the level of orientation towards the EU27 when granting tenders.

This is followed by a review of the regulatory framework for procurement in defense, a description of the methodology used, a presentation of the empirical results, and finally a discussion and conclusion.

Review of the regulatory framework

As stated above, public procurement in the European Union is mostly dictated by two directives and a novel regulation. The overviews below highlight the relevant features of these regulatory instruments in view of the thrust of this article.

Public procurement directive

The 2014/24/EU Directive constitutes an update of the 2004 Directive.[12] This general directive holds across sectors and aims to ensure free and fair competition in the context of EU public procurement. Among others, the directive

5 European Commission (2022b).
6 Blauberger & Kramer (2010).
7 Directive 2014/24/EU (2014).
8 Directive 2009/81/EC (2009).
9 Arrowsmith (2017).
10 European Commission (2022c).
11 Luja (2021).
12 Burnett (2015).

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demands transparency with regard to the selection and award criteria; both the criteria themselves and their weights need to be specific and predefined.[13]

The tender issuer has the option to choose one of five types of public procurement procedures: the open procedure, the restricted procedure, the competitive procedure with negotiation, the competitive dialogue, the innovation partnership, and the negotiated procedure without prior publication.[14] Some of these procedures are only suitable in a limited number of specific cases. The level of openness of the procedures varies both by the nature of the procedure (open versus restricted), but also by concrete stipulations included in the tender documents (such as interoperability demands).[15]

Some changes compared to the directive from 2004 that may be especially relevant for the non-mature EU defense markets are: (1) improved possibilities to divide tender contracts into lots, (2) the introduction of the European Single Procurement Document (ESPD), (3) new limits on participation requirements, and (4) the freedom to directly pay subcontractors.[16]

First, using lots can ensure that smaller companies are able to compete in the context of larger contracts;[17] SMEs are faced with more stringent resource restrictions, and might not have capacity to take on very high value contracts by themselves. Second, the ESPD simplifies demonstration of compliance with certain procurement participation requirements through self-declaration, and renders it uniform across the EU.[18] The administrative burden is thus significantly reduced. Third, procurement participation requirements in terms of financials are limited (e.g., required turnover is limited to a maximum of twice the contract value[19]), and should always be proportional to the contract at hand. Last, allowing direct payment to subcontractors makes SMEs more independent of integrators[20] and ought to make participation more attractive from their viewpoint.

Directive 2014/24/EU is fully applicable in cases where certain threshold values with respect to the size of the public procurement procedure are met. These thresholds can be as low as EUR 140,000 in the case of procurement of supply and service, or as high as EUR 5,382,000 for works.[21] However, it is important to note that even when thresholds are not met, tender issuers need to respect the essence and the key principles of EU law.[22] It follows that this is highly influential in shaping Directive national procurement practices across the European Union.

Defense procurement directive

The European Commission originally proposed a directive on defense procurement to counter the widespread fragmentation of the European defense markets.[23] This fragmentation was encouraged by member states consistently invoking national security reasons to not abide by the general public procurement directive—so in many cases all procedural elements were decided at the national level.[24] The proposal of the European Commission led to the sector-specific regulatory instrument that is Directive 2009/81/EC.

The directive targets increased transparency and competition in general, but the Defense Procurement Directive

13 Directive 2014/24/EU (2014); Telles & Butler (2014).
14 Directive 2014/24/EU (2014).
15 Chever, Saussier & Yvrande-Billon (2017); Mardas & Triantafyllou (1997).
16 Trybus (2014).
17 Hoekman & Taş (2022).
18 Trybus (2014).
19 Trybus & Andrecka (2017).
20 Mitran (2013).
21 European Commission (2022d).
22 European Commission (2022d).
23 Yukins (2009).
24 Terpan & Saurugger (2019).

contains two recitals and three articles could be particularly relevant with regard to strengthening the EDTIB.[25]

First, recital 18 reiterates that defense-related procurement often does not fall under the WTO Government Procurement Agreement (GPA) and that EU27-states are thus free to exclude non-EU27-tenderers from participation.[26] Moreover, the recital explicitly mentions a few considerations that a tender issuer might consider when deciding whether or not third country bidders will be allowed. One of those considerations is "the need for a globally competitive European Defence Technological and Industrial Base".[27]

Second, recital 45 basically attempts to abate traditional offsets.[28] It is stated that all selection and award conditions must directly relate to the specific procurement.[29] Since third country suppliers will be inhibited from offering considerable offsets in exchange for contract awards, European tenderers not willing to do, or not having the capacity for, large foreign investments become relatively more attractive.

Third, Article 21 deals with the possibility of embedding subcontracting requirements.[30] Tender issuers can stipulate that the winning tenderer is obliged to subcontract part of the tender (up to 30 percent).[31] It can be argued that since the contract is to be performed in a certain member state, companies based in that member state hold a significant competitive advantage.[32] Subcontracting facilitates the involvement of domestic partners which do not have the capacity to perform the full contract.

Fourth, Article 22 outlines several routes through which a tender issuer can make sure that classified information exchanged in the context of the tender is treated with due care.[33] Most notably, the Directive foresees tendering organizations needing to pass national security clearance procedures. This might be challenging for all non-domestic companies, but it might be highly resource intensive for some third country tenderers.

Fifth, Article 23 considers security of supply[34]. The Covid-19 pandemic (e.g., building materials) and the 2022 Russian invasion of Ukraine (e.g., gas and wheat) have demonstrated that global supply chains entail substantial risks in terms of security of supply.[35] Having a supplier belonging to the same strategic economic alliance is therefore a strong advantage. Also, with respect to the maintenance of certain procured goods, proximity can proxy for security of supply.

Like Directive 2014/24/EU, the Defense Procurement Directive is applicable to procurement at various thresholds. The threshold is EUR 5,382,000 for works and EUR 431,000 for all other procurement.[36] Considering the nature of defense services and equipment in general, it can be deduced that most procurement will surpass the threshold level. However, the Directive also foresees a derogation in case the subject matter of the procurement is extremely sensitive (Article 346 Treaty for the Functioning of the European Union[37])—but only to be employed in rare cases.[38]

Interestingly, the tender issuer still holds some discretion as to the selection of the appropriate legal basis for the procurement. In the case that procurement concerns both defense security aspects and elements falling within the realm of the general directive, the procurement can take place either under the defense directive or the general

25 Weiner (2011); Yukins (2009).
26 Directive 2009/81/EC (2009).
27 Directive 2009/81/EC (2009).
28 Yukins (2009).
29 Directive 2009/81/EC (2009).
30 Directive 2009/81/EC (2009).
31 Directive 2009/81/EC (2009).
32 Weiner (2011).
33 Directive 2009/81/EC (2009).
34 Directive 2009/81/EC (2009).
35 Mbah & Wasum (2022); Moosavi, Fathollahi-Fard & Dulebenets (2022).
36 European Commission (2022d).
37 Directive 2009/81/EC (2009).
38 Terpan & Saurugger (2019).

directive.[39]

Foreign subsidies regulation

The European Commission's proposal for an FSR was recently adopted by the European Parliament and the Council, and the regulation will fully enter into effect by mid-2023.[40] The FSR was conceived to "close a gap" in the rules on state aid[41]; while financial support to national champions by EU member states has long been closely monitored, financial contributions by third countries to boost domestic business have gone largely unchecked.

The FSR is a horizontal regulation, the primary aim of which is to combat distortion of competition resulting from third country state aid.[42] The focus area of the FSR is on concentrations (M&A, joint ventures, etc.) on the one hand, and on public procurement on the other.[43]

Regarding public procurement specifically, the FSR introduces a notification requirement on tenderers of any received foreign financial benefit when participating in a tender exceeding EUR 250mn.[44] The Commission then has the competence to review the distortive effect of this foreign benefit in the context of the tender procedure.[45] Although there is not a defined legal minimum, it is mentioned that financial benefits totaling less than EUR 5mn per undertaking over three fiscal years are unlikely to be distortive.

It is important to note that the above implies two pertinent cut-offs: (1) EUR 250mn tenders regarding notification obligations (before any investigation), and (2) foreign financial benefits of EUR 5mn over three fiscal years when assessing distortive effects (during any investigation).

For defense procurement, it is likely the former cut-off which is most problematic, since the extremely high threshold exempts many tenders in the defense sector from any notification obligation. Moreover, the proposal entirely exempts procurement under the Defense Procurement Directive from its public procurement obligations.[46] Therefore only procurement in the defense sphere and under the general Public Procurement Directive is covered.

It can be concluded that the coverage of the FSR in the realm of defense is in any case quite limited. For defense procurement, tender issuers can thus not solely rely on the new regulation to truly aid in achieving EDTIB goals.

Methodology

This article uses a mix of methods. First, an explorative quantitative analysis of EU27-tenders in the defense sphere is conducted. Second, a case study is made of the Belgian situation based on a series of recent public procurement procedures issued by the military.

Data sources

The quantitative research makes use of the public procurement data published on the Opentender.eu-portal. As a deliverable of a European research project, the portal provides extensive data on tenders issued in 33 different countries, among which are the EU27-states.[47] Data from Tenders Electronic Daily (TED) and national public procurement portals is combined to arrive at a total of around 40,000,000 tenders spanning the period 2009-2020.[48]

39 Directive 2014/24/EU (2014).
40 Viaene, Van der Putten & Wiame (2022).
41 European Commission (2022e).
42 Hornkohl (2022).
43 Luja (2021).
44 European Commission (2022e).
45 Luja (2021).
46 European Parliament (2022b).
47 DIGIWHIST (n.d.).
48 OpenTender.eu (2022a).

Table 1: Variable operationalization

Variable	*Operationalization*
Year	This variable indicates the year in which the tender was issued
Financial value	This variable indicates the final size of the tender in euros
Number of bids	This variable indicates the number of received bids for the tender
EU27-tender winner	This variable equals 1 if the tender winner is based in the EU27-region

Source: own creation based on OpenTender.eu (2022a).

Data for the case study was gathered from the Belgian Public Procurement Portal.[49] This portal, managed by the Belgian Federal Public Service for Policy and Support, gives metadata for all tenders issued by Belgian public entities.[50] Moreover, whenever possible, the portal also provides the actual tender documents.

Sample selection

For a high-level exploration of EU27-defense procurement practices, it is necessary to delineate which tenders qualify as defense tenders. To that end, the Common Procurement Vocabulary (CPV) of the European Union was used.[51] In short, all tenders which are attributed 35 as the main CPV-code are considered as defense tenders. It should be noted that this also includes tenders that are loosely part of the defense sphere, for example firefighting equipment.[52]

Following this definition, the Opentender.eu-portal contains 21,812 defense tenders for the EU27-states over the period 2009–2021.[53] However, to enable a sound analysis, a balanced sample of 14,207 observations was constructed. These observations all have reported values for the variables Year of tender, Financial value of tender, Number of bids, and EU27 tender winner. The operationalization of these variables based on Opentender.eu is in Table 1.

The case study methodology, through document review,[54] allows for a more in-depth analysis of defense procurement practices. When studying the award and selection criteria embedded in the various procurement processes, the tender documents can be especially informative in terms of priorities, emphases, and red lines of tendering organizations.

Belgian defense procurement in 2020 is focused upon. The Belgian case is interesting as it concerns a member state that is largely dependent on international partners.[55] Belgium is also a prime example of an EU-member state in which small-and-medium sized enterprises produce a large part of the aggregate added-value[56], and in the defense sector specifically, 60% of enterprises are small- or medium-sized.[57] Furthermore, the recommendations for the Belgian Defense's Strategic Vision 2030 explicitly targets the strengthening of industrial capabilities and mentions the current local nature of the defense industry in Belgium.[58] The selection of 2020 as the period of analysis optimizes

49 Federal Public Service for Policy and Support & Federal Public Service Chancellery of the Prime Minister (2014).
50 Federal Public Service for Policy and Support (2022a).
51 Regulation (EC) No 2195/2002 (2002).
52 OpenTender.eu (2022a).
53 OpenTender.eu (2022a).
54 Bowen (2009).
55 De France, Mampaey & Zandee (2016).
56 Unizo (2021).
57 Agoria (2020).
58 Defence Institute (2021).

Table 2: Descriptive statistics

Variable	*Mean*	*Std. dev.*	*Min*	*Max*
EUR Financial value of tender	1,719,969	18,700,000	105	1,000,000,000
Year of tender	-	-	2009	2020
Number of bids	3.0331	4.8084	0	122
EU27-tender winner	-	-	0	1

Source: own creation based on OpenTender.eu (2022a).

the contemporary relevance of derived insights and allows us to also take up tender outcomes in the investigation. The Belgian procurement portal holds information on 40 tenders issued by various branches of the Belgian military.[59] However, only six of those tenders are accompanied by the original tender documents. These documents are imperative to perform an analysis that goes beyond mere description, therefore the final sample for the case study consists of six tenders.

Results

The presentation of the findings is divided into two parts. Part one covers the statistical analysis of defense procurement practices in the EU, while Part two contains the case study of Belgian defense tendering.

Statistical analysis

The analysis commences with a short descriptive overview of the distribution of the different variables of interest for the 14,207 observations. The descriptive statistics are presented in Table 2.

First, the average defense tender in the European Union has a value of just over EUR 1.7mn. While this is a substantial size, it is very small when compared to something like the notification cutoff of the FSR. Table 3 elucidates the distribution of the financial values of tenders—notably, 33 of the 14,207 defense tenders had a size of EUR 100mn or higher, amounting to only 0.23% of the observations. However, it has to be noted that due to national security implications and strategic public policy intricacies, many large-value defense contracts are allocated through direct government-to-government agreements or via procurement which follows the exception under Article 346 TFEU.[60] Since these types of purchases most often are not reported (in public procurement portals), they are not included in the sample. This caveat should be kept in mind when interpreting the

Table 3: Distribution of financial values of tenders

Financial value of tender	*Number of tenders*
Less than EUR 1mn	11,963
Equal to or more than EUR 1mn	2,244
Equal to or more than EUR 10mn	315
Equal to or more than EUR 100mn	33
Equal to or more than EUR 250mn	8

Source: Own creation based on OpenTender.eu (2022a).

59 Federal Public Service for Policy and Support (2022b).
60 Meershoek (2021); Miller (2009).

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results.

Second, the variable denoting the year in which the tender was issued offers insights into the composition of the dataset. Observations are skewed to the more recent period. This could imply that the number of tenders has increased over time, and Figure 1 demonstrates that there is indeed a trend in that direction. The upward trend could signify growth of the EU defense market as a whole—alternatively, it could indicate that the (sector-specific) Procurement Directive(s) were indeed successful in pulling procurement into the more traditional public procurement arena that in the past was performed via direct government-to-government agreements, or under the Art. 346 TFEU exception. In any case, the growth of the number of published tenders over time underlines the relevance of this article.

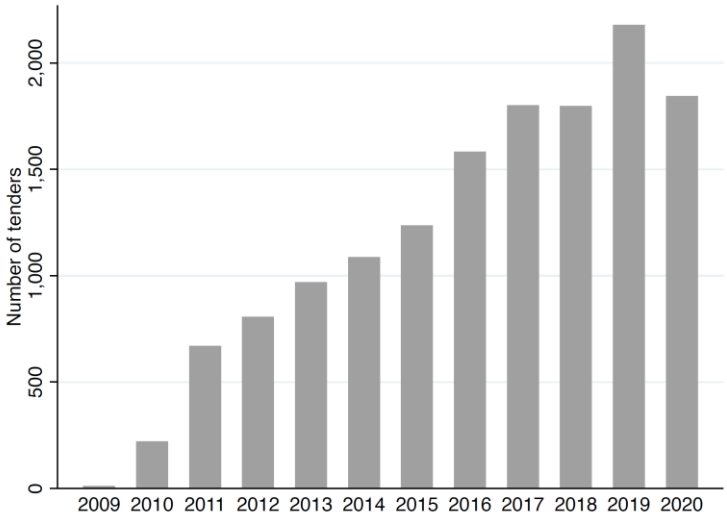

Figure 1: Evolution of the annual number of tenders.
Source: Own creation based on OpenTender, EU (2022a).

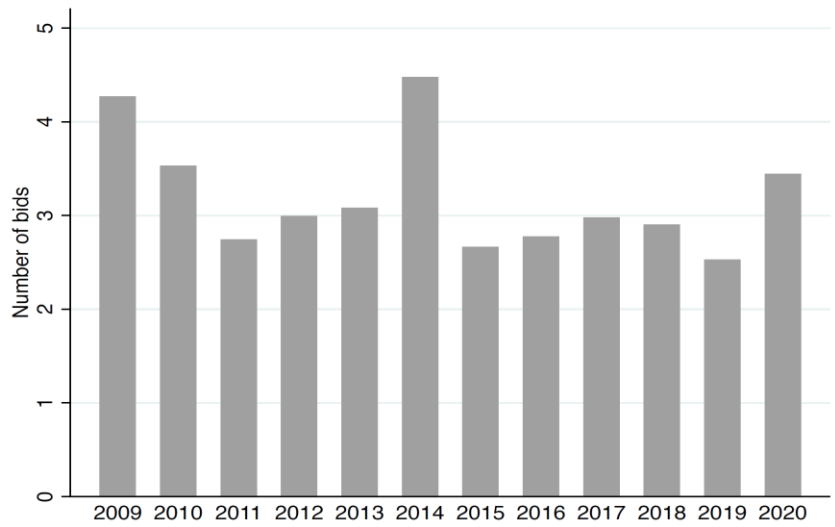

Figure 2: Evolution of the annual average number of bids per tender.
Source: Own creation based on OpenTender, EU (2022a).

