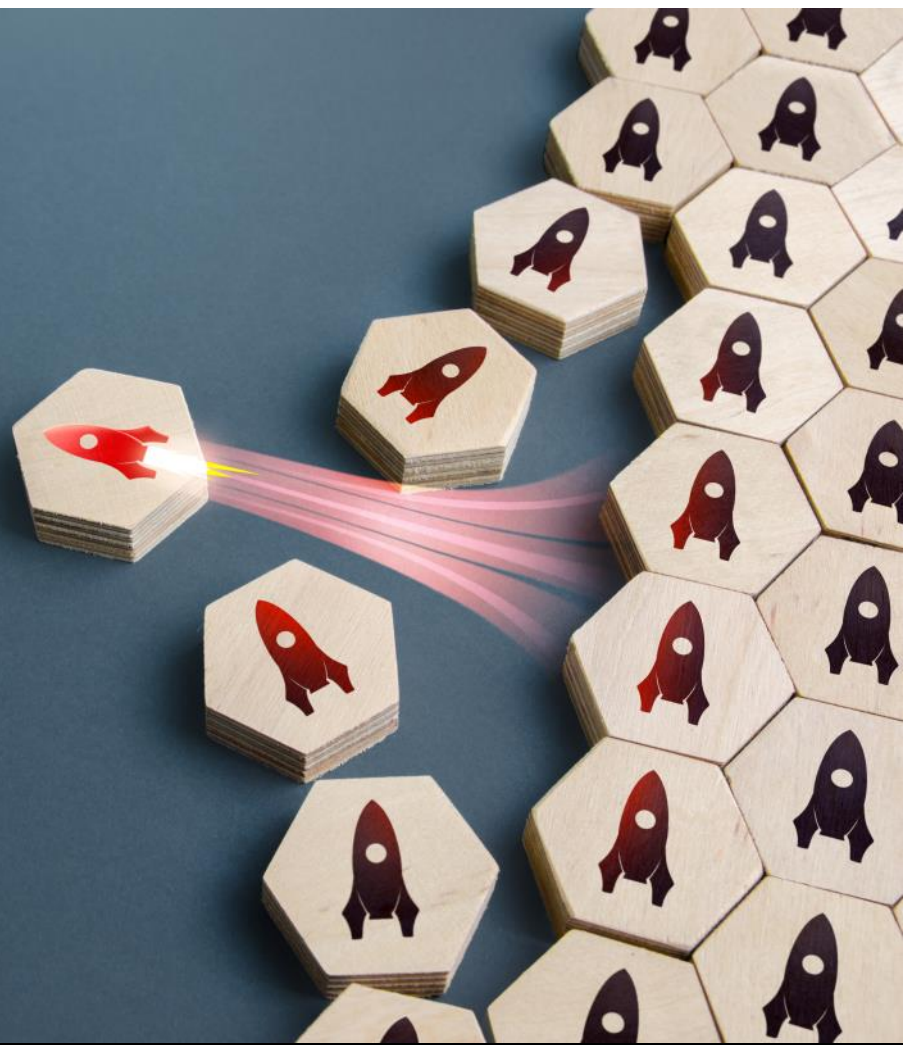


Navigating the Euro-Atlantic defence innovation landscape



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About Politea

Politea is an analysis company focusing on international political risk, geoeconomics, and technology, based in Stockholm, Sweden. With research, foresight, and strategy development, Politea helps companies and authorities to navigate in an increasingly turbulent environment and position themselves for the future.

About the report

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EXECUTIVE SUMMARY

This report set out to analyse emerging transatlantic defence innovation systems and the extent to which EU and NATO efforts in the domain overlap, are in conflict or have potential synergies. The overarching finding is that EU and NATO systems are separate but heavily interdependent. They are separate in terms of membership, governance structures, legal regimes and the way financial resources can benefit innovation in non-member markets. However, they are interdependent in the sense that they cover similar fields, their memberships are similar, investments – both financial and human – in one setting will affect the resources available in the other and the end-product can benefit the security of both.