Third, a tender in the sample receives three bids on average. As Figure 2 shows, this number has been quite stable over the 2009–2020 period. A limited declining trend is perceptible, but the average remains around the three bids per tender mark. In many markets, tenders which receive three bids can hardly be considered highly competitive. An important caveat here is that the defense market is somewhat peculiar in structure because of inherent market characteristics, e.g., low-frequency high-value purchases leading to large economies of scale.[61] While in theory the reception of two bids is sufficient to provide contestability in defense[62]; in order to effectively rely on competition to produce optimal outcomes for the buyer, more bids would arguably be preferred.

Diving deeper into the data on the number of bids reveals that well over 5,000 tenders only received one single

61 Bellais & Fiott (2017).
62 Baumol (1982); Laguerre (2009).

bid. It is evident that in those cases supplier power is elevated.[63] Moreover, the distribution of the number of bids per tender is heavily skewed to the left as can be discerned from Figure 3.

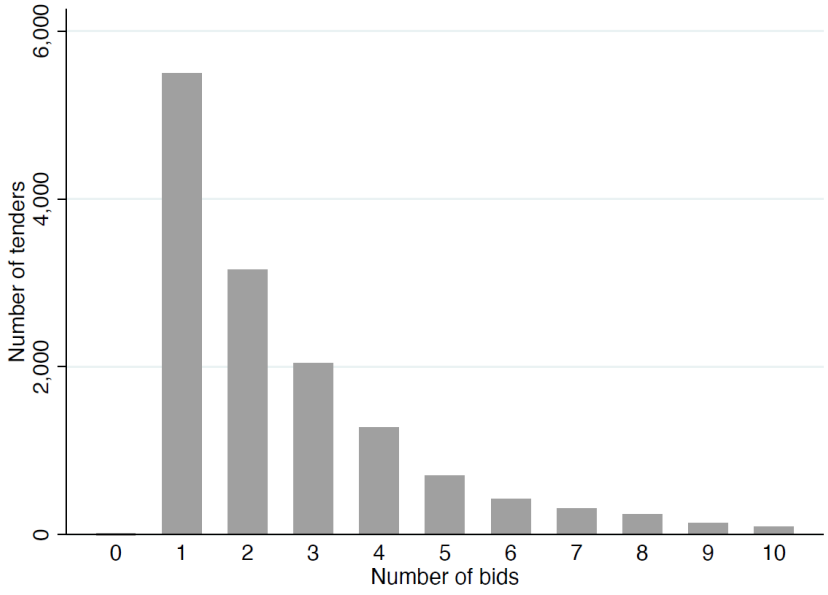

Figure 3: Distribution of number of bids per tender (limited at ten).
Source: Own creation based on OpenTender, EU (2022a).

Finally, looking at the variable EU27-tender winner, while 97.42 % of EU27-defense tenders were won by a tenderer based in the EU27-region, still in 367 cases a tenderer from a third country was successful. Closer inspection reveals that these 367 tenders are distributed unevenly among EU member states. In particular, tender issuers from Finland, Denmark, and Lithuania have relatively many tenders won by non-EU27-companies (see Table 4). Also, successful third country tenderers are more likely to be based in particular countries— mostly the United States, the United Kingdom, and Switzerland. Of course, this makes sense in view of strategic (military) alliances of which the European Union is part.[64] However, to strengthen the EDTIB, it is likely necessary for the deliverables of these tenders to be (partly) produced in the European Union.[65]

Zooming in, it becomes clear that tenders won by third country tenderers are substantively different from those procurement procedures that are filled domestically on two main fronts: (1) financial value of the tender, and (2) competitiveness of the tender. A series of two-sample t tests with unequal variances was run to determine the significance of these differences.[66] Table 5 displays the results of the t test regarding tender financial value. Tenders with a non-EU27-tender winner are significantly larger than those won by tenderers based inside the European Union. The difference of the average sizes of the tenders is remarkable, being EUR 6,938,009 compared to EUR 1,581,601.

Also, in terms of competitiveness proxied by the number of bids a tender receives, tenders won by third country tenderers are measurably different. Table 6 displays the results of the t test for this. It shows the difference is strongly significant, which means that tenders won by non-EU27-tenderers receive less bids than those which go to domestic tenderers.

63 While this supplier power could in some cases be balanced through buyer power on the government side (Bellais et al., 2014; Dunne, 1995; Hartley 2020; Laguerre, 2009), ceteris paribus supplier power is elevated.
64 Council of the European Union (2022).
65 Taking into account the fact that some markets are captive (Gereffi & Lee, 2012), e.g., in terms of (natural) resources, (a certain level of) foreign dependence is thus inherent.
66 Wilcox (2003); The equal variances assumption was tested for both cases and was rejected twice by way of the Levene's test (Carroll & Schneider, 1985). When the two subsamples do not have equal variances, F-tests can produce biased outcomes even when both subsamples follow a normal distribution (Wilcox, 2003)

Table 4: Issuers with most non-EU27-winners (left), and most successful non-EU27-countries (right)

Country tender issuer	#	*% of total*	*Country winning tenderer*	#	*% of total*
Finland	65	17.71%	United States	118	32.15%
Denmark	32	8.72%	United Kingdom	74	20.16%
Lithuania	29	7.90%	Switzerland	38	10.35%
Germany	28	7.63%	Norway	21	5.72%
Austria	25	6.81%	Israel	20	5.45%

Source: Own creation based on OpenTender.eu (2022a).

Table 5: Two-sample t test (unequal variances): Financial value of tender

Group	*Number of tenders*	*Mean EUR*	*Std. err. EUR*	*[95% conf. interval] EUR*	
Non-EU27-tender winner	367	6,938,009	2,088,397	2,831,245	11,000,000
EU27-tender winner	13,840	1,581,601	150,667.1	1,286,273	1,876,928
Difference		5,356,409	2,093,825	1,239,112	9,473,705

Two-sample t test with unequal variances
diff = mean(Non-EU27-tender winner) - mean(EU27-tender winner) with H0: diff = 0

Ha: diff < 0	*Ha: diff != 0*	*Ha: diff > 0*
Pr(T < t) = 0.9945	Pr(|T| > |t|) = 0.0109**	Pr(T > t) = 0.0055***

Source: Own creation based on OpenTender.eu (2022a).

Table 6: Two-sample t test (unequal variances): Number of bids

Group	*Number of tenders*	*Mean*	*Std. err.*	*[95% conf. interval]*	
Non-EU27-tender winner	367	2.6458	0.1348	2.3807	2.9108
EU27-tender winner	13,840	3.0434	0.0413	2.9625	3.1242
Difference		-0.3976	0.1409	-0.6746	-0.1206

Two-sample t test with unequal variances
diff = mean(Non-EU27-tender winner) - mean(EU27-tender winner) with H0: diff = 0

Ha: diff < 0	*Ha: diff != 0*	*Ha: diff > 0*
Pr(T < t) = 0.0025***	Pr(|T| > |t|) = 0.0050***	Pr(T > t) = 0.9975

Source: Own creation based on OpenTender.eu (2022a).

Case study

As mentioned, the case study focuses on the Belgian context, performing a more in-depth analysis of six specific public procurement procedures by the military. This section begins with a general overview of Belgian military procurement in 2020 based on the available metadata.

The military had 40 public procurement procedures in 2020 according to the national public procurement portal.[67] As can be expected, the large majority (over 75%) of tenders was issued under the sector-specific Directive 2009/81/CE. The most popular procedure type was the negotiated procedure with prior publication, with the open procedure being used in only 4 of the 40 cases. In line with what was found at EU27-level, quite a substantial number of tenders received only a single bid. However, also tenders with four or five bids are well-represented in the sample. Figure 4 gives a complete overview of the competitiveness of the various tenders.

Most interestingly, the portal often also provides data on the tender award mechanisms and evaluation criteria. For the implementation of policy objectives through public procurement, the selected set of award criteria is clearly crucial. Figure 5 shows the distribution of the 40 tenders over the different criteria. As can be seen, over half of the tenders are awarded solely based on price, while only four featured quality and or technical criteria that were deemed more important than price. This demonstrates that the cost efficiency rationale is still very strong and that, in the Belgian case, room for inclusion of criteria related to strengthening the EDTIB is sometimes limited.

To get a better a grasp of current practices, an in-depth review was performed of six 2020 tenders issued by branches of the Belgian

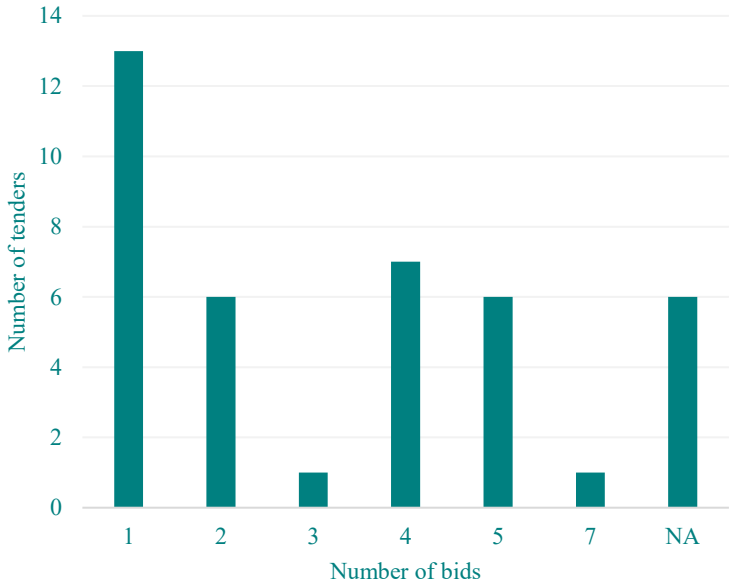

Figure 4: Overview of number of bids per tender (n=40).
Source: Own creation based on Federal Public Service for Policy and Support (2022b)

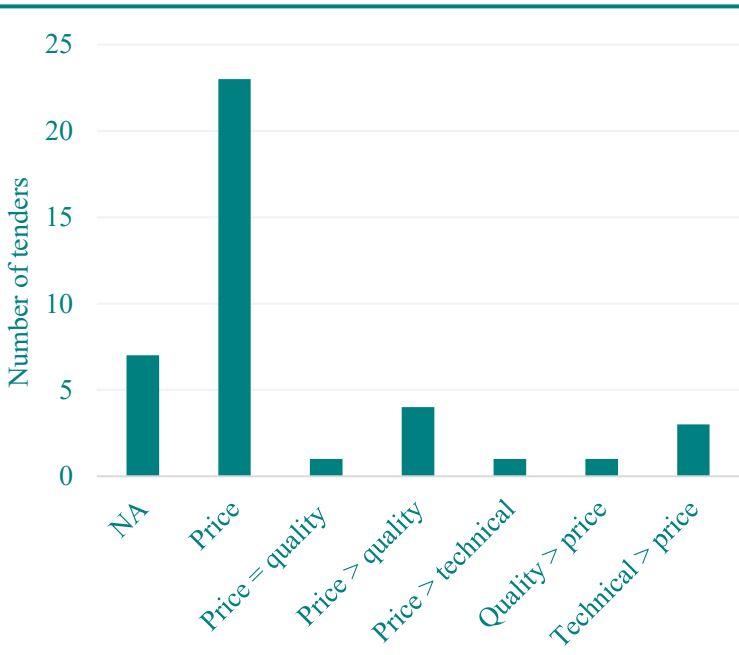

Figure 5: Overview of tender award criteria per tender (n=40).
Source: Own creation based on Federal Public Service for Policy and Support (2022b).

67 Federal Public Service for Policy and Support (2022b).

military. Tenders were selected based on the availability of the tender documents on the public procurement portal. While this method comes with the downside that the sample might be biased[68], it allows us to explore a larger number of tenders than a more traditional single case study. The tenders (listed in Table 7) vary widely as they include a procedure to procure an aviation instrument landing system as well as a procurement to rent a series of mini excavators. Four of the six tenders were won by either Belgian or German tenderers. For the two remaining tenders, the country of origin of the winning tenderer is unavailable.

Table 7: Overview case study data: Selected tenders.

#	*Title*	*Procurement procedure*	*Legal basis*	*Winner country (# bids)*
1	Flare kit lifesaver	Negotiated with publication	Directive 2009/81/CE	NA (NA)
2	Flashover container	Open	Directive 2014/24/UE	NA (NA)
3	Safety and signaling equipment	Open	Directive 2014/24/UE	BE (4)
4	Instrument landing system	Open	Directive 2014/24/UE	BE (1)
5	Low velocity flash & bang ammunition	Negotiated with publication	Directive 2009/81/CE	DE (1)
6	Renting of mini diggers	Open	Directive 2014/24/UE	BE (5)

Source: Own creation based on OpenTender.eu (2022a).Each row refers Belgian Defense (2020a) through to Belgian Defense (2020e).

It is important to note that Table 7 shows that the case study sample differs from the profile of the overarching dataset of 40 tenders. Most tenders in the sample follow the "open" procedure, contrary to the dataset where "negotiated with publication" was by far the most prevalent. Moreover, four out of six tenders were issued under the general public procurement directive, while in the dataset these constituted only 10 % of the observations.

Two dimensions central to attaining the goal of fortifying the EDTIB are focused upon: (1) the compatibility of tender set-ups with promoting SME participation, and (2) the level of EU27-orientation of tenders.

First, whether the defense tenders are SME-friendly—this is an important characteristic to account for as the current EDTIB largely consists of companies of limited size on a global scale, with an eye on growing these businesses into (inter)national champions.

Dividing tenders into lots constitutes a well-known practice to stimulate SMEs to take part in larger procurement contracts.[69] While managing a complete large-sized tenders might be beyond the grasp of certain emerging companies, taking on a smaller part of the work, e.g., a single or a few lots, could be a possibility. This assists companies to become a valued part of established supply chains. However, none of the tenders in the sample opted for the possibility of utilizing lots. A consequence of not using lots but opting for a single large procurement contract, is that technical requirements can be numerous. This additional complexity can more easily be borne by industry leaders than by SMEs. Four out of six tenders featured more than 25 technical requirements, with two tenders even having 175. Notably, a particular tender explicitly mentioned that it would not be divided into lots to maximize economies of scale.[70] This is of course contrary to the rationale of growing domestic companies to stimulate competition. However, it is completely consistent with a cost-effectiveness rationale.

68 Leuffen (2007).
69 Hoekman & Taş (2022).
70 Belgian Defense (2020c).

A more indirect way of stimulating SME participation is by including certain award criteria with respect to non-price aspects. An example would be quality elements in the sense that the procured good service needs to be tailored to the specific case. SMEs active in more niche markets might particularly benefit from such an approach. However, the sample of Belgian military tenders is heavily focused on price—for five out of six tenders, price is the only criterion.

From the above, it can be concluded that there is no structural support for SMEs embedded in the sample tenders—Table 8 illustrates these findings.

Table 8: Overview of (lack of) SME-support features of tenders.

#	*Lots*	*Technical requirements*	*Advances*	*Award criteria*
1	No	11	No	Price
2	No	31	No	Price
3	No	11	No	Price
4	No	175 (103 for maintenance contract)	Yes	Price
5	No	26	No	Price
6	No	175	No	Price 80% Tech. 20%

Regarding the second dimension (the extent to which tenders are oriented toward strengthening the EU27-internal defense market), the procurement directives aimed to unify (defense) markets across the European Union by outlining a set of common rules.[71] However, being directives and not regulations, they allow some tweaking of these rules to national contexts.[72] EU27-orientation is assessed by examination of the tender documents available.

Table 9: Overview of (lack of) EDTIB-building features of tenders.

#	*Way of tendering*	*Language*	*Only EU tenderers*
1	Electronic or paper	Dutch or French (technical can be English)	No
2	Electronic	Dutch or French	Yes
3	Electronic	Dutch or French	Yes
4	Electronic	Dutch or French (technical logistical can be English)	No
5	Electronic or paper	Dutch or French (technical logistical can be English)	No
6	Electronic	Dutch or French	No

The strong emphasis on price in award procedures also plays a role in this regard. A high weight to price in evaluation mechanisms benefits large incumbents which can strongly focus on cost efficiency. Not using the possibility to explicitly include award criteria related to, for example, the level of interoperability (within strategic alliances), or certain EU27-preferences, undermines promoting EDTIB growth.

Table 9 outlines the various underlying elements per tender that further influence their likelihood to strengthening the EU27-internal defense market. The submission process for tender bids can play an important role in determining the de facto openness of a public procurement procedure. The electronic submission system can be considered to not favor domestic companies to the same level as requiring submissions on paper[73], since ensuring timely receipt of bids

71 Yukins (2009).
72 Thomson (2010).
73 Gourdon & Messent (2019).

via postal services can be time- and resource-consuming. The Belgian military procurement scores well on this metric, as it allows electronic submission of bids for all tenders under investigation.