NATO established its Defence Innovation Accelerator for the North Atlantic (DIANA) in 2022 as an initiative to accelerate and promote transatlantic cooperation on the development of critical technologies and to harness civilian innovation to solve critical defence- and security-related issues. It has also established the NATO Innovation Fund (NIF) as the world's first multi-sovereign venture capital fund to invest in start-ups and to provide funds to develop emerging dual-use technologies. Questions remain regarding engagement from member states, in particular the US with its highly guarded defence innovation system, and how innovation within NATO will be affected by the lack of a common regulatory regime on new technologies.

The EU established a defence innovation hub (HEDI) at its European Defence Agency in 2022, streamlining existing innovation work and adding new tasks. It seeks to attract non-traditional defence actors using challenges and prizes. In parallel, the European Commission has established a defence innovation scheme (EUDIS) using test hubs, hackathons, matchmaking and a defence equity facility to find synergies between civilian and military research, and support innovative companies entering the defence market. To what extent the funding will be sufficient and there is political will to support these measures, and how common procurement and export control regimes might impact defence innovation remain unclear.

The synergies, overlaps and gaps are many. On a positive note, the two organizations increasingly view defence innovation and emerging and disruptive technologies (EDTs) in a similar fashion. One area of potential competition is the security and ownership of intellectual property rights (IPRs), where protection of IPRs differs in an EU and a NATO context. Another area of friction could be funding, where the extent to which either organization could benefit from financial resources that stem from the other's innovation system is unclear. In addition, both the EU and NATO are public bodies that are destined to want to justify public investments in defence. This is likely to lead to a potentially worrying situation in which an extremely low risk approach is adopted, where organizations only fund those defence innovation projects that they deem to have a high chance of success.

Member states that want to maximize the benefits of either system should consider the areas of activity set out below.

Work to integrate the two innovation systems by:

- Increasing staff-level coordination between NATO's DIANA and the EU's HEDI and EUDIS.
- Establishing more common ground on the policy and regulatory issues surrounding critical technologies using existing avenues such as the EU-US TTC.
- Working jointly with the EU and the US on securing access to the raw materials required for many emerging technologies, such as rare earth minerals.

Nurture national ecosystems by:

- Speeding up the domestic innovation cycle and establishing novel procurement procedures that are more accommodating to smaller companies entering the defence market.
- Establishing avenues that can bridge cultural and knowledge barriers between public agencies, military forces, traditional defence industry prime contractors and smaller companies and start-ups in the field of EDTs.
- Ensuring that national export control regimes do not undermine national interests in international defence innovation.

Manage the politics of innovation in the EU and NATO by:

- Conducting a thorough assessment and prioritization of the sort of innovation a member state hopes to achieve or requires, the value that can be added to each or any available innovation system, and which organizations and modes of working are best suited to the national innovation system and its industrial set-up.
- Leveraging bilateral and mini-lateral cooperation to maximize the benefits of cooperation in a multilateral setting.

Secure outreach and engagement by:

- Actively informing the target audiences for EU and NATO measures about initiatives that might not be on their radar.
- Investing in secondments to accrue and bring back knowledge to national systems.
- Engaging with the armed forces as end-users when strategies for international defence innovation cooperation are written and actions are implemented.

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Part one - Introduction

Both the North Atlantic Treaty Organization (NATO) and the European Union (EU) have recently established dedicated units to foster defence innovation among their largely identical group of member states. This report analyses these efforts and the potential overlaps and synergies that might result. It offers pointers for member states on how they can capitalize on available platforms and make choices on how to invest and participate in a strategic fashion.

States worldwide are currently in a race to harvest the spoils of defence innovation. Innovation has of course always been crucial in the military domain, but the field has witnessed incremental development as well as giant leaps over time. Currently, innovation that can be fostered and utilized in a military context is developing at an unprecedented speed, as are government policies in the field.¹ With the great powers currently locked in a rivalry that is to a large extent played out in the field of innovation – and at a time when several disrupting technologies are on the verge of reaching maturity – defence innovation has become a dominant theme for any military actor seeking geopolitical relevance in the 2020s. Russia's war in Ukraine has accentuated this trend and underscored the importance of swiftly developing, deploying, and scaling advanced commercial technology.