Another element of openness to non-domestic EU27-tenderers is reflected in the language in which bids have to be submitted. Allowing bidders to submit bids in English is clearly more conducive to building a truly integrated market, than requiring bids to be prepared in the respective national languages. Of course language laws might restrict the use of non-official languages in procurement procedures. Nonetheless, letting tenderers submit certain parts of the bid documents in English might already help. In the sample, half of the tenders allows technical and or logistical parts to be in English, while the other half demands that all information be provided in either Dutch or French.

The most explicit way to ensure that specific public procurement procedures favor the EU27-defense industry is to exclude third country bidders entirely. As mentioned, defense procurement is often not covered by the WTO's GPA which means that tender issuers are free to do so.[74] Two out of six tenders from the sample do indeed apply this option.[75]

The analysis of the level of EU27-orientation of tenders reveals mixed results. Tender issuers could certainly do more to pursue European strategic security aims and aid in strengthening the EDTIB.

Discussion and conclusion

Both the EU27 level analysis as well as the review of Belgian military tenders, offer notable insights.

EU27-level findings concern the composition and evolution of defense sector tendering on the one hand, and the particularity of tenders typically won by non-EU27-tenderers, on the other. Key takeaways regarding the composition and evolution of EU27-defense tendering are threefold. First, tenders are of limited size, averaging around EUR 1.7mn. Very large-value tenders are quite rare, only 0.23 % of tenders equals or exceeds EUR 100mn. It has to be noted that much of defense purchasing does not follow a regular public procurement track but is part of government-to-government agreements, and as a result goes unreported in the dataset. Very large contracts are arguably likely to be more entangled with other policy objectives (e.g., the Eurofighter Typhoon project, juste retour[76] etc.), and thus involve unique agreements. Second, the growth in the number of tenders in the sector has been generally consistent, which underlines the importance of developing structural approaches to fortify the EDTIB. Third, the average competition for tenders is already limited; a tender receives three bids on average. However, over a third of tenders receive only a single bid—highly undesirable from a buyer power perspective. An EDTIB with strong companies across all important sub-sectors might alleviate some of this tension.

To uncover gaps in the current EDTIB, tenders won by non-domestic companies were particularly reviewed. Tenders won by non-EU27-tenderers are relatively few, i.e., 367 of 14,207 tenders, but certain member states account for substantially larger proportions than others. The asymmetric dependency on non-EU27-tenderers arguably inhibits strategy formulation at EU-level (e.g., Finland with larger dependence on non-EU27-tenderers and a historically complicated relationship having been at the edge of NATO and the former USSR[77]). Moreover, tenders won by non-EU27-tenderers are markedly different from those won by tenderers based inside the region. This indicates that their success might be related to certain particularities, for example size- or resource-based competitive advantages (e.g., captive resources[78])—a theory supported by the fact that tenders won by non-EU27-tenderers are larger and less competitive on average. From an EDTIB perspective, breaking into/competing in a competitive space characterized by large scale economies or centered around (natural) resources that are foreign to the EU27-region is

74 Directive 2009/81/EC (2009).
75 Belgian Defense (2020b); Belgian Defense (2020c).
76 Matthews & Al-Saadi (2021).
77 Czibik et al. (2021).
78 Gereffi & Lee (2012).

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of course more challenging.

For the Belgian context, insights are centered around the (lack of) inclusion of certain modalities to fortify the EDTIB in a sample of tenders. First and foremost, price remains the most important award criterion in practice. Close to 90% of the 40 tenders issued by the Belgian military have price as their most important evaluation criterion. This practice is likely counterproductive to achieving growth of the EDTIB, because it favors large incumbents rather than stimulating the growth of SMEs and/or the entry of new European challenger companies.

Second, there is no structural support for security and defense SMEs embedded in the sample of Belgian tenders: tenders are not divided into lots, and tenderers can only rarely be (partly) paid by way of advances.

Third, when it comes to stimulating the integration of EU27-member states' security and defense markets, Belgian procurement practices are only partly conducive. While submitting bids electronically is possible in all six of the tenders under investigation, technical features of bids can only be in English in half of the observations—strong stances on language requirements can be particularly exclusionary to non-national EU27-tenderers. The possibility to explicitly exclude third countries from participating in defense and security tenders was only used in two of six cases, while this is a very direct way to further EDTIB objectives.

In conclusion, while outcomes both at EU27-level, and in Belgium in particular, do not currently show a strong prevalence of non-EU27-tenderers in the defense and security sector, this situation might change if the passive approach is continued. In any case, the political discourse on the importance of strengthening the EDTIB is not being met by current tender practices. The potential of public procurement as a tool for strengthening the EDTIB is clearly underutilized. Future research should focus on avenues to strengthen EDTIB while respecting the essence of public procurement and competition law—comparative research contrasting tender practices in various sectors might offer interesting best practices in this regard.

This article's findings are subject to three limitations. First, the statistical analysis is based on data from the Opentender.eu portal which contains data on a very large number of tenders, but which also has ample missing values particularly for certain variables.[79] Nonetheless, the balanced sample of 14,207 observations remains substantial. Second, the analysis has solely focused on tenders which have been reported on TED and/or on national public procurement portals. Consequently, tenders issued following the Article 346 TFEU exception have been excluded. Given the fact that this article is a key instrument in the pursuit of strategic (security) objectives, this is an important drawback. Observing that no or very limited data on these tenders is available[80], this caveat can unfortunately not be rectified. Third, the sample of the six tenders issued by the Belgian military might be subject to selection bias. The sample differs in key characteristics from the whole population of 2020 Belgian military tenders. However, since the goal of this article is to merely explore current practices, the sample suffices for these aims.

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79 OpenTender.eu (2022a).

80 See e.g., Terpan & Saurugger (2019).

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Defense industrial bases (DIB) in six small NATO post-communist countries

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Abstract

This article investigates the changes in the defense industrial base (DIB) of the small NATO post-communist countries: Czechia, Slovakia, Hungary, Lithuania, Latvia, and Estonia. It considers the historical development of their industries from the Soviet era and the developments caused by the Crimea and Ukraine conflicts. It finds that exports to the markets of the former communist Czechoslovakia continued for Czechia with the DIB owned and controlled by oligarchs—who have been able to leverage this power to influence defense policy. In Slovakia, the DIB is insignificant and mainly under the influence of Czechia. The Hungarian DIB is being redeveloped by the richest members of Hungarian society, through international joint ventures, with the aim of expanding exports. The DIBs of Estonia, Latvia, and Lithuania produce only what is needed by their national armed forces—which seems unlikely to change.

The Crimea crisis in 2014 and the Russo-Ukrainian war commenced in 2022 triggered the rapid modernization of the armed forces in many NATO countries. Small post-communist countries in the Baltic region (Lithuania, Latvia, Estonia) and in Central Europe (Czechia, Slovakia, Hungary) responded to Russian aggression by raising defense spending. As well as increasing demand for arms imports, this provided a stimulus for the development of domestic defense industrial bases (DIBs) in these countries. So far, little is known about what happened as the literature has dealt only with Western DIBs. Markowski *et al.* (2009) considered small NATO member nations in the West and found that they did not challenge the economic transition and collapse of their product markets and have integrated their defense industry within the European Union, e.g., Sweden[1], Belgium, and the Netherlands.[2] The Russian aggression may have encouraged DIBs in the post-communist European Union to cooperate yet more intensively across Europe.

This article provides an exploratory analysis of the changes that have taken place in the DIBs of these small post-communist countries. It considers the historical background and the functioning of national DIBs, with close attention to the structural features of the DIB in each country. A number of challenges exist, such as the lack of transparency of post-communist defense institutions and more limited access to essential data.[3] In addition, international sources are limited, for example the SIPRI collection of national reports on arms exports does not include Lithuania and Latvia, and the Hungarian report is only available in the Hungarian language. Czech and Slovak reports provide detailed information, but based on the regulation of the arms trade introduced in Czechoslovakia.

1 Stenlas (2015, pp. 258–259)
2 Markowski et al. (2009, pp. 313–317)
3 As noted by Young (2017) and Transparency International (2015, 2020, 2022)

The term *national DIB*[4] is taken to mean all companies and other legal entities organized in a national association of producers and traders of products and services for defense and security institutions (police, fire brigades, etc.); it also includes the national defense and security industry association, as a central entity lobbying for the interests of its members. An assessment of ownership and structure, status in the economy and society, relationship with the defense institution, and success of products provides valuable information and,, at the very least, a starting point for more detailed research.

Most of the literature deals with Western European countries and little is known about the evolution of the post-communist countries' Eastern European defense industrial bases (DIBs) and in light of the Ukraine conflict this does seem an oversight. An analysis of developments in Czechia, Slovakia, Estonia, Latvia and Lithuania and find considerable changes have taken place, with Czechia and Hungary the main players, focusing upon expansion of the defense industry, but with governance concerns. The DIBs of Estonia, Latvia, and Lithuania produce only what is needed by their national armed forces.

The next section provides some historical background, providing a picture of the DIBs during their time in the Eastern bloc. This is followed by an analysis of the changes that took place after the end of the Soviet Union. The next section considers more recent developments and issues of governance, influence, and corruption, followed by some consideration of prospects for the countries DIBs. Finally, some conclusions are presented.

Historical background

Lithuania, Latvia, Estonia, Czechia, Slovakia, and Hungary are small nations that before 1990 had national economies subservient to the military interests of the Soviet Union (USSR). These interests were dictated by three institutions. First, the Kremlin and the Soviet communist party via communist parties in the nations that were either integrated directly into the USSR (Lithuania, Latvia, Estonia) or which constituted the Soviet bloc (Czechoslovakia, Hungary) after the second world war. Second, the Council for Mutual Economic Assistance (1949–1991), an economic organization established by the USSR for the purposes of integration of centrally planned economies in the communist countries. Third, the Warsaw Pact (1955–1991), a defensive alliance established by the USSR in response to the enlargement of NATO in Europe after 1949.

The main center of power influencing the DIB in communist countries was the Supreme Defense Council of the USSR, which had "authority over the Party, the administration, the armed forces, and the whole of the Soviet Union and the Soviet bloc".[5] It was responsible for "the standardization, modernization, and normalization of weapons and all other technical military aspects of the Joint Armed Forces", as well as "for coordinating armament production planning and research and development (R&D) in the Warsaw Pact countries". Both bodies worked "in close cooperation with the Military-Industrial Commission of the Council for Mutual Economic Assistance (COMECON) and the Soviet Deputy Defense Minister for Armament."[6] The DIBs were assigned a specialization within COMECON[7] and produced Soviet weapons under license. They were allowed to develop new functionalities of Soviet weapons by means of national R&D and some (e.g., Czechia and Slovakia) served the USSR as auxiliary capacity.[8] Only military materiel which was vital to military readiness but not to imperial Soviet interests (e.g., battle dress, ammunition, etc.), and small weapons, could be developed and produced without Soviet surveillance.

These countries would have been the front line for conflict with NATO.[9] The Baltic countries hosted the Baltic

4 Markowski et al. (2009); Chovančík (2018); Reis (2021); Reis et al. (2022)
5 Sadykiewicz (1988a, p. 2)
6 ibid p. 13
7 Štaigl and Turza (2013a, 2013b)
8 Pernica (2020)
9 Sadykiewicz (1988b, p. 11)

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Military District, with 231,000 troops under the command of Soviet headquarters[10], and the Baltic fleet.[11] Czechoslovakia was to establish a national front by mobilization of its armed forces[12], and Hungary was to counterattack toward the Po Plain in Italy. The DIBs were supposed to support any offensive operation conducted by the Warsaw Pact nations with Soviet strategic military plans determining the production capacity of the national DIBs.

The Czechoslovakian DIB was a legacy of the Habsburg monarchy[13] and was further developed by democratic Czechoslovakia in 1918–1938[14], Nazi Germany (1939–1945), and communist Czechoslovakia (1948–1989). Production had been moved from the western part of Czechia to Slovakia as early as the 1930s in response to the threat of Nazi Germany[15]—this continued during the communist period with production of advanced military hardware continuing in Czechia. At the end of the 1980s, around 61% of Czechoslovakian weapons were produced in Slovakia, with 32% of national production for the Czechoslovak People's Army. Arms exports to other Warsaw Pact countries accounted for 52% of the total, with a further 17% to developing countries.[16] International trade with all military hardware and services was a monopoly of OMNIPOL, the state-owned foreign trade corporation.[17] The share of the defense industry in the economy as a whole peaked at 11% in 1987, but subsequently fell to 6% in 1990 due to the implementation of the Treaty of Conventional Forces in Europe.[18] At the end of the Cold War, 120,000–150,000 mainly Slovak workers lost their jobs with "the federal government only plan[ning] to assist 13 of 111 factories engaged in weapons production during their conversion process".[19]

Loyalty to the Soviet military-industrial complex was rewarded by lucrative COMECON projects. Czechoslovakia held a monopoly in the production of training aircraft, small aircraft (air taxis), cabin flight simulators, medium amphibious rope transporters, and tank periscopic lenses. Production of other items was done in cooperation with either Poland or Hungary. The basic production for the Slovak DIB was concentrated in 25 companies and all production of military electronics was shared with Hungary.[20] Czechoslovakia was also allowed to develop military applications for civil production, such as heavy lorries and radars. The breakup of Czechoslovakia in 1992 did not result in the collapse of the DIB in Czechia, despite their production chain being linked with the Slovakian DIB.

Hungary's losses at the end of world war I reduced its industrial strength and defense capabilities.[21] The DIB was re-developed in the second world war[22] when Hungary became a German ally[23] and in the early 1950s, when Hungary became a Soviet satellite. It saw a high rate of investment in heavy industry and the military[24], but the Hungarian Revolution of 1956 saw a significant reduction in the military program.[25] The DIB mainly supplied the military with hardware, such as cannons, truck components, etc. The only competitive sub-sector within COMECON was ICT. Furthermore, Hungary exported communication, signal, and electronic warfare equipment to non-Soviet Warsaw

10 Sadykiewicz (1987, p. vii)
11 Sadykiewicz (1988a, p. 15)
12 Sadykiewicz (1987, p. vii)
13 Jindra (2021)
14 Pavel (2004, 2006)
15 Zavadil (2021)
16 Szayna (1992, pp. 56–57)
17 Štaig and Turza (2013a)
18 Štaigl and Turza (2013b)
19 Szayna (1992, p. 56)
20 Štaigl and Turza (2013a)
21 Sadecki (2020)
22 Dombrády (2003)
23 Bíró et al. (2006)
24 Gunst (2002)
25 Germuska (2014)

Pact members and third world countries, e.g., Libya, India, etc.[26] These capabilities vanished with the collapse of communism.[27] Although the Hungarian DIB employed 18,000 people in 1988, it had fallen to 1,900 by 1998.

Lithuania, Latvia, and Estonia depended upon military production from Great Britain, Germany, Sweden, and Czechoslovakia in the interwar period. They did strive to build up their national capacities for the production of vital military materiel, such as ammunition, mines, explosives, battle dress, gas masks, light weapons (under license), and armored vehicles[28] and Latvia produced aircraft for the national air force.[29] After the Soviet occupation in 1945, the capacities of the DIBs were integrated into the Soviet military-industrial complex whereby Lithuania and Latvia repaired tanks and warships, produced radio, electrical and telecommunication equipment, airplane black boxes, and listening devices, e.g., the chips installed in the communication hardware of the Soyuz spacecraft.[30]

Altogether, it is of note that the Soviet Union allocated only 3.7% of its DIB capacity to the Baltic states.[31]

Post Cold War developments

At the end of the Cold War (1990), the 1992 Treaty on Conventional Forces in Europe set national ceilings[32] for military hardware produced in the Warsaw Pact countries, as shown in Table 1. This affected sales for the mainly privatized DIBs in the countries under study and only the Czech DIB has continued the production it had developed earlier (with a significantly reduced market potential). NATO enlargement meant military equipment not produced in the country had to be replaced by equipment from NATO countries that were enemies during the Cold War.[33] Domestic production had to meet NATO standards while the size of the armed forces fell significantly under ceilings set by the 1992 treaty.[34]

Certain products became unmarketable due to market liberalization and the countries not being able to afford investment into national DIB development.[35] Some hope came with NATO enlargement (1999 and 2004), the global war against terrorism (2001–2021), and the Arab spring (2010–2022). Czech and Slovak DIBs could export refurbished military surpluses of Soviet equipment and supply post-communist NATO countries with traditional products, such as military training aircraft. While the NATO and European Union enlargements offered opportunities for regional cooperation with allies, they did not have an adequate R&D base for the development of complex military products, having only provided components and produced Soviet weapons under license. Since advanced military hardware had been produced in Czechia and was mainly a spin-off from civilian production, the Czech DIB managed to recover by the 1990s.[36] Military products developed and manufactured in communist Czechia until 1990 continued to be exported to the other post-communist countries. In contrast, the Baltic countries became recipients of military equipment manufactured in Western NATO countries.