The scholars Tom Mahnken, Andrew Ross and Tai Ming Cheung define defence innovation as “the transformation of ideas and knowledge into new or improved products, processes and services for military and dual-use applications”.² The dual-use aspect is crucial here as much innovation is centred on a set of emerging and disruptive technologies that have relevance in both the civilian and the military domain. Indeed, it is the direction of innovation from the globalized civilian sector to the military domain that is increasing the speed of, and the risks associated with defence innovation:

*New, emerging and over-the-horizon technologies – which are as likely as not to be imported by the defence sector from the commercial sector (rather than, as in the past, exported by the defence sector to the commercial sector) and, as a result of the globalisation of R&D, will be broadly disseminated – may be as likely to undermine as to enhance security, even contributing to the onset of, or exacerbation of, arms races and security dilemmas.*³

The framework in which defence innovation occurs can be described as an ecosystem where “a network of organisations and institutions [...] interactively pursue science, technology and innovation-related activities to further the development of defence interests and capabilities, especially related to strategic, defence and dual-use civil–military activities”.⁴ These defence innovation systems have traditionally been national – and states have indeed strengthened their domestic capacities. In the US, long-established structures such as the Defense Advanced Research Projects Agency (DARPA) have been complemented by novel establishments such as the Defence Innovation Unit and the Office of Strategic Capital. From a US perspective, defence innovation constitutes a crucial element as it restructures its military posture to counter a peer-rival after decades of warfare against inferior adversaries. As Eric Schmidt and Robert O. Work note:

As emerging technologies mature, particularly artificial intelligence, and as the geopolitical rivalry between the United States and China intensifies, changes in warfare will only accelerate. The next great-power war – should we be so unfortunate as to experience one – will be unlike any in history.⁵

In addition, measures to defend and protect innovation in dual-use applications have been upgraded through a range of new policy tools in the field of export controls, outbound investment screening, screening of inbound foreign direct investment and national subvention schemes to counter harmful foreign dependencies.

Nonetheless, tighter geopolitical alliances, ambitious supranational actors and the fact that the increasing costs of innovation are hard for many states to bear alone mean that defence innovation systems must now transcend national borders. This is an integral part of new frameworks such as AUKUS.⁶ As noted above, however, it is also a prioritized area in established platforms for security cooperation such as NATO and the EU. These frameworks for cooperation unite 21 (soon to be 23) states that are members of both, and have explicit ambitions to cooperate on defence innovation and critical technologies. It is therefore useful to ask whether they form a common defence innovation system as defined above or two competing subsystems. This report grapples with this issue, with a focus on the novel defence innovation structures in each platform: how they relate, what members states want to achieve with them and how a nation's scarce resources can best be used given access to both platforms.

Part two - NATO's Defence Innovation Ecosystem

Background and Key Policies

The new security reality, characterized by intense systemic competition, a return to Cold War-era tensions and a European security order turned upside down following Russia's illegal war in Ukraine, has led to robust responses by the North Atlantic Treaty Organization (NATO) and renewed calls for significant investments in collective security. During the Madrid Summit in June 2022, NATO unveiled an updated Strategic Concept that re-emphasizes its core defence and deterrence mission in the Euro-Atlantic region amid the Russian threat.¹ While Russia's war in Ukraine dominated NATO's work in 2022, it was already facing significant security challenges to its mission before the invasion, including the risks and vulnerabilities that come with new technologies and new competitive domains.² While NATO's work on innovation predates the Russian invasion, recent technologies combined with the current plethora of security challenges have combined to create rapid and profound changes in how militaries organize themselves and fight.³ To ensure the collective defence of its members, NATO must ensure technological superiority to maintain the military supremacy required to fulfil this core mission.⁴ Credible and resilient warfighting capabilities are very much dependent on the ability to strike the right balance between investments in the modernization of existing systems and the development of next generation technology. Experience in Ukraine has in many ways served to validate NATO's aim of ensuring preparedness for threats across the spectrum of warfare, from conventional deterrence and defence methods to the more unconventional challenges.