Mass privatization of DIBs in the 1990s contributed to a rise in economic power of owners operating DIB entities and their power to affect national defense and security policy.[37] With the Russo-Ukrainian war, these oligarchs have gained significant control over military production in Central Europe. Across all of the countries, the ownership structure is mainly private and in production industries, as shown in Table 2.

26 ibid
27 Kiss (2014)
28 Pociūnas (1993); Vaičenonis (2000); Jokubauskas (2011)
29 Nõmm (2004)
30 Prikulis (1996)
31 Leanovich (2012)
32 Sharp (1993)
33 Pernica (2020)
34 Dvorak and Pernica (2021)
35 Kiss (1993); Štaigl and Turza (2013a, 2013b)
36 Pernica (2020)
37 Dvorak and Pernica (2021); Pernica and Ženka (2022)

Table 1: Conventional Forces in Europe (CFE) ceilings and equipment reported in 2014

		Tanks	*ACVs*	*APs*	*CAC*	*AHs*	*Manpower*
Czechia	**ceilings**	**957**	**1,367**	**2,262**	**230**	**50**	**93,333**
	2014	123	442	179	39	17	33,907
Slovakia	**ceilings**	**478**	**683**	**383**	**100**	**40**	**46,667**
	2014	30	319	67	18	12	15766
Hungary	**ceilings**	**835**	**1,700**	**840**	**180**	**108**	**100,000**
	2014	154	597	30	25	18	22,593
Lithuania	**ceilings**	**(184)**	**(1591)**	**(253)**	**(46)**	**(0)**	**16,400**
	2014	0	126	48	0	0	**10,950**
Latvia	**ceilings**	**(138)**	**(100)**	**(81)**	**(183)**	**(23)**	**5,310**
	2014	3	8	76	0	4	**5,310**
Estonia	**ceilings**	**(184)**	**(201)**	**(29)**	**(153)**	**(10)**	**5,750**
	2014	0	144	376	0	0	**5,750**

Sources: Sharp (1993, p. 471), IISS (2015).
Notes: ACVs: armored combat vehicles, Aps: artillery pieces, CAC: combat aircraft, AHs: attack helicopters. The ceilings in brackets for Lithuania, Latvia, and Estonia are not from the Treaty on Conventional Forces in Europe, but treaty-limited equipment declared on their territory in February 1991.

Table 2: The ownership and branch structure of the DIB, 2022

Country	*Private ownership*	*Public ownership (with state-owned entities)*	***Total***	*Producers*	*Dealers, Resellers, etc.*	*R&D (with state-owned entities)*
Czechia	118	8(7)	**126**	118	4	4(3)
Slovakia	40	8(5)	**48**	42	2	4(2)
Hungary	38	7(5)	**45**	43	2	0
Lithuania	58	6(3)	**64**	52	6	6(4)
Latvia	88	7(6)	**95**	82	7	6(5)
Estonia	125	3(1)	**128**	116	9	3(1)

Sources: Authors' own research based on national defense industry associations' home pages.
Notes: Private ownership means enterprises. Public means different actors such as institutes, universities, and state-owned companies (entities integrated into defense institutions). Producers include both industry and services. The table presents only the members of the national defense industry associations.

While the core of the Czech DIB was developed from the Czechoslovakian DIB, some firms focus mainly on trade (Omnipol, Glomex) and are resellers of Western products. They often employ retired officials from the Ministry of Defense and General Staff officers who were involved in planning and procurement.[38] A distinct feature of the Czech DIB was that firms such as SAAB AB, Honeywell, and Siemens established joint ventures with Czech entities to gain access to Ministry of Defense tenders. The main domestic actor is the Czechoslovak Group (CSG), owned as a family business by billionaire M. Strnad, which recently expanded into the Western Europe.[39] Defense R&D is supported by the government and 64 of the 126 DIB members in Czechia have received some form of public R&D subsidy.[40] R&D in advanced military technologies is also linked with the employment of retired senior officers.[41] As well as these links, the Defense and Security Industry Association (DSIA) lists among its members the University of Defense (UOD) in Brno, an inherent part of the military sector. UOD hosts International Defense and Security Technologies (IDET) Fair conferences and provides academics and Ministry of Defense (MOD) staff to comment on policy. DSIA also includes CEVRO, a private academy, which offers a haven to retired members of the political and military elites. [42] Some of them are also official agents of American arms companies[43] and have a direct access to ministerial officials.[44] The involvement of national universities of defense is a legacy of communism, where military technical academies (one in Czechia and another in Slovakia) educated specialists for the defense industry in regions with high concentrations of defense industry enterprises.

Such an involvement of interest groups is less apparent in the Slovakian DIB, though the Security and Defense Industry Association of the Slovak Republic (SDIA) includes the national defense academy as well as public and private colleges. Firms focusing only on the arms trade in the SDIA are rare and many act as subcontractors to Czech companies. The Slovak DIB has a dependence on the Czech economy similar to that prior to 1992.[45]

The Hungarian DIB is small but ambitious. Before the Orbán government's defense reindustrialization program in 2015, four state-owned companies mainly provided outsourced services for the military. When launching the Defense Industrial Strategy in 2021, the government decided that the best course of action was to entice direct investments from conventional actors in the defense industry and form joint ventures with them.[46] The strategy calls for six clusters, each headed by a flagship company, including joint ventures (with Airbus, Rheinmetall), recent state acquisitions (Hirtenberger Defense), state domestic private companies (4iG), and Government-owned contractor-operated (GOCO) entities.[47] The strategy aims to integrate as many domestic enterprises into the clusters' value chains as possible.[48] The Defense Industry Association of Hungary is not an important actor of this reindustrialization plan, as these new flagship companies are not members of it (so they do not appear in Table 2).

As well as differing in size, the national DIBs also differ in their significance to the domestic economy and society. The Czech DIB makes the most significant contribution to national exports—however it is not state-of-the-art products but the refurbishment of tanks, armored personnel carriers (APCs), and artillery systems sold to national producers as military surplus in the 1990s and 2000s.[49] It is also not clear how important the companies are.

38 Frič and Pernica (2022)
39 ČTK (2022)
40 Štampach (2022)
41 Májek and Šlouf (2015); Constantinescu (2016)
42 Pernica (2018, p. 75)
43 Frič and Pernica (2022), CEVRO, presenting itself as the Centre of Transatlantic Relationship propagating NATO in Czechia, employed prime minister P. Nečas43 who was involved in a misuse of the Military Intelligence Service (Novotný, 2016).
44 Pernica (2018, p. 75)
45 For instance, there was a subsidy of Tatra national company in Bánovce and Bebravou where heavy military tracks were produced. CSG reestablished this production as Tatra Defense Slovakia in 2021. Adamowski (2021)
46 Notably from Germany, whose companies certainly welcome the much more permissive Hungarian weapons export policy.
47 Taksás and Hegedűs (2022)
48 Gosselin-Malo (2023)
49 Pernica (2020)

Consultants Ernst &Young estimated that one CZK spent on defense with CSG generates CZK 2.8 for the national economy.[50] However this evidence is open to question as CSG benefited from the wars in Iraq and Ukraine by selling surplus Czechoslovakian military equipment bought cheaply in the 1990s (the government sold them at scrap value to help it meet NATO targets). It was devised by oligarch Strnad's father-in-law, who was the deputy director of the Ministry of Defense Office of Armament and Logistics.[51] In Slovakia, the DIB collapsed in the 1990s and defense policy is mainly influenced by traders operating out of the national association, who have been close to the left-wing populist party SMER. In Czechia, owners back more right-wing parties and populist individual leaders.

In recent decades, Hungary has not been a large exporter of defense goods, but its defense reindustrialization policy is likely to mean an export push. Many traditional domestic defense enterprises are still trying to determine how they fit within the new national DIB structure, with its international joint ventures. The government has put in place mentorship programs for small and medium-sized enterprises that wish to enter this sector, but there are barriers that are mostly caused by Hungary's relatively weak innovation ecosystem and labor shortage.[52]

Lithuania, Latvia, and Estonia are small countries with minimal experience in military production, but their DIBs include as many entities as in Czechia and Slovakia and contain defense education institutions. Most production is intended for their growing national military forces and thus have low levels of exports[53], but they do collaborate with other countries.[54] Their DIBs have not yet gained any significant share in the international arms trade and none of them has the potential to produce a cutting-edge military product, vital though they are to national defense.

Governance corruption and influence

Governments in post-communist countries have struggled to control corruption.[55] Too-close relationships among defense industry, politics, and the defense institutions have resulted in institutional corruption[56]; a problem exacerbated by the power of special interest groups.[57] As Table 3 shows, the production of strategic documents protecting the Czechia DIB is comparable only with Hungary. The Czechian Defense Review facilitates access to media without any screening by the political elite with an editorial board composed of 64 members.[58] In addition, the employment of retired generals has been common.[59] Owners (families) of vital companies in the DIB became sponsors for presidents and defense ministers[60], many of whom were included on the Forbes list of the 172 wealthiest families in Czechia in 2022. Czechia is one of the few European Union members where there is no regulation of lobbying activity.[61] Transparency International judged the Czech Tatra as the only company doing business on a global scale and gave it an anti-corruption index of 'poor'. In contrast, Slovakia's only notable support for its DIB is the IDEX fair in Bratislava, close to the Czech, Austrian, and Hungarian borders. Its heavy defense industry was subsidized during the Czechoslovak period, but its neoliberal governments have not been keen on providing such support.

50 The multiplier for Czech defense expenditures spent in Czechia is estimated to be 3.2. HRB (2022).
51 Dolejší and Koděra (2016)
52 Budavári et al. (2022)
53 SIPRI (2022)
54 Markowski et al. (2009)
55 Transparency International (2022)
56 Caiden (1988)
57 This situation arose in Czechia where the DIB benefited from special status in defense policy as early as the 2000s. For example, the government entered into a contract with the DSIA to support the DIB by means of economic diplomacy (Pernica, 2020; Dvorak and Pernica, 2021).
58 Pernica (2018, pp. 77–78)
59 Frič and Pernica (2022)
60 ČTK (2017)
61 Kverulant.org (2022)

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Table 3: The relationship between the DIB and defense institutions

	the MOD supports the DIB by			*DIB´s activities*	
	Organizing (subsidizing) trade fairs	*Organizing (subsidizing) conferences, forums, popularization*	*Special documents*	*Commercial review*	*Special sponsorship*
Czechia	IDET, Brno (in odd years)	Future Forces, Prague (annually)	Yes (2001, 2004, 2011, 2017)	Defense Review (4 issues in a year)	The Czech Armed Forces ball
Slovakia	IDEX, Bratislava (in even years)	None	None	None	None
Hungary	Planned in the future	Wide range of activities for popularization	Yes (2012, 2016, 2021)	None	None
Lithuania	-	Baltic MilTech Summit, Vilnius and Drone days, Vilnius district (annually)	Yes (2017)	None	fireworks festival
Latvia	-	Industry Day at National Army Forces Day (annually), different cites	None	None	award for researchers
Estonia	EWLive2.0, Tartu (annually)	EWLive2.0 conference, Tartu (annually)	Yes (2012)	None	None

Sources: Authors' own research based on national defense industry associations' home pages and Pernica 2020.
Notes: Special documents are those which set out the exclusive position of the national DIB in the economy (years of issue of such documents in brackets).

In Hungary, the push to develop arms production is part of an industrialization policy that restricts competition and promotes high levels of collaboration and cooperation among economic actors. It means that in the Hungarian defense industrial sector, political decision-makers heavily affect corporate behavior and decisions. This state-driven economic approach has contributed to the decline of the nation's standing in corruption rankings.[62]

Lithuania, Latvia, and Estonia are not as prone to corruption as their fellow post-communist countries Czechia, Slovakia, and Hungary.[63] The DIBs are supported by defense policy, but the extent of such support is relatively small, though there is some evidence of influence from vested interest groups, as found in Lithuania.[64]

Prospects

Only Czechia and Hungary are recognized as producing state-of-the-art products that meet the standards of the armed forces in NATO and the European Union. The best-known military product is the VERA passive radar manufactured by ERA, owned by Omnipol.[65] The best-known post-communist trademark in the European Union is Tatra. The first NATO country to opt for cooperation with Tatra was Denmark, which procured Caesar self-propelled howitzers

62 Transparency International (2022)
63 World Bank (2022)
64 Palavenis (2022)
65 Turnbull (2018)

produced by the French Nexter to be mounted on Tatra chassis.[66] Hungary currently lacks well-known products, but this will change soon when joint venture projects will be produced in the country, including Rheinmetall's Lynx modular medium weight combat vehicle, the Turkish-German-Hungarian co-produced Gidran tactical vehicle, the former Czech Aero Vodochody training aircraft[67], and the former Austrian Hirtenberger mortar,.

There are no significant military products produced in Lithuania, Latvia, and Estonia with no continuity from the Soviet era, when large electronics companies existed in Latvia and Lithuania (VEF, Komutators Alfa, the Vilnius Institute of Radio Measuring Devices and the Kaunas Radio Measurement Institute).[68]

All of the countries are involved in the Permanent Structured Cooperation. This is the part of the European Union's security and defense policy where 25 of the 27 national armed forces pursue structural integration. As would be expected, given the developments above, the focus of the countries differ. The Baltic countries are looking to participate in disruptive weapon projects, Slovakia is looking to participate in projects developing machinery, while Czechia and Hungary are to participate in projects involving the production of sensors and the development of artificial intelligence.[69]

Conclusion

The Crimea crisis in 2014 and the Russo-Ukrainian war in 2022 led to security concerns in the smaller countries in the Central European region (Czechia, Slovakia, Hungary) and the Baltic region (Lithuania, Latvia, Estonia). Except for Czechia, all of them had seen a decline in military production since the collapse of the Warsaw Pact in 1991. The Baltic countries have developed their DIB capacities to cover the needs of their armed forces and opted for a strategy of cooperation and collaboration with Western arms companies for weapon systems. Arms production links between the post-communist countries collapsed and have not recovered.

All the DIBs have consisted mostly of private capital, but state-owned entities still exist, usually to maintain Soviet military equipment. Companies have been privatized or are used to support equipment from Western allies. In Czechia and Slovakia, state-owned companies are involved in defense R&D activities, much as they were during the communist period—also defense universities continue to play a central role in the DIB, providing officers with military higher education closely integrated with the defense industry. DIB activities in Central Europe are often affected by corruption more than in the Baltic and Western Countries. Czechia seems to be the worst, with powerful interest groups and oligarchs owning military industrial capacities in the DIB. Private owners of firms organized in the DSIA influence defense policy and represent the wealthiest members of society. A growing military budget has given them opportunities and the oligarchs are now seeking international collaboration across the European Union. The Slovak DIB is linked with the Czech DIB and the war in Ukraine gave Slovakia the opportunity to export artillery systems based on the Tatra—the only state-of-the-art product left after the collapse of the production of tanks and APCs under Soviet license in the 1990s. Hungary is showing similar features as it develops its national DIB as part of its modernization strategy.

With the present security environment, it is likely that the respective country's DIBs continuing to develop along similar lines, with Czechia and Hungary dominating the group, but with the others increasingly engaged in arms production and maintenance across the European Union and NATO.

66 Tran (2017)
67 ČTK, iDNES.cz (2021)
68 Prikulis (1996)
69 EU (2020)

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The future of the European defense firm

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Abstract

The future European defense firm will be radically different, being determined by future threats, novel technology, and yet to come European defense policy. The immediate threat arises from the war in Ukraine, but longer-term European defense policy based on the Strategic Compass will provide the framework for the future European defense firm. Past developments offer some indication of the future and it is predicted that the defense firm has a future and will survive. The past trend of smaller numbers of larger defense firms will continue with firms being even more technologically-intensive—reflecting Augustine weapons systems, which are characterized by continuously rising unit costs and smaller volumes. There will be more mergers between European defense firms and more joint European projects developing and producing combat air and naval systems, tanks, and cyber systems.

The question is what might the future European defense firm look like? The future defense firm depends on a variety of factors such as threats, new technology, and national defense policy. All national defense policies have to respond to uncertainty and change. Uncertainty means that future threats are unknown and unknowable. They take different forms, in different locations, over different time periods requiring different defense budgets. New threats mean that defense policies have to change, adapting and adjusting to new challenges. Change might arise from a new political–strategic environment and new technology (e.g., the end of the Cold War, the emergence of drones, and new space systems). Overall, the future European defense firm will be determined by broad demand and supply-side factors. Broadly, demand-side factors will be represented by European defense policy and by future threats whilst supply-side factors will be represented by the costs of new technology, scale and learning economies, and the development of transaction costs. Aerospace firms are taken as typical of defense firms.