To counter the unprecedented scale of the challenges posed by new technologies and to ensure the maintenance of the technological edge that is so key to its 2030 Agenda, NATO has recognized the importance of collaboration across the organization.⁵ Because new technologies affect the ways in which wars are waged and won, the adoption of Emerging and Disruptive Technologies (EDTs) is key to NATO's innovation ecosystem.⁶ NATO has launched two major initiatives to harness dual-use technologies-in critical EDT areas: the Defense Innovation Accelerator for the North Atlantic (DIANA) and the NATO Innovation Fund (NIF).⁷ The former is in many ways a modified version of the US Defense Advanced Research Project Agency (DARPA).⁸ Both initiatives have been set up to support start-ups and academic institutions working on cutting-edge EDTs and other critical technologies that address the organization's most pressing security challenges.⁹ NATO's work on EDTs is guided by its 2021 EDT strategy, *Foster and Protect: NATO's Coherent Implementation Strategy on Emerging and Disruptive Technologies*, which seeks to ensure strategic dominance by promoting a coherent approach to the development and adoption of new technology.¹⁰ The organization's innovation activities currently focus on nine priority areas:

- Artificial intelligence (AI)
- Big-data processing
- Autonomy
- Quantum-enabled technologies
- Biotechnology
- Hypersonic technologies
- Space

- Novel materials/ manufacturing (2022)
- Energy/propulsion (2022).¹¹

Plans are being developed in each area, in line with the overarching EDT Strategy.¹²

DIANA

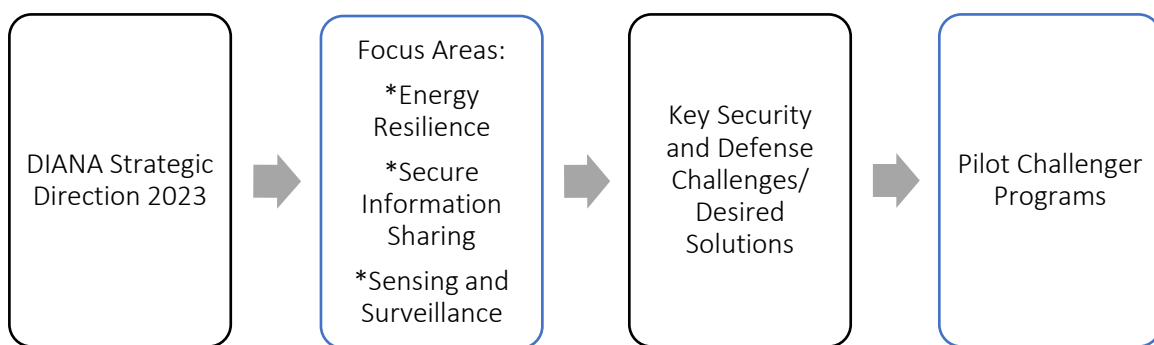
First launched at the 2021 NATO Summit in Brussels, DIANA was approved by NATO members on 7 April 2022 as an initiative to accelerate and promote transatlantic cooperation on the development of critical technologies and harness civilian innovation to solve critical defence- and security-related issues, in order to stay ahead of the technological advances of and challenges posed by adversaries.¹³ By bringing together academia, industry and government, and connecting the civil with the military sphere to leverage the best commercial minds alongside their government and military counterparts, the goal of DIANA is to support development of the technological capabilities and solutions necessary to deter and defend against existing and future threats.¹⁴ DIANA will support all the priority area EDTs outlined by NATO and “accelerate, test, evaluate and validate new dual-use technologies that address both societal challenges and critical national security issues”.¹⁵ DIANA is a separate NATO entity with its own legal and financial framework overseen by a board with members from academia, the private sector and government. A new strategic direction will be set every two years.¹⁶ From what has emerged at this stage, it also seems that the goal is for the managing director and DIANA itself to be distanced from Brussels headquarters, making it an overwhelmingly civil-guided process.¹⁷ In an interview in *Defense News*, David van Weel, Assistant Secretary General for Emerging Security Challenges, explained that DIANA will be a “joint-funded” entity in that member states will have the flexibility to invest through their defence or foreign affairs ministries.¹⁸