European Union defense policy

European Union defense policy has been characterized by change. For example, there was the 2003 European Security Strategy, the 2016 European Union Global Strategy, the 2016 European Defence Action Plan. and the 2022 EU Strategic Compass (EU, 2022). The Strategic Compass has some distinguishing features which affect the future European defense firm. It aims to develop an EU Rapid Deployment Capacity comprising up to 5,000 troops to be deployed for different types of crises. It will develop EU intelligence capacities, an EU Cyber Defence Policy, and an EU Space Strategy for security and defense. The Compass will also develop the next generation of capabilities in air, land, sea, and space domains (e.g., FCAS, advanced naval platforms, tanks, and space systems). EU cooperation with partners will be strengthened with partners named as NATO, UN, the United States, Norway, Canada, the United Kingdom, and Japan. The Strategic Compass was introduced at a time of war in Europe (i.e., Ukraine). By identifying future capabilities and partner nations, the Compass provides a framework for the future European defense firm.

Whilst the Compass presents a clear plan for future EU defense policy, it has two major deficiencies. First, like many previous European defense initiatives, it is good on rhetoric but lacks firm commitments and funding—offering an attractive but empty set of promises. Second, a Rapid Reaction Force of 5,000 troops is far too small and its tasks

are vaguely outlined. For instance, will it be used for worldwide operations and for what duration? Duration has major implications for the number of troops available for extended overseas deployments.[1] Nonetheless, the Strategic Compass will affect the development of the future European defense firm. It outlines future European demand-side prospects for defense firms; however, it is less specific on European supply-side prospects.

The future European defense firm will be determined by future threats, new technology, and future defense policy. The immediate threat is the war in Ukraine, but longer-term European defense policy, based on the Strategic Compass, will provide the framework for the future European defense firm. None of the Strategic Compass commitments are costless. Defense firms will continue to become more technologically intensive, with more mergers and joint European projects developing. Nationalism cannot be avoided, with nations responding to their national defense preferences—it may also constrain the choice of collaborative partners. However, cost pressures and defense budget constraints might lead to the choice of partner nations outside of the European Union.

Future threats

The Strategic Compass presents a comprehensive assessment of the likely future threats facing Europe. Threats include military aggression from Russia (e.g., cyber-attacks, energy coercion, and the Ukraine), threats from China, and threats from failed states such as Afghanistan and North Korea together with instability and poverty in Africa. Further multiple threats to Europe are recognized from terrorism, population migration, arms proliferation (nuclear weapons), and the weakening of arms control regimes. European defense firms will respond by developing new technologies to meet such threats. New equipment projects include next generation combat aircraft, strategic air transports (for rapid deployment of armed forces), new naval platforms, new tanks, smart ammunition, cyber systems, and space systems. But as Norman Augustine predicted, new military technologies will be costlier, which will affect the supply-side of the defense market.[2]

Costs of new technology

Augustine (1987) found that the unit cost of certain high technology equipment is increasing at an exponential rate with time. For example, the unit cost of high performance fighter aircraft has grown by a factor of four every ten years, with no ceiling in sight. Elsewhere, similar trends apply to helicopters, ships, tanks, and commercial aircraft but with a unit cost growth rate of a factor of two every ten years. Comparing trends in national defense budgets with unit costs led to Augustine's Final Law of Economic Disarmament or Impending Doom which predicted that by the year 2054, the entire defense budget will purchase just one aircraft (Augustine, 1987, p. 143). Other commentators have similarly forecast a future armed forces comprising a single ship navy, a single tank army, and Starship Enterprise or Battlestar Galactica for the air force (Kirkpatrick and Pugh, 1983).

Examples of unit cost data for U.K. combat aircraft are shown in Table 1. This demonstrates both rising unit costs in real terms between successive generations of combat aircraft and the actual levels of real unit costs. Combat aircraft are becoming costlier with fewer being acquired. For example, over 20,000 Spitfires (1940) were acquired compared with 160 Typhoons in 2003.3 Similarly for bomber aircraft, almost 8,000 Mosquitos (1943) were purchased compared with 136 Vulcans in 1954. Combat aircraft are also costly—reflected in the trade-offs compared with earlier generations of aircraft. A 2003 Typhoon cost the equivalent of some 8 Lightning aircraft of 1959, 26 Hunter aircraft

1 Typically, overseas troop deployments require a multiple of the numbers actually deployed. Overseas deployments require acceptable rotations so a 6 month overseas deployment requires at least another 1-2 troops for each one deployed overseas; and for a 6 month overseas deployment every 2 years requires at least another 4 troops for each one deployed overseas.
2 There is a view in the European Commission that the European Union is not in the business of collective defense. Instead, its focus is on a limited range of defense equipment aimed at reducing 'fragmentation.' In view of policies such as the Strategic Compass this is a strange view of EU defense policy.
3 Eurofighter is a European collaborative project with the four partner nations (U.K., Germany, Italy and Spain) purchasing 530 aircraft with exports of 151 units giving a total output of 681 units by 2019.

of 1955, 68 Meteor aircraft of 1946, and 163 Spitfires of 1940. These changes were over 63 years (1940–2003) with costs rising by a factor of 163 between the Spitfire and Typhoon fighter aircraft. The trade-offs can be presented differently—a force of 160 Typhoon aircraft is equivalent to over 26,000 Spitfires or almost 11,000 Meteors or 4,150 Hunters or 1,260 Lightning aircraft.

Rising unit costs will affect the future defense firm, leading to more technology-intensive and costlier equipment with smaller volumes. As a result, defense firms will become more R&D-intensive and less production-intensive, leading to long-run outcomes such as Starship Enterprise or Battlestar Galactica (Markowski *et al.*, 2022). But this is not the only future scenario. Technical progress in defense equipment might mean a greater emphasis on drones and uninhabited air, land, and sea vehicles, some operating from Battlestar Galactica. This scenario still means a technology-intensive defense firm but with a continued production-intensity with cheap drones being produced in large numbers. Such impacts will not be confined to defense firms but will have wider implications for a nation's armed forces. Augustine weapons systems will change the military personnel requirements of the armed forces with greater demands for highly-skilled technology-intensive military personnel.

Table 1: United Kingdom unit costs for fighter and bomber aircraft

Aircraft	*Unit costs (£s 000s, 2018 prices)*	*Date*	*Cost factor*	*Time period (years)*
Fighters				
Spitfire	219.5	1940		
Meteor	529.7	1946	x2.4	6
Hunter	1,376.8	1955	x2.6	9
Lightning	4,539.7	1959	x3.3	4
Typhoon	35,737.9	2003	x7.9	44
Bombers				
Mosquito	355.2	1943		
Lancaster	714.9	1943	x2.0	0
Canberra	1,660.2	1951	x2.3	8
Vulcan	9,740.7	1954	x5.9	3
Tornado	12,930.5	1979	x1.3	25

Notes: Fighters and Bombers are U.K. fighter and bomber aircraft. The time gap between the Lightning and Typhoon was filled by the United Kingdom acquisition of the U.S. Phantom aircraft for which no data were available in the DSTL data set.
Unit costs are for airframes only, excluding other aircraft costs such as engines, avionics and landing gear.
Dates are for date of first production contract.
Cost factor is the increase in unit costs between successive generations. For example, Spitfire to Meteor and Meteor to Hunter.
Time period is gap in years between successive generations such as Spitfire to Meteor and Lancaster to Canberra.

Sources**:** DSTL (2010); Hartley, K. (2020)

Evidence on defense firms

Past trends offer some guidance of possible future trends and the role of uncertainty. In 1900, aircraft firms did not exist and defense industries comprised land and naval firms supplying land equipment in the form of artillery, guns, ammunition, and surface warships. Over time, the defense industry has been subject to technical change. Bows, arrows, and horse-mounted cavalry were replaced by cannons, rifles, machine guns, and tanks; sail-powered naval ships were replaced by steam-powered battleships and submarines emerged as a new form of warship with a shift from steam and diesel power to nuclear-powered propulsion.

The aircraft industry is an example of the emergence and rapid development of a new industry accompanied by new armed forces in the form of air forces. The industry developed with the first manned powered flight in 1903. It received major boosts to both output and technical progress from the World Wars and entry into space led to it being renamed the aerospace industry. Aerospace firms dominate the world's top arms companies such as Lockheed Martin, Boeing, Northrop Grumman, and BAE Systems. Over time, aerospace firms grew from one person enterprises to large corporations, during which they achieved economies of scale and learning with new and different organizational forms (leading to new efforts to economize on transaction costs). Governments determined demand-side market changes but firms also responded on the supply-side of the arms market.

Technical progress has been a further distinctive feature of the industry. Since its creation in 1903, it has developed aircraft which fly faster, further, higher, and can carry greater loads more safely (i.e., weapons and passengers). Technical progress led to entry into new markets, especially space, jet engines, rocket power, and uninhabited air vehicles—all achieved in 120 years. Novel technology in design and manufacturing will result in a reduced importance of labor inputs in the production function. New materials and automation mean the substitution of labor with capital (machinery) and fewer opportunities for traditional labor learning. All these changes are costly, and increasingly the costs of change are borne by government.

Table 2(a): ***Top 10 arms companies, 2002***

Company	*World Rank*	*Arms Sales (USDm)*	*Arms Sales as share of total sales (%)*
Boeing	1	35,351	44
Northrop Grumman	2	31,510	93
Lockheed Martin	3	28,314	71
BAE Systems	4	22,416	77
Raytheon	5	18,036	72
General Dynamics	6	14,735	71
Thales	7	11,083	65
United Technologies	8	8,463	20
EADS	9	9,217	20
Honeywell International	10	5,582	17
Average		**18,474**	**68**

Notes: Data for 2002 excludes China. Chinese top arms companies entered SIPRI rankings from 2015.
Ranking based on arms sales for 2002 shown in 2021 prices.
EADS ranking was sensitive to the price index.
Average is for Top 10. Average for arms sales share based on median.

Government is central to understanding aerospace and defense industries. It determines the demand for aerospace and defense equipment and can use its buying power to determine the size, structure, conduct, performance, location, and ownership of the industry (Hartley, 2014). Over time, arms companies have become larger and their numbers have declined through acquisitions, mergers, and exits; it is likely that such structural changes will continue. Tables 2 (a) and (b) present examples of structural change amongst the world's top 10 arms companies between 2002 and 2021.

A comparison of the 2002 and 2021 data (Tables 2(a) and (b)) shows changes in company names, company rankings, and the average size of firm. EADS (European firm) changed its name to Airbus and United Technologies merged with Raytheon to become Raytheon Technologies. For company rankings, Boeing was the top world arms company in 2002 but was ranked third in 2021. Similarly, Lockheed Martin was ranked third in 2002 but was the top company in 2021. And over the period, the average size of firm within the top 10 increased by almost 60% in real

terms and their defense dependency declined substantially. Similar changes occurred when comparisons are made with the top 10 firms at an earlier date. In 1995, the top 10 firms were in rank order: Lockheed Martin; McDonnell Douglas; British Aerospace; Loral; General Motors; Northrop Grumman; Thomson; Boeing; GEC; and Raytheon (tenth rank). Again, between 1995 and 2002, there were name changes and acquisitions. McDonnell Douglas was acquired by Boeing; British Aerospace became BAE Systems after the acquisition of GEC–Marconi; Loral became part of L3 Harris; and Thomson became Thales.[4] Overall, the major aerospace firms dominated the world's top 100 arms producers. Increasingly, the major aerospace firms entered other arms markets, such as land, sea systems, electronics, and cyber.

Comparing the nationality of firms over the period 2002 to 2021, the most striking result is the crowding-out of European firms from the top 10. This partly reflects the inclusion of Chinese firms and that European defense firms are perceived as being too small. In 2021, only one European firm ranks in the top 10 (BAE Systems). It is also notable that there are no IT firms in the world's top companies.

European defense firms face two types of competition. First, top level competition from U.S. and Chinese firms and second, competition from the bottom from emerging countries such as Israel, South Korea, and Turkey. In coming years, competition will be a major driver and challenge for the future European defense firm. European collaborative defense projects are a possible solution.

Table 2(b): ***Top 10 arms companies, 2021***

Company	*World Rank*	*Arms Sales (USDm)*	*Arms Sales as share of total sales (%)*
Lockheed Martin	1	60,340	90
Raytheon Technologies	2	41,850	65
Boeing	3	33,420	54
Northrop Grumman	4	29,880	84
General Dynamics	5	26,390	69
BAE Systems (United Kingdom)	6	26,020	97
NORINCO (China)	7	21,570	26
AVIC (China)	8	20,110	26
CASC	9	19,100	44
CETC (China)	10	14,990	27
Average top 10		**29,367**	**60**
Average top 5		**38,376**	**65**

Notes: Data for 2021 include major Chinese arms companies and BAE Systems of the United Kingdom. All remaining firms in Top 10 are U.S. arms companies.
Time period 2002 to 2021 chosen because data available from SIPRI with 2002 sales data in 2021 prices.
Arms sales in 2021 prices. Arms shares of totals are medians.
See also Notes for Table 2(a).

Future European joint projects

European joint projects offer economic benefits but at political costs. Economic benefits arise from the expected cost savings from sharing total development and production costs. In the simple case, two or more nations agree to share the total costs of some new equipment, such as an aircraft, warship, or tank. To date, most completed European joint defense projects have been joint ventures for aerospace projects between a small number of European states, usually comprising France, Germany, Italy, Spain, and the United Kingdom. Examples include the two nation Jaguar strike

4 The 1995 data are not reported since they were not presented by SIPRI on the same basis as the 2002-2021 data.

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aircraft (France–United Kingdom), the three nation, multi-role Tornado (Germany, Italy, and the United Kingdom) and the four nation Eurofighter Typhoon (Germany, Italy, Spain, and the United Kingdom). Aerospace collaboration offers cost savings in development together with scale and learning economies in production compared with similar national projects. In a two nation example with equal sharing, development costs are divided equally between the two nations and production orders are combined from, say, 200 aircraft each, to give a combined total of 400 units. In principle, for each nation development costs are halved and unit production costs might be some 10% lower due to scale and learning economies (compared with two separate national projects).

Collaboration involves costs as well as benefits, with the ideal case being seldom achieved. Partner nations will have national requirements for work sharing, reflected in their demands for a share of new technology and production work, aimed at providing benefits for their national defense industrial base and their "national champions". The result might be reflected in duplicate flight test centers and final assembly lines, both reflecting departures from the allocation of work on a least-cost basis. Organization and management arrangements will reflect complex transaction costs as partners negotiate compromises about operational requirements, time schedules, work, and budget sharing. Overall, transaction costs reflect the fact that collaboration is a painful process, with each partner making sacrifices. Transaction costs are especially relevant for analyzing collaborative projects, since they involve complex international contracting. Collaboration costs are recognized by the European Defence Fund, which offers small amounts of funding to "incentivize" partner nations to collaborate through research windows.

Public choice analysis provides one explanation of the economic and non-economic features of collaborative projects. It identifies agents in the political marketplace and their behavior within the military–industrial–political complex (MIPC). The agents comprise voters, politicians, bureaucracies, and producer groups. For instance, budget-maximizing bureaucracies, in the form of the armed forces and government defense ministries, have incentives to over-estimate the threat and under-estimate project costs. Once started, collaborative projects are difficult to stop—exit might be costly for any one partner nation. International collusion replaces rivalry and national governments will be confronted with interest groups of scientists, contractors, and trade unions in each partner nation. Such international groups of experts will seek to influence vote-conscious national governments with the technological, military, and economic benefits of continuing with a collaborative project (e.g., employment and exports).[5] The outcomes of complex international bargaining between agents in the MIPC has resulted in inefficient work-sharing and management arrangements. Inefficiency has been reflected in the duplication of flight testing centers and final assembly lines (*juste retour*), additional management and organizational costs, delays due to design and management by committee as well as compromises in agreeing operational requirements, budget-sharing, and delivery schedules (Bellais, R. 2022; Matthews and Al-Saadi, 2021).

Assessing collaborative projects is difficult since there is only a small sample of projects for empirical analysis. The sample involves different types of projects (e.g., combat and trainer aircraft, transports, helicopters, and missiles) and different partner nations (France, Germany, Italy, Spain, the United Kingdom). Furthermore, there is the problem of the counter-factual, i.e., what would have happened without the collaborative project? For example, without the four nation Eurofighter Typhoon aircraft, would each of the partner nations have built an identical aircraft, buying the same quantity in the same time-scale; or would they have imported a U.S. combat aircraft (from a choice of the F-15, F-16 or F-18)? Further, collaborative projects need to be subject to the opportunity cost question: what is the alternative use value of the resources used in collaboration? This question is more easily asked than answered.

5 Hartley (2017)

Future European combat aircraft

Currently, two groups of European nations are developing two new combat aircraft known as the Tempest (or the future combat aircraft, FCA) and the future offensive air system (FOAS). These two projects will determine the future European aerospace firms and the European combat aircraft market. They show that the European combat aircraft market has consolidated around two major projects instead of the previously three independent programs (i.e., Gripen, Rafale, and Typhoon). The challenge is whether two projects are sufficiently viable to survive.

At the time of writing, the national groupings are the United Kingdom with its Team Tempest aircraft (FCA) and France and Germany with their FOAS. The United Kingdom led Team Tempest project is a sixth generation combat aircraft involving the United Kingdom, Italy, and Sweden with Japan as a further possible partner nation. It is planned to be flexible, capable, and affordable with innovative systems embracing manual and unmanned flight and will replace Typhoon. Launch was in 2018 with a planned in-service date of around 2040. The major companies involved in Team Tempest are BAE Systems, Rolls-Royce, Leonardo, MBDA, and Mitsubishi. Manufacturing will be based on the "factory of the future" using advanced manufacturing capabilities.

The European FOAS (also known as the Next Generation Fighter or NGF) is also a sixth generation combat aircraft designed to replace Typhoon and Rafale aircraft. France, Germany, and Spain are the partner nations involving Dassault Aviation as lead firm together with Airbus, Indra Systems, Safran, MTU Engines, Thales, and MBDA. In-service date is planned for 2040/45.

Inevitably, questions arise about whether the European nations and the United Kingdom can afford to develop two similar but costly combat aircraft—hence the case for collaboration. Both aircraft are designed to meet similar operational requirements in similar time-scales. Two aircraft will involve two R&D bills and smaller production runs compared with all nations agreeing to develop one combat aircraft and combining their national production quantities. Development costs for each aircraft type may exceed £300 billion.[6] But collaboration would increase total development costs by some 50% for each participating nation.[7] Also, Augustine forecast unit costs rising by a factor of four every 10 years. If development takes 20 years, unit production costs might reach £1.6 billion (based on Typhoon unit production costs of £100 million in 2022 prices). Such unit costs mean each nation will only be able to afford small quantities, say, 50–100 units per nation.[8]

Collaboration also requires the partner nations to reach agreement about a common operational requirement which often forms a barrier to any agreement, especially between France and the United Kingdom with traditional disputes over design leadership (i.e., between Dassault and BAE Systems on airframes; Rolls-Royce and Safran on aero-engines). The eventual outcome of the European rivalry in the combat aircraft market will have implications for the future European defense firm.

Future European defense firms

Forecasting faces uncertainty, and as no one can accurately predict the future, today's sunrise industries will be tomorrow's sunset industries—inevitably all forecasts will be wrong.[9] Nonetheless, some broad generalizations are possible using the past as an indicator of future trends in the period to 2050.

The first prediction is that the defense firm has a future. Unless there is an unexpected outbreak of world peace maintainable without a world military policing organization, the defense firm will survive although its future form

6 2022 prices from Pugh (2007, p. 86) which provides a formula used to estimate the relationship between development costs and unit production costs.
7 Pugh (2007, p. 87).
8 These cost estimates are illustrative only and are meant to provide orders of magnitude.

9 An earlier version of this article appeared in 2003: Hartley and Sandler (2003).

could change. Even a limited world policing organization would require modern weapons to enforce world peace. The surviving defense firm will be a different form of organization, using innovative forms of information technology leading to a new form of the modern corporation. It will adjust to new epidemics such as novel forms of Covid, to new national commercial laws, and greater "working from home". But for defense firms, "working from home" will be limited for some personnel as firms become more technically-intensive where costly technologies and physical capital inputs are provided internally by the firm (e.g., testing facilities and final assembly plants which are not available "at home").

The second prediction is that the future defense firm will be the result of changes in threats and changes in technology. New threats will emerge from different nations and groups. The Russian invasion of Ukraine in 2022 is an example of a new threat leading to NATO nations adjusting to the re-emergence of Russia as a military threat in Europe. Longer term future threats are much more difficult to predict; the European Strategic Compass outlined possible future threats for European defense firms, but inevitably cannot predict the unknown and unknowable. However, the Strategic Compass outlined a future for European firms supplying modern combat aircraft, new warships, and new tanks.

Novel technology is a further source of change. The armed forces will need to adjust and respond to new forms of weapons. Some technologies represent threats to the traditional activities of some branches of the armed forces; for instance, tanks and helicopters were a threat to cavalry regiments and a failure to adapt leads to defeat in conflict. Similarly, new technology represents a threat to the traditional business of some defense firms and failure to adapt and respond results in exit from the industry. Here, the costs of new technologies will be a factor in firm survival. Costly technologies such as Augustine weapons systems (Battlestar Galactica) are likely to be beyond private financing and will require substantial government funding. Other cheaper technologies will be within the financing of private firms and their survival depends on entrepreneurship. State-owned firms are less likely to be as entrepreneurial as private companies, but state-owned firms will be less constrained by budgets.

Change provides fresh market and profitable opportunities for defense firms. They will respond by creating new businesses or acquiring firms already established in emerging markets (i.e., acquisitions and mergers). Space systems provide another market opportunity, especially in satellite surveillance, navigation, and communications. Despite international agreements preventing the deployment of weapons in space, it is possible that such restrictions will not continue indefinitely or that nations might not observe international conventions, especially since there are first mover advantages.

The third prediction is a continuation of the long-run trend toward a smaller number of larger defense firms resulting in supply-side changes. As such, Augustine weapons systems will be a major driver of such trends. Increasingly, rising costs mean that national independence becomes too costly. For European defense firms, these changes will be reflected in more European-wide mergers, especially with European defense policy favoring less fragmentation of weapons systems (i.e., greater standardization of weapons with fewer new types). The search for less fragmentation within European defense markets will also lead to more collaborative defense projects, especially involving land and sea systems (e.g., tanks, armored fighting vehicles, and warships). The future market for advanced combat aircraft offers opportunities for collaboration amongst European, U.K., and U.S. defense firms. Rising costs of defense equipment might result in international mergers between European and U.S. firms with other possibilities involving Japan, Turkey, South Korea, and India. Such international mergers will raise new regulatory challenges. For example, there will be challenges in determining the profitability of international defense contracts. Nations have different rules for determining the profitability of non-competitive defense contracts and different arrangements for auditing profits.

There will be challenges in maintaining a national defense industrial base. For example, if the European Union wishes to maintain a defense industrial base for strategic and other reasons, it will have to be prepared to bear its

costs. Problems arise when the industry is faced with the downturn in sales which happens between major projects. Various policy options can be used to retain the industry, such as additional production orders for existing projects, ordering new technology demonstrators, or the "mothballing" of plants. None of these policies are costless. Mothballing of plants appears to be a cheap option but it also creates problems. Retaining a mothballed plant involves costs to maintain and police the physical plant and equipment. Also, when a mothballed plant is required for production, a new labor force needs to be recruited and trained, involving costs and time. Next, the costs of retaining an EU defense industrial base have to be estimated and member nations have to pay; member states need to agree how costs are to be shared and free riding avoided. The alternative to supporting an EU defense industrial base is to import defense equipment, most likely from the United States, which conflicts with the EU preference for strategic independence.

Another prediction is that company names will change and that new entrants will emerge, possibly from the information technology sector. The future defense firm will be radically different. In terms of new names, it has to be remembered that a century ago, Boeing, Lockheed Martin, BAE, and Airbus did not exist. The next generation of new entrants might be electronics and IT companies or large civil firms initially without any defense activities. There will be a focus on more profitable defense activities such as systems integration rather than "metal bashing" forms of manufacturing (e.g., robotics in the future factory).

Two general forms of defense company are likely to emerge. One is the highly specialized defense company with a range of defense activities (e.g., air, land, sea, and space systems). The other form is a diversified defense–security business with a substantial civil business providing insurance against downturns in defense sales. Mergers and acquisitions will involve acquisitions of different types of business such as the acquisition by airframe companies of aero-engine, missile, and helicopter companies in the aerospace industry (e.g., BAE acquiring Rolls-Royce in the United Kingdom). Defense firms are likely to acquire new technologies created by other firms rather than other firms entering the defense market. Such a development reflects entry barriers into defense markets resulting from the complexity of defense products even for new large technologies firms (Hobday, 1998).

Conclusion

The above predictions suggest that the future European defense firm will be different. Future firms will be as different as today's firms are as different from those of 1945, and more so compared with firms that were active in 1900. The European Strategic Compass will be a key determinant of the future European defense firm (probably to be termed defense and security firms). The Compass outlines the EU's Strategic Vision to 2030 and provides a framework for the future defense firm, where there will be more and better defense spending with projects being better defined and increasingly delivered as joint European projects. There will be a future for combat air systems, naval platforms, space capabilities, and tanks; these will be a focus for joint projects. New technologies will emerge with more emphasis on cyber warfare, such as artificial intelligence and quantum computing. There will be a continued support for an EU defense and technology industrial base which will benefit European defense firms. In the short term, the future firm will be affected by the conflict in the Ukraine with an emphasis on the production of existing weapons and the development of new systems arising from the Ukraine experience (e.g., various types of drones).

None of the Strategic Compass commitments are costless. Support for an EU defense industrial base cannot ignore the costs of maintaining the industry during troughs in project work. Costs of buying from Europe will also be apparent when the alternative of importing cheaper equipment is an option (e.g., from the United States). Nor will a European rapid reaction force be costless; it will need military personnel and new standardized equipment both of which raise major problems for any EU defense policy. These include trust, free riding, and nationalism. Trust is needed for any international military alliance; all partners need to be confident that their allies will turn up in any military conflict. Free riding means that smaller partners have every incentive to shift defense spending to their larger

allies. Nationalism cannot be avoided and will mean that nations will respond to their national defense preferences rather than the preferences of the collective alliance (especially where conflict involves deaths and injuries of European military personnel). Nationalism might also constrain the choice of partners for collaboration. Typically, European nations prefer European partners; but cost pressures and defense budget constraints might lead to the choice of partner nations outside of the European Union (e.g., Japan and the United Kingdom).

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The future of cooperative programs in Europe, paradox of a hybrid market

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Abstract

For European arms-producing countries, launching a cooperative program represents a compromise between preserving their domestic industrial base and achieving an affordable acquisition. Nevertheless, scientific literature is marred with criticisms regarding the effectiveness of such an approach. Paradoxically, this does not prevent European states from committing to new cooperative programs—the European Commission has set up mechanisms for improving the effectiveness of European defense industry based, de facto, on incentives to launch cooperative programs. This article looks at the place of cooperative programs in Europe to understand whether the new initiatives of the European Union can succeed in improving the effectiveness of military spending as well as enhancing European strategic autonomy. It analyzes the organization of the European armament market to explain why cooperative programs appear unavoidable. It explores how the European Commission could overcome current limitations through community-funded programs, given that such funding would foster the emergence of a European defense technological and industrial base.

Cooperative programs are a common feature among arms-producing countries, notably the most ambitious ones. This is particularly the case in Europe, where cooperation has represented a means to overcome the fragmentation of demand and supply into several national markets—with purely domestic complex defense capability programs becoming unsustainably costly in the 1980s. Cooperative programs represent a compromise between preserving a domestic industrial base and achieving affordable acquisition. Nevertheless, the literature in defense economics and political science is critical regarding the effectiveness of such an approach.[1]

Paradoxically, these critics do not prevent states from committing to new cooperative programs, e.g., future combat air systems (FCAS) and main ground combat systems (MGCS) today. In addition, the European Commission has set up mechanisms for improving the competitiveness[2] of the European defense industry that are based, de facto, on incentives to launch cooperative programs—notably, this is how the European Defence Fund (EDF) is functioning.[3] It is therefore necessary to understand how such programs can deliver the expected secure access to advanced capabilities at an affordable cost with a certain degree of strategic autonomy, despite the limits of past cooperative programs.

This article looks at the place of cooperative programs in Europe in order to understand whether the new initiatives of the European Union, like the EDF and the European Defence Investment Programme (EDIP), can succeed in improving the effectiveness of military spending as well as enhancing European strategic autonomy. The first part explores the limits of past cooperative programs, in the light of the organization of the European armament market, in order to explain why such programs appear to be unavoidable. The reasons why it is unlikely that intergovernmental

1 Hartley (2008); Schumacher (2014)
2 Even though the European Commission uses the concept of competitiveness, it would be more relevant to speak of effectiveness since this dimension looks primarily at costs than at the ability to export. Therefore, this article will use effectiveness instead of competitiveness with regard to the mechanisms set up by the European Commission.
3 De La Brosse (2017)

cooperation leads to an integrated European market are then examined. This is followed by an exploration of how the European Commission could overcome related limits through community-funded cooperative programs—fostering the emergence of a European DTIB (defense technological and industrial base).

Cooperative programs have been a critical feature of the European armament market for decades.
At the same time, European countries try to preserve their local capabilities by guaranteeing domestic security of supply while also minimizing costs by gathering resources on both demand and supply sides. The European Commission aims to induce countries to go further in terms of European supply and demand integration. It must however, clarify how cooperative programs are expected to promote the emergence of a genuinely European defense technological and industrial base.

Cooperative programs: a European way for accessing advanced capabilities

There is an apparent paradox regarding the European armament market. Despite many critics being against cooperative programs, they still represent a preferred approach for arms-producing countries, especially in order to access advanced defense capabilities. Nevertheless, the unique not-purely-domestic and not-yet-truly-integrated structure of the market can explain both these limits and the reason why states continue to launch such cooperative programs. Given this, cooperative programs are likely to remain a key feature of armament programs in the future, even for projects supported by community funding.

Intergovernmental cooperative programs and their limits

Cooperative programs are a feature of the European armament market since the second half of the 20th century. As Western European countries expected to restore or expand their DTIB during the cold war, working together was the preferred approach to improve strategic autonomy. Even though this approach was primarily a political choice[4], budgetary and industrial constraints have become predominant in favoring cooperation from the 1980s. Due to the cost escalation of major capabilities, even large European arms-producing countries have become less and less capable of sustaining purely domestic programmes [5]

Indeed, in theory cooperative programs can provide substantial benefits compared to domestic ones. Research and development costs represent a large share of advanced capability programs—for instance, even for a program as large as the F-35 combat aircraft, R&D represents 22.6 percent of total costs.[6] The lower the production volumes are, the higher the share of budget allocated to R&D is—although, R&D costs are independent from expected production volume but depend on expected performances of a given capability. The fragmentation of European market results in multiplying redundant R&D spending, making purely domestic programs unaffordable; cooperative programs offer the possibility of substantial savings.

Combining national orders is also likely to reduce unit costs—deliveries can come closer to the optimal level of production, minimizing unit cost, and a large volume of orders smooths production ups and downs thereby maximizing productivity. In a cooperative program, participating countries can also share non-recurring costs (e.g., final assembly lines), which are generally sunk costs being specific for particularly advanced defense capabilities.

In the last quarter of the 20th century, economic imperative has favored a Europeanisation of defense investment,[7] a trend reinforced by enthusiastic states with regard to the deepening of European defense.[8] However, when political division prevents market integration achieving the market size required for a sustainable DTIB, cooperation can be adopted as the second-best solution. European cooperation has taken multiple forms, from bilateralism to

4 Faure (2020)
5 Bellais (2017b)
6 GAO (2022)
7 Bellais (2017b)
8 For an overview of such trend, see From St-Malo to Nice, European defense: core documents, compiled by Maartje Rutten. Chaillot Paper 47, Paris: Institute for Security Studies, 2001.

multilateralism (including minilateralism); i.e., flexilateralism, defined by Samuel Faure as "the policy through which a state simultaneously implements varieties of international cooperation to address a public problem."[9]

However, cooperative programs have not delivered their theoretical benefits. Some consider that arms cooperation simply fails in Europe—"not as successful as expected" would perhaps be more appropriate, with some European cooperative programs underperforming or encountering stalemates.

Most initial assessments regarding defense programs suffer from "the conspiracy of optimism", being a (sometimes consciously deliberate) underestimation of risks, costs, and timescales in order to ease the launching of a new program.[10] This is especially true with regard to cooperative programs, because of higher information asymmetry and frequent lack of past experiences between participating states and industrial stakeholders. Such a conspiracy represents a means to launch a cooperative project, then later insulating the corresponding program from possible budget cuts.

Nevertheless, the limits of cooperative programs result mainly from specific issues that are markedly evident in Europe (though can appear in non-European projects). In particular:

- Such programs do not have optimized specifications, because participating states are not keen to compromise on domestic military specifications. Rather than leading to a unique design, cooperative programs result in several variants of systems (e.g., 23 versions for the NH90 mission helicopter) that have sometimes a markedly loose connection between each other (e.g., French and Italian FREMM frigates). Limited convergence on specifications significantly reduce potential economies of scale.
- The workshare between industrial partners is not based on industrial grounds but on political ones. Each participating country expects to get back at least its share of funding and, to secure such juste retour, it designates which domestic companies must be included in the project. Due to such political interferences, the choice of contributors does not rely on industrial logic in terms of work-sharing or responsibilities. It can also introduce unnecessary risks when industrial partners have to develop new competencies and systems which already exist elsewhere (e.g., the TP 400 engine for the A400 mission aircraft).
- European intergovernmental cooperation is problematic since there is no *primus inter pares* between countries (contrary to transatlantic ones for which the predominance of the United States gives it such a role[11]). This results in a lack of demand-side leadership: no delegation of authority, limited competences, conflicts of agendas, heterogeneity of domestic procurement agencies, etc. that impedes both the implementation of the project on the demand side and the supervision of the supply side.
- Because of the political selection of participating companies, it is difficult to designate a single industrial architect as decision make regarding the design, workshare, and management of the supply chain (e.g., the stalemate between Germany and France about the leadership of FCAS project being Airbus or Dassault Aviation). The lack of supply-side leadership is likely to result in dysfunctionalities, such as weak mechanisms of arbitration and cooperation/competition dilemmas for industrial partners.