DIANA is expected to reach initial operating capability (IOC) in 2023 and full operational capability (FOC) in 2025, capable of interacting with hundreds of innovators each year from a network of ‘accelerator sites’ and ‘test centres’ across 20 member states.¹⁹ The initial network will consist of 60 innovation sites, with headquarters in London, and Tallinn. Canada is looking to host the North American regional office and 9 accelerator sites will provide financing, mentoring and business exposure to participating start-ups, while more than 50 dedicated test centres will host laboratories and equipment to test, validate and design EDTs.²⁰ While the initial footprint will cover 20 NATO members, NATO expects it to continue to expand in the future.²¹ Although not quite yet NATO members, Sweden and Finland have been at the table in the capacity of invitees to ensure a smooth integration once the accession process is complete.²² Both will automatically become part of the DIANA ecosystem on joining the organization, while the NIF is an opt-in fund that they will have to decide whether to join.²³

Actors from start-ups, academic institutions and industry can participate in Challenge Programmes based on critical defence and security problems to which NATO is seeking the best technological solutions by the best innovators. These will be given access to the network of accelerator sites and test centres.²⁴ DIANA’s Board of Directors agreed on its strategic direction for 2023 on 12 December 2022. It made “energy resilience, secure information sharing and sensing and surveillance” its priority focus areas for work on EDTs. These choices probably reflect

the lessons learned from Ukraine’s creative use of technology.²⁵ Each focus area will guide development of the first “pilot” challenger programmes, which seek to resolve critical security and defence challenges.²⁶ According to Bryan Clark, Director of the Center for Defense Concepts and Technology and senior fellow at the Hudson Institute, “these priorities that NATO has laid out, including energy resilience, all point to them tapping into what the commercial world has been doing over the last 20 years”. He describes this as “pretty disruptive”.²⁷

Figure 1 – Diana process



The first programme is expected to commence in April and to be presented at the Vilnius Summit. The aim is to run up to three programmes per year. These are expected to range between different Technology Readiness Levels (TRLs), with the standard reference set between 4 and 7.²⁸ The timeframe for the projects will vary significantly depending on the state of research in the focus area, possibly by as much as ten years.²⁹ There is also some uncertainty about how some areas, such as biotech, should be defined, and what should result from its development.³⁰ Through its programmes and partnerships with accelerators and test centres in member states, DIANA will connect NATO with entities in the deep-tech field and provide opportunities to bring their technologies closer to the market.³¹ By uniting defence personnel with the best start-ups, research and technology companies seeking to resolve critical defence and security challenges, DIANA will strengthen transatlantic security and deterrence.³²

DIANA will thus seek to promote closer ties with, and stronger collaboration between, partners in industry, academia and start-ups in the private and civil sectors to provide the cooperation necessary to ensure a continued technological edge.³³ Many of the latest defence applications derive from private sector tech companies. By promoting deepened engagement with the private sector and bringing innovative civilian and military organizations closer together, DIANA is expected to promote the development of cutting-edge EDT solutions.³⁴ Commenting on this vital link, NATO Secretary General Jens Stoltenberg has said that in “working with the private sector and academia, Allies will ensure that we can harness the best of new technology for transatlantic security”.³⁵ According to a former NATO official, the use of the SpaceX developed *Starlink* satellite

internet constellation in Ukraine is an excellent example of the need for civil technology in defence.³⁶ This push to promote private sector innovation for defence constitutes a notable shift in NATO's approach to innovation and is, according to Tomas Jermalavičius, Head of studies at the Estonia-based think tank International Centre for Defence and Security (ICDS), an almost revolutionary step: "Creating this NATO structure shows flexibility and ability to take advantage of all the capacities that exist in the private sector, where innovations are born".³⁷

The link between public and private is also evident in the NATO Advisory Group on Emerging and Disruptive Technologies, an independent group of 12 experts with backgrounds in the private sector and academia, that provides advice on how to optimize the strategic approach to NATO's innovation efforts.³⁸ First established in July 2020, it is renewed every two years.³⁹ DIANA has its roots in the Advisory Group, which recommended in 2020 that NATO should use a model where the private, public and academic sectors find common ground, to create an innovation ecosystem for "exercising, developing and growing its competencies in Emerging and Disruptive Technologies".⁴⁰

Working closely with the Advisory Group, the Innovation Board brings together civilian and military leadership from across NATO to promote the adoption of practices that will help the organization innovate.⁴¹ However, the prospects for successful cooperation with the civilian sector will depend on sufficient funding. Assistant Secretary General van Weel has noted that, "ultimately, reimagining NATO's engagement with civilian innovators is only credible if we also provide the right funding mechanisms".⁴² To this end, projects developing innovative technological solutions that cannot be commercialized will not be funded through DIANA or the NIF.⁴³

The Innovation Fund

NATO launched the NIF as the world's first multi-sovereign venture capital fund and an entity independent from NATO at a signing ceremony on 30 June 2022.⁴⁴ The fund will invest in start-ups and other funds developing dual-use emerging technologies, and complement DIANA through its support for the development and adaptation of dual-use EDTs to solve critical security and defence challenges.⁴⁵ Inspired by the US IN-Q-Tel, the NIF is a historic opportunity for NATO to boost its defence capabilities by investing in dual-use EDTs.⁴⁶ €1 billion will be allocated over 15 years as strategic investments in EDTs start-ups and other deep-tech funds aligned with NATO's strategic objectives and priority areas.⁴⁷ Secretary General Stoltenberg believes that the 15-year timeframe or runtime makes the fund unique and "will help bring to life those nascent technologies that have the power to transform our security in the decades to come, strengthening the Alliance's innovation ecosystem and bolstering the security of our one billion citizens".⁴⁸ As a "patient investor", deep-tech start-ups struggling to secure sufficient investment because of lengthy timelines will be able to turn to the NIF for uninterrupted support for scaling-up innovations. However, the NIF will not only focus on early-stage investments by providing risk capital to early-stage start-ups, but also invest in top-tier deep-tech venture capital funds.⁴⁹

Investments will be guided by three main strategic objectives: to seek out "cutting-edge technological solutions that solve the Alliance's defense and security challenges"; to "bolster deep-tech innovation ecosystems across the Alliance"; and to "support the commercial success

of its deep-tech start-up portfolio”.⁵⁰ Initial investments are due to begin in 2023, following selection of an investment team and the signing of final agreements. The NIF will then take a minority stake in companies to coordinate other private capital that might be hesitant to take a risk on early-stage or dual-use start-ups.⁵¹ According to a Senior NATO Official, the €1 billion in public funds that the 22 participating nations can allocate either from their defence budgets or from established innovation funds.⁵² While other member states can decide to contribute to the fund at a later stage, they will have little say over its structure.⁵³