The NH90 helicopter perfectly illustrates the combination of such biases, but it is possible to find counter-examples of successful European cooperative programs like the Scalp/Storm Shadow missile or the Boxer armored

9 Faure (2019, p. 1)
10 Witney (2012)
11 Some biases of cooperative programs can be reduced when the United States is involved thanks to a huge asymmetry of power that gives the American side the ability to impose decisions (cf. F-35). There is a de facto alignment of other countries, which accept both military specifications and industrial workshare defined by the United States.

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vehicle. There are no exceptional issues linked to military capabilities with problems in cooperation and/or obstacles in developing complex systems being similar in both civilian and defense programs. For instance, developing civilian aircrafts can be challenging with multiple industrial partners, large international value chains, and ambitious technological roadmaps. Programs like the A380, C919 or B787 have experienced several difficulties and crises that are very similar to ones observable in the defense industry (or other civilian domains like nuclear energy, high-speed trains, or satellites).[12] Many civilian cooperative programs have experienced disappointments too, especially concerning complex systems. Defense cooperation is not doomed to failure *per se,* but, particularly in Europe, factors exist that favor issues and stalemates which particularly apply in Europe.

A unique hybrid armament market in Europe

The limits and stalemates of cooperative programs are not specific to projects between Europeans. Non-European cooperative programs and even purely domestic ones have experienced additional delays, excessive costs or lower than expected technical performance[13].

Nevertheless, it is certain that many European cooperative programs have delivered lower than expected outcomes, repeatedly and without evidence of learning. An explanation can be found in the organization of the European armament market, characterized by the major role played by cooperative programs for advanced military capability (out of necessity). The European configuration is globally atypical in that cooperative programs have not logically led to cross-border integration (as would be expected in civilian markets). In reality there is no "European armament market" because of constraints imposed by states to preserve their domestic DTIB. Europe is in fact composed of a set of national armament markets with limited porosity between them—creating a need for repeated new cooperative programs in order to maintain industrial cross-border partnerships.

Given the above, this article labels the European armament market as a "hybrid market" reflecting its arrested development between a purely domestic organization and a full Europeanisation. This concept can be compared to the different kind of industrial globalization in civilian sectors.[14] Despite some cross-border links, companies have to find a compromise between a true industrially-sound integration at the European level and a national footprint that is still required by the demand side as a condition for the security of supply.[15] This in-between situation creates a hybrid market, combining national and European dynamics, where companies must rely on cooperative programs in order to manage both levels of this peculiar market. This feature explains why most of European groups can be defined as multidomestic companies.

With limited success, the European Commission has pushed for a more open internal market at the European Union level, in fact since the years that followed the end of the cold war.[16] Contrary to the civilian market, armament regulation remains a national competency and states rely on Article 346 TFUE (Treaty on the Functioning of the European Union) to prevent the European Commission from harmonizing rules and creating a unique market at European Union level. Despite this, the European Commission succeeded in promoting two directives on intracommunity transfers (2009/43) and public markets on defense and security (2009/81); paving the way for the

12 Cohen (1992); Lawrence and Thornton (2005)

13 Reports from American GAO, British NAO, French Cour des Compte, etc. provide numerous examples of programs that have poorly performed.

14 Berger (2005); Hagedoorn and Schakenraad (1994)

15 We do not consider, here, other grounds that push states from rejecting the creation of an integrated armament market in Europe similarly what was achieved for many civilian markets. However, several reasons exist beyond national security favoring a kind of protectionism: local industry interests, employment, dual activities and technologies, exports, etc. These dimensions can be considered as factors amplifying the dynamics linking to the security of supply rather than modifying them. For the sack of demonstration, this article does not deal with these dimensions.

16 Underlined by the Bangemann communication. See *The Challenges facing the European defense-related industry, A contribution for action at European level*, COM(96) final, Brussels: Commission of the European Communities, 24 January 1996.

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creation of a unique European market by facilitating better fluidity on both demand and supply sides.

Despite the defense package of 2009, states still resist the integration process that these directives should favor. The implementation of these directives relies on the goodwill of states and the limited implementation of this defense package clearly demonstrates that states are not keen to accept such rules of the game, especially regarding the opening of their defense procurement; and so the situation remains fragmented. Maulny *et al.* (2020) illustrate the situation:

> "*During the 2016-2019 period, the study suggests that the implementation of Directive 2009/81/EC has improved compared to 2011-2015 but remains at a significantly lower level than for non-defense procurements. In particular, the publication rate (i.e. the proportion of procurements that have been tendered competitively through TED) for defense procurements has reached 11.71 % in average over the 2016-2018 period which is higher than on the 2011-2015 period (8.5% in average). However, it remains significantly lower than for non-defense procurements (around 24% for procurements covered by the 'general directive'). Despite a certain improvement, TED data suggests that most contracts remain awarded on a purely national basis (82% in average).*"[17]

Even with this favourable environment, states have not fundamentally changed the way they regulate armament markets. They continue to focus on a domestic perspective that maintains the fragmentation of markets over Europe. This fragmentation on both the demand and supply sides results in poorly effective domestic markets, which are quite often below the threshold of sustainability due to the size of domestic orders and the cost of required technology and investment. The only solution is to integrate national DTIBs to create a larger and more competitive European market—an economic evolution made difficult by political requirements linked to sovereignty and security of supply.[18] This is why cooperative programs play such a critical role as a second-best solution in Europe and why most of these programs appear inadequate.

Arms procurement is ultimately a demand-led market that is defined at the national level. Indeed, the defense industry can influence the choices of investment (technical specifications, types of equipment, quantity, intra-budgetary competition, etc.). However, nothing is possible without demand-side impulse and decisions. In addition, European industrial cooperation implies that many decisions that companies usually take in civilian sectors are also taken by states in the field of armament: which company is involved, how workshare is allocated, in which country activities are located, how IPRs are managed, etc.

Companies are not able to push for a deeper integration of national markets, since any cross-border activity relies on the authorization from involved countries—in particular with regard to export regulation or the security of supply. The defense industry exists primarily in order to fulfil the needs of domestic armed forces. Contrary to civilian activities, defense companies do not have many levers to reshuffle their assets across borders (even though they are multi-domestic groups) and to implement strategic decisions at the group level.

This explains that while European mergers and acquisitions have created some European groups (e.g., Airbus, Thales, and BAE Systems), it has not resulted in the creation of specialized centers in different European countries. Trans-European companies have an industrial footprints quite similar to the one before consolidation.[19] Thus the only specialization that has emerged has resulted from demand-side requirements.

MBDA, however, may provide a good example of consolidation. Its centers of excellence in France and the United

17 TED is the Tenders Electronic Daily published online by the EU. Quotation from Maulny, Simon and Marrone (2020, p. 63)
18 Briani (2013)
19 Bellais and Jackson (2014)

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Kingdom were created thanks to the Lancaster House treaty signed in 2010 and the resulting intergovernmental agreement in 2015. Both countries had similar competencies in missiles systems but without a sufficient workload to secure the sustainability and related strategic autonomy. The treaty opened the way to overcome duplications and create specialized centers of excellence located across the countries thanks to a politically-blessed mutual interdependency, giving birth to a shared missile technological and industrial base.[20]

This example is almost unique in Europe regarding its degree of cross-border integration, but it proves that this process can be achieved given the political will and trust between involved countries. As such, the European armament market can further be defined as a hybrid market because it combines purely domestic features with some aspects of Europeanisation achieved mainly through cooperative programs (mostly in terms of value-chain organization). However, cross-border features rely on domestic decisions and could be reversed if such a change corresponds to national choices. In this sense, the European armament market's unique configuration that simultaneously combines domestic and European features has come about because a purely domestic DTIB is no longer sustainable industrially while a fully European DTIB is not acceptable politically.

States interfere with industrial dynamics and strategy. For instance, they can induce competition or duplications across Europe despite limited market size or limiting/blocking cross-border consolidation and reshuffling without a true industrial rationale.

Europe's unique configuration in the world renders any progress toward the integration of domestic DTIBs fragile since it depends on the goodwill of national decision-makers without any third party being able to push in favor of an irreversible integration process. We are far from the expected dynamics from a national to a European market that many had envisioned in the late 20th century.

No ratchet effect from intergovernmental cooperation

By the end of the 20th century, many had perceived the blossoming of European cooperative programs as the prelude to the creation of an integrated armaments market inside the European Union—particularly after the European Defence Agency (EDA) was set up in 2004. However, intergovernmental cooperation appears to be a temporary coalition of the willing because it is driven by a series of specific passing shared interests or stakes. If the Europeanisation dynamic stalls or if domestic interests are no longer compatible with a cross-border approach, any progress toward a more integrated European market could be stopped or even reversed.

The weakening of the Europeanisation dynamics

While many European cooperative projects were launched at the turn of century, such dynamics have almost vanished over the past two decades. Ongoing programs have experienced some difficulties which to a degree can explain the lack of appetite for new cooperative projects with European countries continuing to prefer domestic rather than cooperative projects, despite a fall of military spending after the 2007-2009 financial crisis. As EDA statistics underline, European collaborative procurement remains limited to a fifth of total procurement in the long term despite limited budgets and cost escalation of major capabilities.[21]

European collaborative procurement spending was on an upward trend until 2011 as a result of legacy programs, especially those launched in the 1980s and 1990s. Such dynamics seem to have weakened ever since—despite the creation of the EDA in 2004 as an intergovernmental agency aimed to foster cooperation and market integration at the European Union level. As the EDA underlines, member states have not achieved the benchmark they had

20 Bellais (2022)
21 Kirkpatrick (2004, 2008)

collectively approved, namely that of 35 percent of European defense equipment procurement being collaborative. It seems that the creation of EDA did not help to strengthen the incentives to develop and procure capabilities through cooperation.

In Figure 1 this trend is clear in absolute values, with collaborative spending being nearly cut by half. The marked exception to this is 2021, and the below further analysis is based on the period to 2020.[22] Without a concerted effort to pursue the Europeanisation of defense investment, nations will continue favor domestic programs or off-the-shelf procurement to the detriment of new European cooperative projects. It is even worse regarding defense Research and Technology (R&T). European collaborative R&T spending has collapsed in both absolute value and relative share since 2008, revealing the absence of common desire for sharing future capability programs. Such investment is especially required for emerging technologies where huge non-linear investments are necessary in order to have a level playing field with international competitors.[23]

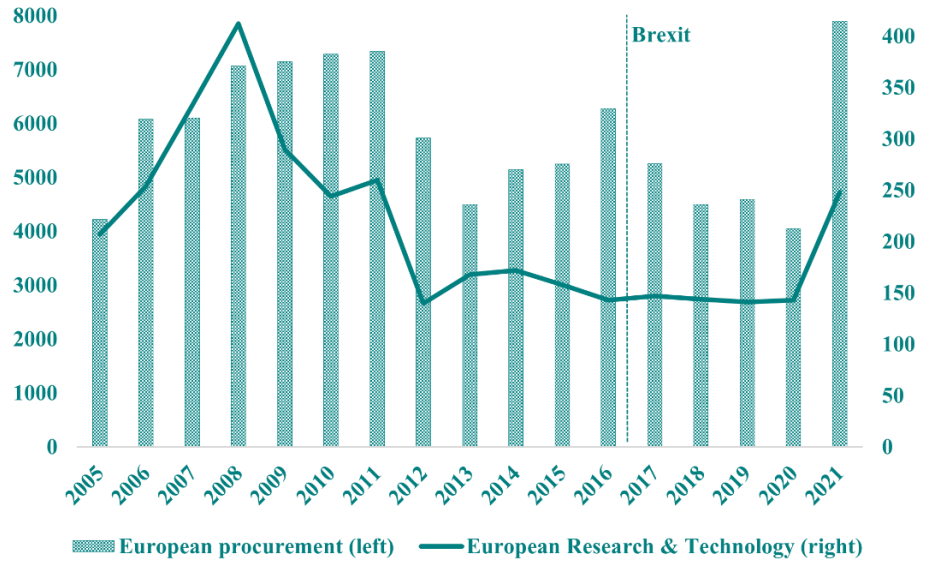

Figure 1: European collaborative military spending in EUR bn
Note: 'EDA 27' until 2016, all EU member states except Denmark; 'EDA 26' from 2017 after the exit of the United Kingdom from the EU.
Source: European Defence Agency.

As described in Figure 2, member states have been far from reaching both EDA collaboration targets of 20 percent of R&T and 35 percent of procurement. Shared R&T as a whole and as a percentage of all R&T spending have drastically fallen since their 2008 peak due to the ending of major cooperative projects launched in the 1990s and the lack of major new projects. Paradoxically, the smaller the budget that states allocated to defense R&T, the more resources they spend in purely domestic projects. It seems that the EDA has not be able to become the expected catalyst for common projects between its member states.

Available EDA statistical series contain a discontinuity, since they include the United Kingdom only until 2016, when it left the European Union. It is not possible to reconstruct global statistics without the United Kingdom—however, given that the United Kingdom was a country with low enthusiasm for European cooperation, its exit from the European Union would have been expected to raise the relative number of cooperative programs as seen in the EDA data. The fact that this is not visible illustrates that the United Kingdom was far from the only country to become reluctant to choose European cooperative programs.

22 2021 is ignored as recent data of this sort is often subject to revision, there may be COVID lockdown effects. Further year data publications will clarify this.
23 Setter and Tishler (2006)

It seems that cooperation between European countries can no longer nurture a cross-border integration of both demand and supply sides at the European level or favor the deepening of existing cross-border links.

Nevertheless, while cooperative programs are seen not to be the preferred option, the apparent disenchantment does not prevent countries from launching new cooperative programs when this is the only option to combine autonomy and sustainability—illustrated by Eurodrone, FCAS (with two competing projects[24]) and MGCS. The European armament market seems to be stuck with its suboptimal hybrid organization with fragile intergovernmental cooperation—it favors neither a convergence of military needs on the demand side, nor an integration of DTIBs at a European level.

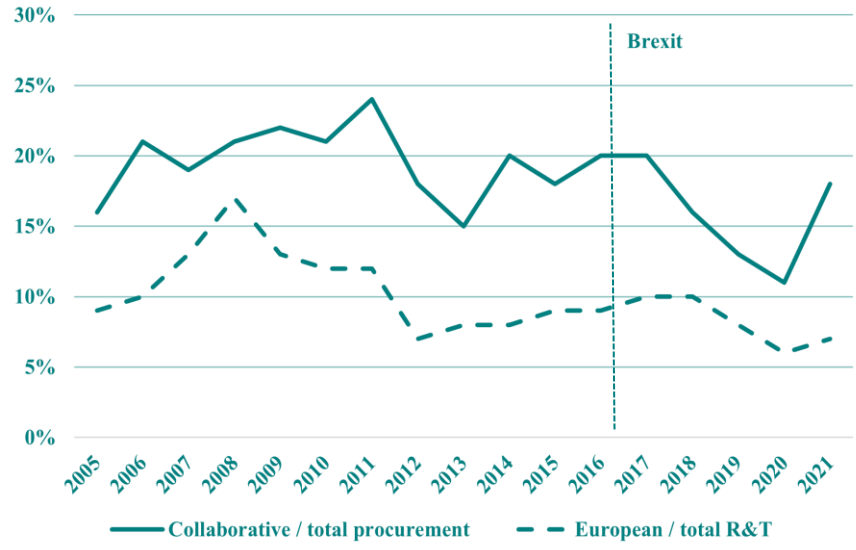

Figure 2: European collaborative military spending as percentage of total military spending
Note: 'EDA 27' until 2016, all EU member states except Denmark; 'EDA 26' from 2017 after the exit of the United Kingdom from the EU.
Source: European Defence Agency.

The temporary nature of intergovernmental cooperation

Contrary to late 20th century expectations, the launching of cooperative programs is not an irreversible process that transforms the European armament market. It seems far from being obvious or automatic that once countries and companies cooperate on a given kind of capability, they will build on this relationship and eventually evolve into an integration process at the European level. As long as cooperative programs remain based on an intergovernmental approach, the hybrid nature of the European armament market looks set to remain—even though such programs can lead to an industrial consolidation between some participating companies, there is no integration on the demand side or at the level of industrial assets through specialized centers across Europe.

Each arms-producing country expects to keep (or acquire) as many competences as possible on its territory. This duplication risk was demonstrated once again when France and Germany disagreed on the sharing of competencies regarding FCAS project. Rather than favoring a cross-border specialization, discussions revealed that each country still wanted to master domestically the whole range of competencies, thus being able to go alone if necessary. This example echoes the reason why Thyssen Krupp Marine Systems had to demerge with Swedish shipyard Kockums, since Sweden had feared that the German shipyard would sacrifice some local competencies and deprive Swedish Navy from a fully-capable domestic supplier.[25]

24 France and Germany launched a FCAS project in 2017 eventually joined by Spain two years later. The United Kingdom announced the Tempest programme in 2020 in association with Italy and Sweden, enlarged to Japan in 2022.
25 Bellais (2017a).