The UK (HQ) and DASA

As host to one of two DIANA headquarters, the UK stands to take a leading role in the DIANA framework, supporting start-up companies with funding, guidance and expertise, while also offering the use of test centres to develop technological solutions to military problems, including use of its Dorset-based Defence BattleLab.⁵⁴ In harnessing, testing and developing new start-up technology as a potential defence capability, the UK will strive to connect start-ups with trusted investors and get products to buyers and military end-users faster, to the benefit of all of its allies as they tackle future military threats.⁵⁵ The UK’s Defence Secretary, Ben Wallace, sees the UK as one of the most innovative countries in NATO with a vibrant tech community that combines “academia, financiers, and high-tech start-ups” that “make it an ideal place to develop the next generation of military technologies”.⁵⁶ Imperial College London’s Institute for Security Science and Technology (ISST) has been selected as the headquarters for DIANA. According to Professor Deeph Chana, co-director of the ISST and Chair of the NATO Advisory Board, its position as a world leading STEM-B university makes it a good choice to power a “progressive, responsible and holistic dual-use security and defense technology innovation program”.⁵⁷ The UK will also host an accelerator at the Innovation Hub (IHUB) in the White City Innovation District, West London, which will share space with the UK’s Defence and Security Accelerator (DASA) that will play a key role in the development of DIANA.⁵⁸ By funding relevant defence and security projects, DASA seeks to ensure that the UK maintains its strategic advantage by possessing among the most innovative defence and security capabilities in the world.⁵⁹ While NATO and the US will remain the UK’s foremost security guarantors, hosting DIANA headquarters aligns well with its desire to take a leading role in NATO’s initiative to counter new threats and methods of warfare. The UK is reportedly likely to maintain an initial focus on AI and autonomy, and more gradually venture into biotechnology and novel materials.⁶⁰

The US in NATO Defence Innovation and DIANA

In the wake of Russia’s invasion of Ukraine and with the European security order turned on its head, the US has reaffirmed its leading role in transatlantic and European security.⁶¹ At the 2022 NATO Madrid Summit, US President Joe Biden announced an expansion of US forces in, and cyber capabilities for, Europe: “NATO is strong, united, and the steps we’re taking during this summit are going to further augment our collective strength”.⁶² The US will significantly increase its presence in Europe to contribute to a strengthening of NATO interoperability and deterrence, including the establishment of a permanent US 5th Army Corps headquarters in Poland.⁶³ According to Celeste A. Wallander, the US Department of Defense Assistant Secretary for

International Security Affairs, such actions reflect a “recognition that the security environment has changed” and that Eastern European countries “are facing a heightened threat from a Russian leadership that has shown itself willing and capable of launching military attacks on bordering countries”.⁶⁴ Even though the US has a declared policy of non-direct involvement in Ukraine, it has used NATO’s 2022 Strategic Concept to reassure member states of its continued commitment to European security.⁶⁵ It will do so, however, without downplaying its commitments to the Asia-Pacific region, since the region’s strategic status was elevated by the 2011 “Pivot to Asia”.⁶⁶ NATO partners are also actively participating in ‘Freedom of Navigation Operations’ and other maritime exercises to ensure that waters remain open and free to navigate.⁶⁷

On DIANA, the White House communicated in a June press release that the US will work to facilitate access to its test centres and accelerator sites for NATO members.⁶⁸ It was also announced that Barbara McQuiston, Deputy Chief Technology Officer for Science and Technology in the Office of the Under Secretary of Defense for Research and Engineering, will serve as the US representative on and Chair of DIANA’s Board of Directors.⁶⁹ Made up of one representative from each NATO member, the Board is responsible for DIANA’s organizational governance and for approving its strategic direction.⁷⁰ According to McQuiston, DIANA will be key to establishing a framework “for working with our Allies in enterprising new ways, capitalizing on relevant future capabilities and interoperability. Accelerating and investing in opportunities ensures that we can capture these capabilities to address the challenges we are tackling now and into the future”.⁷¹ It is however worth noting the extensive regulations designed to safeguard US technologies and preserve its defence industrial and military power base.⁷² Maintenance of its privileged position in foreign defence markets is acknowledged as instrumental to cementing a strategic buffer against China’s rise.⁷³ This has led some analysts to question the motives for establishing partnerships with European actors. While it may be the case that the US wants to bring European partners along on the quest to develop EDTs, it will do so on its own terms. Whether it is looking to simply harvest innovative technologies or to establish genuine partnerships remains to be seen.⁷⁴