We should keep in mind that cooperative programs are opportunistic by nature on both sides of the market. On the demand side, states look for a second-best solution to overcome the dilemma between strategic autonomy and budget constraint. However, this dilemma no longer exists if states renounce strategic autonomy. This most notably occurs through off-the-shelf acquisition, or if they can afford developing a purely domestic solution as long as they accept a lowering of their ambitions (e.g., Gripen combat aircraft in Sweden).

Moreover, the political nature of defense cooperative projects explains that failure is more frequent and less costly than in civilian projects. Indeed, cooperative programs represent peer-based programs, with limited commitment since they are non-binding agreements with only political exit costs.

A good illustration of the limits of intergovernmental cooperation in progressing toward an integrated European armament market is the "Letter of Intent" (LoI), a document signed in 1998. France, Germany, Spain, the United Kingdom, Italy, and Sweden, which were the six largest arms-producing countries in Europe, proposed to facilitate European defense industry restructuring. It became a framework agreement in 2000 and an international treaty in 2003. The LoI aimed to act mainly as a forum where country representatives could discuss harmonization and identify joint priorities.

Unfortunately, this forum was not able to deliver any significant progress with regard to the six domains on which it was supposed to work[26]. In all of them, progress was limited to either bilateral negotiations[27] or initiatives from the European Commission (e.g., the Code of Conduct regarding exports). The failure of LoI, despite initial strong political will, underlines that states are not able, or lack the determination, to move from a domestic armament market to a truly European one. Since states engage into cooperative program as the second-best solution to preserve their DTIB, such cooperation is conditioned by this constraint. This means that any cross-border organization based on European cooperative programs can be undone as soon as a better solution becomes available.

If links are weak on the demand side, they are even weaker on the supply side. Most companies are not keen to participate in a cooperative program—with most of these programs being initiated and organized by states, with companies having no choice but to join if they want to remain in the armament market. Quite often the imposed industrial consortia encompass their competitors with similar competencies; a situation which is vastly contrary to civilian projects undertaken on an industrial rationale where companies choose to work together because they share strategic stakes.

In addition, links created through a cooperative program are based on a workshare inside an ad hoc value chain. Once this program ends, there is no reason for participating companies to continue to work together. Most of the time, such cooperation does not result from a strategic commitment but from political necessity with companies designated as "national champions". Rather than companies working together for industrially strategic reasons (as in the civilian sector), intergovernmental cooperative programs put together companies that have not considered a strategy together, have not necessarily worked together before, and could even be competitors in side markets or even in the same market before and/or after the program. The NH90 helicopter provides a good example of such a situation. This program gathered two prime companies, AgustaWestland (now Leonardo Helicopters) and Eurocopter (now Airbus Helicopters) because they were designated as national champions by Italy and France. However, these companies were (and still are) fierce competitors in both civilian and military markets, rendering both eager to get their freedom back as soon as possible; making cooperation difficult and rendering any integrative benefit of such a program improbable.

26 Namely, Security of information and mutual procedures, Standardization of contracting procedures (including IPRs), R&T priorities and establishment of joint military needs, Export control with the principle of a global license by project, and Procurement safety (especially in case of restructuration).

27 For example, the Lancaster House treaty between the United Kingdom and France, and the Aachen treaty between Germany and France.

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Even in the example of MBDA, the degree of cross-border integration appears limited.[28] Even though the missile industry has benefitted from the political incentives to organize an integrated French-British industrial network, the "One MBDA" process remains incomplete. Each country asked to keep a nucleus of skills and knowhow in each critical domain in case the bilateral cooperation ceased.

It is demonstrated that intergovernmental cooperative programs do not provide sufficient incentives, on both demand and supply sides, to build an integrated European market. Any step toward some level of integration can be reversed if an alternative approach becomes possible or if an existing cross-border relation is not cemented with sequential programs—without launching a next-generation project, it is likely that the cooperation between participating states, and even more so between companies, will dry up once the initial capability has been delivered.

Lessons learnt and the design of European Union defense industrial policy

The European Commission has become increasingly involved in European cooperative programs since 2016. This community funding could become a game changer since it could disrupt the hybrid nature of the European armament market by favoring a stronger integration.[29] Nevertheless, cooperative programs are not an end in themselves, they ought to constitute a means to irreversibly achieve cross-border integration and so progress toward a truly European DTIB.

New European Union tools, new market rules?

The hybrid nature of the European armament market hinders the effectiveness of the supply side and increases costs for states. Even though EU states have favored cross-border links, integration remains unachieved and cannot be compared to a full consolidation of the defense industry across the main arms-producing countries—not to mention the persistent fragmentation on the demand side. The European Commission made such an assessment as early as the middle of the 1990s with the Bangemann Communication[30] but was prevented from interfering with state policies. As Jean-Pierre Darnis states, "functionalist integration does not work for defense, because the monopoly of violence is not shared, or only marginally."[31]

This is the reason why the European Commission has changed its approach to encourage a transformation of the European armament market. Since 2016, it has set up financial tools providing incentives to behave according to the Commission's vision regarding the evolution of the European armament market on both the supply and demand sides. Such incentives can work if, and only if, states and companies accept community funding. Resistance is possible, but the new geostrategic context is favoring a more flexible approach from states. The Russian invasion of Ukraine has provided a need for greater military efforts, paving the way for a larger role for community funding.

The European Defence Fund (EDF) was initiated in 2016 with a first call in 2021, but its role seems to have become more and more important since the February 2022 Russian invasion of Ukraine. This fund was conceived as a means to improve the effectiveness of the European defense industry, which in large part consists in overcoming the limits of intergovernmental cooperative programs. It represents an opportunity to set up incentives to base cooperation upon an industrial rationale by choosing new eligibility rules for projects.

The EDF gives access to community funding that aims to complement national R&D spending. Admittedly its budget is only EUR 8bn for the period 2021–2027, significantly below the initial ambition of EUR 13bn. This represents an average yearly budget of EUR 1.14bn, which is significant but remains limited compared to member

28 Bellais (2022)
29 Bellais and Fiott (2017)
30 See *The Challenges facing the European defense-related industry, A contribution for action at European level*, COM(96) final, Brussels: Commission of the European Communities, 24 January 1996.
31 Darnis (2021, p. 7)

states' total investment of EUR 9.2bn in 2021 alone. Its impact is likely further limited because EDF funding will be spread over all EU countries whereas two of them account for 96 percent of defense R&D in Europe.[32]

However, community financing will either reduce the budget constraint for participating countries, encouraging them to cooperate on new projects for which there were previously no funds available either multilaterally or domestically.

Beyond an additional funding, the EDF aims to increase the effectiveness of expenditure by encouraging participating countries to pool their efforts. Its eligibility rules promote the consolidation of existing centers of excellence in Europe by selecting partners on the "best athlete" principle and not according to their nationality. By strengthening these centers rather than duplicating them, these rules are likely to favor the specialization across Europe necessary to converge toward a European DTIB and achieved the critical mass required to guarantee the sustainability and effectiveness of such centers. The EDF may be a vector of efficiency for public spending by effectively promoting consolidation of industrial assets.

The involvement of the European Union in cooperative programs could help to avoid the limits and stalemates experienced through intergovernmental cooperative programs. The European Commission can act as a third party with the ability to put in place effective rules and arbitrate among stakeholders to limit counterproductive behaviors. Indeed, lessons learnt from past projects provide clear guidance about how cooperation ought to be organized.

Four dimensions can be identified. First, it is important to avoid viewing cooperation as a last resort for when domestic programs are no longer affordable or manageable—cooperating must be the starting point.

Second, states have to converge their operational needs and approach before launching a cooperative program to reduce divergences or incompatibilities in technical specifications. This may be difficult to achieve where states have identical legitimacy to request national specificities in exchange to their participation. The European Union could achieve better results since EDF-funded projects are supposed to respond to military needs identified through the Permanent Structured Cooperation (PESCO[33]).

Third, critically many intergovernmental cooperative programs failed or faced major troubles because of a loose or ineffective industrial organization. It is therefore important to organize the industrial side of cooperative programs on industrially-sound criteria similar to those of successful of civilian cooperative programs for complex systems. Lessons learnt provide four critical rules:

- Design a clear industrial leader architect/integrator as a decision-maker, judged on milestones and outcomes, to avoid being stuck between same-level peers with conflicting interests (often backed by their domestic authorities).
- Select industrial partners based on the "best athlete" principle rather than on juste retour to minimize the number of weakest links throughout the value chain. This helps overcome *relational* complexity usually experienced by traditional state-led projects.[34]
- Give the integrator margins of maneuver to propose technical adjustments and manage the supply chain smoothly (no political/administrative interference), which helps minimize the *task* complexity usually experienced.[35]
- Favor a work-share allocation that reinforces existing centers of excellence rather than duplicating competencies in new facilities elsewhere. Such duplication engenders risk of failure or under-performance and is likely to create

32 In 2021, France spent €6.8bn and Germany €2.0bn in defense R&D. The Netherlands is the third largest spender but only invested €148m.
33 Established in 2017, this state-level mechanism allows willing and able member states to jointly plan, develop and invest together by committing to binding projects. See https://www.eeas.europa.eu/eeas/permanent-structured-cooperation-pesco_en
34 Ford (2015)
35 Ford (2015)

"industrial zombies" after program completion because of a de facto overcrowded market.

Fourth, since community-funded projects will remain intergovernmental programs in their implementation, it is appropriate to use a third-party institution to pilot these projects and stabilize national commitments. The European Commission could play such a role, assuming it has the suitable technical competencies, but it seems improbable in the short run. As such, it should rely on existing specialized institutions, on the model demonstrated by the European Space Agency regarding space programs; these can be either international project agencies (e.g., ESA, OCCAr)[36], or national acquisition agencies acting on behalf of the European Union. This last configuration may seem surprising, but it worked effectively for the Meteor missile program where the United Kingdom managed the program through its national procurement agency but to the benefit of all participating countries.[37] The issue is identifying, on an ad hoc basis, the institution that has required expertise.

Cooperation vs integration? The European dilemma

As Daniel Fiott underlines:

> "*The Commission's enhanced role in defense is not just a question of institutional arrangements and remits. Rather, the presence of the Commission raises a fundamental question about the very soul of EU defense cooperation—should it proceed in an intergovernmental fashion as it has done in the past, or is a more communitarian approach desirable in order to break through intergovernmental deadlock?*"[38]

The new community dynamics represent a positive evolution to support a stronger mutualization of defense efforts and a more effective use of public spending for Europeans. Nevertheless, the chosen approaches underline the limits to the hybrid nature of the European armament market. Indeed, the European Commission aims to foster cooperation in both the demand and supply sides—suggesting that the European armament market is likely to remain fragmented despite efforts to promote an integrated market.

There is a contradiction in the desire to generate a European DTIB while the using of financial tools that reward a cooperative approach that supports the classical intergovernmental framework. As such, the European armament market is likely to fall into the same trap again and again that prevents Europe from leveraging on projects to build an integrated market.

This is especially obvious on the supply side. The implementation of new EU tools is based on rules that prevent a trans-European company from proposing different national subsidiaries under separate national flags because projects must gather unconsolidated companies from multiple countries. This was driven by requests from states wanting to secure the participation of domestic companies rather than foster trans-European consolidation that may negatively affect their own DTIB. So the rules appear contradictory, with the objective being integration but the chosen means to achieve this in fact encourages fragmentation to secure community funding. While this criterion is in line with the objective of opening up value chains, by integrating companies from other countries in EU-funded projects, community funding must encourage the links between domestic DTIBs. However, this principle contradicts the pre-existing company efforts to overcome national boundaries and create trans-European suppliers. Paradoxically, from the late 1980s to 2016, companies such as Thales, Airbus, MBDA, Leonardo, and BAE Systems had their desire to consolidate assets in Europe blocked by national states' restrictions imposed to preserve their domestic DTIB. As such, EU policy promotes cooperative projects to promote the creation of a European DTIB while simultaneously

36 The European Space Agency and the Organisation for Joint Armament Cooperation
37 Bellais (2022)
38 Fiott (2019, p. 4)

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sanctioning trans-European companies that have already achieved a certain degree of cross-border integration.

Comparisons can be made with similar situations in international economics. Globalization can be understood from two perspectives.[39] First, that globalization simply represents an intensification of trade flows between countries with more globalization simply meaning that flows are denser without transforming industrial bases in each country (as it was the case for globalization before 1913). Second, that globalization is a transformative process when cross-border flows reflect a deeper integration between national industrial bases through the globalization of companies themselves, and the internationalization of value chains. As summarized in Table 1, apparently similar features of internationalization actually reflect fundamentally different dynamics.

Table 1: Internationalization vs globalization

Internationalized economy	*Globalized economy*
The world is the sum of interdependent nations	The world is integrated with decaying frontiers
Focus on the interdependency and cooperation between states that master the regulation of international interactions	Focus on the integration and the diminishing role of states in favor of companies, markets and global regulations
Economies keep national specificities	Companies' specificities are independent from their home country
Flow indicators: international trade, foreign direct investment etc.	Indicators of economic or social convergence: prices, specialization preferences, institutions etc.
Cyclical evolution of free trade and reversible choices	Irreversible evolution toward the integration of domestic markets

Source**:** Adapted from Siroën, JM, 2004. The international is not the global: For a reasoned use of the concept of globalization. *Journal of Political Economy* , pp. 681–698.

It is likely that even with the community funding, cooperative programs will become an end rather than a means to achieve another step in the organization of the European armament market. Cooperative programs can make sense as a means of strengthening of European strategic autonomy only if they are the prerequisite for the integration of both demand and supply sides. In fact, this was the case in the past for key capabilities like helicopters, missiles, or mission aircraft. Participating states had accepted that a cooperative program led to industrial consolidation and some cross-border specialization. Nevertheless, such integration cannot be taken for granted as they require that new intergovernmental programs must nurture the resulting industrial base, which would otherwise wither and decay.

In fact, the European Commission is learning from the initial steps of its new tools, but it is important to learn fast and quickly evolve associated rules to avoid the "cooperation for the sake of cooperation" trap. Even if EDF rules introduce positive innovations for more effective cooperative programs and stronger integrative dynamics, it is important that the implementation of EDF does not stealthily reintroduce a kind of juste retour because of the reliance on intergovernmental projects. The experience of OCCAr proves that even relevant rules ("global balance"[40]) could result in an inappropriate implementation. In fact, OCCAr member states did not renounce the analytical calculation

39 Siroën (2004)

40 According to OCCAr policies, member states have replaced juste retour "by the pursuit of an overall and flexible multi-programme/multi-year balance of work share against cost share: the concept of global balance" (https://www.occar.int/policies-methods).

of industrial juste retour on a program-by-program basis—so the implementation of cooperative programs remains marred with this rule.

As the implementation of EDF only started in 2021 it is difficult to assess whether the European Commission was able to change the rules of the game. The limited implementation of the 2009 directives, especially regarding public markets,[41] leads one to look closely for any bias that may diminish the integrative power of this tool. It is also important to learn from these preliminary experiences to support the design of effective rules and implementation processes for EDIP and future mechanisms. In other words, the initial approach of EDF should not be an end but a first step toward a more ambitious process fostering the integration of national DTIBs at the European level. This supposes that the European Union and member states accept another form of hybrid market at the European level, which requires an adequate regulation already proposed when the LoI was launched. The EU space policy underlines that such an evolution could be difficult but not impossible.

Conclusion

Cooperative programs have been a critical feature of the European armament market for decades, and it is likely to remain so in forthcoming years because this approach appears necessary in a hybrid market (for political and sovereign motives). European countries try to preserve their local DTIB guaranteeing a domestic security of supply but also to minimize costs by gathering resources on both demand and supply sides. Therefore, cooperative programs are the only answer, even though they represent a second-best solution.

The European Commission represents a newcomer in this complex market organization. It aims to induce countries to go further in terms of European integration on both the demand (e.g., EDIRPA[42] and EDIP) and supply (e.g., EDF) sides. Paradoxically, this is executed through cooperative programs and could result in a kind of arrested development for a European armament *marché unique*. In order to avoid such a "cooperation trap," it seems necessary that the European Commission clarifies how cooperative programs are expected to promote the emergence of a genuinely European DTIB, i.e., an integration of domestic DTIBs rather than interconnections of a sometimes temporary nature.

Even though defense remains in the realm of states (as defined in Article 346 TFUE), recent evolutions have revealed that what was considered previously impossible can become acceptable given a favorable context. The European Commission was able to launch the EDF to improve the effectiveness of the defense industry in 2016, and subsequently proposed EDIRPA and EDIP to induce states to join acquisition efforts after the Russian invasion of Ukraine in 2022. There is an opportunity here, community funding ought to be accompanied by rules that create permanent and not temporary connections between national DTIBs, along with strong incentives that prevent states from reversing these dynamics. The European armament market is likely to remain a hybrid market for political reasons, but requires moderation of the damaging side effects that accompany this original market configuration.

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41 Maulny, Simon and Marrone (2020)

42 The European Commission's European Defence Industry Reinforcement through common Procurement Act. A short-term joint defense procurement instrument worth EUR 500mn.

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