There is also potentially much to be gained from cooperation between DIANA and TASK Force 59, a US Navy unit focused on AI and autonomy, through the NATO Maritime Unmanned Systems Innovation Advisory Board (IAB).⁷⁵ The IAB has been expanded to include innovation on “all-domain systems”, opening up the possibility of greater cooperation with other NATO initiatives such as DIANA to generate greater impact.⁷⁶ The US however joins France and Canada as notable opt-outs from the NIF, probably to ensure, prior to any involvement, that it does not duplicate existing efforts by their own innovation ecosystems.⁷⁷ Should the US become involved, there would be an opportunity to extend collaboration and strengthen defence-technology linkages with democracies in the Asia-Pacific through NIF-aligned investments.⁷⁸ Nonetheless, any discussion regarding innovation and new technology in relation to the US and NATO must consider the delicate balancing act between contributing to the traditional task of maintaining deterrence and defence capabilities in the transatlantic area, on the one hand, and attending to the growing great power rivalry with China and Asia-Pacific geostrategic competition, on the other.

Possible Future Developments, Risks and Challenges

While the speed at which NATO has launched these initiatives is admirable, much work remains to be done to set up the practical elements required to ensure longevity, as DIANA is still very much in its early stages.⁷⁹ Member states will need to provide and disseminate more information about DIANA, and practical guidance on websites will be needed for companies and investors interested in getting involved in the challenge programmes or other forums.⁸⁰ For DIANA to achieve the desired results, the test centres and accelerator sites must also be integrated as a permanent feature of NATO, and how priorities are set, research is disseminated and findings support other activities in the organization must all be codified.⁸¹ Furthermore, without a common regulatory entity or framework, DIANA will face challenges to cooperation in areas such as AI, which is one of the priority dual-use EDT areas identified by NATO that both DIANA and the NIF are intended to fund and develop by bringing industry and states into closer partnership.⁸² It will be critical to come together to develop, agree and adopt a shared set of rules for efficient use of AI-enabled technologies to avoid doing harm to each other and NATO's partners all over the world. This will depend on the ability to develop a set of rules that aligns with both national and organizational expectations.⁸³ Smaller and newer NATO members could play an important role here in providing an understanding of AI technology and how it can be deployed to both detect and protect against threats.⁸⁴

While there is plenty of technological prowess across NATO, the state of innovation varies greatly between member states, which makes it imperative that the plethora of knowledge that sits within the membership can be learned and shared by everyone to promote collaboration and greater harmony between states.⁸⁵ There will always be different reasoning motivated by diverging priorities and interests, and states will seek to protect the best innovation technologies for purposes of national security, regardless of the undisputed importance of innovation by all member states. For DIANA to succeed in its task, however, member states must not only commit the necessary resources to the initiative but display an open-mindedness in being willing to share national experimentation data and make national representatives available to participate in use case exercises. Otherwise, all it will do is leverage talent.⁸⁶ Innovation efforts within the framework of DIANA and the NIF ought to be regarded as *complementary* to, not a substitute for national policies, as the development of a NATO-wide set of principles is in all members' interests. As outlined above in the US/NATO section, some members have already indicated that they are yet to be convinced that NATO is the best framework for defence innovation or the funding of EDTs. This, in turn, greatly affects the chances of DIANA's success. Only 22 of the 30 member states have signed up to be part of the NIF, reflecting a belief that this should remain a national competency rather than a NATO one.⁸⁷ A key challenge will therefore be to reach an agreement on which technologies and capabilities to focus on, while the NIF, in its current form, requires fewer member partners to come to an agreement.⁸⁸ To succeed, however, the NIF will come to depend on the continuing expansion of the depth and breadth of the innovation ecosystem alongside the creation of several out-of-area partnerships.⁸⁹ Industry, which by design is a key beneficiary of both the NIF and the DIANA initiatives, must recognize the opportunity that now exists to partner with NATO to bring forth the best talent to shape a "collaborative, data-driven, use-case tested, executable set of principles and standards for the future".⁹⁰

Despite NATO's leading role in the creation of a multinational transatlantic defence-tech ecosystem, given the wider geopolitical uncertainties and Asia's geopolitical instability, dominated by China's rise, there is also an imperative to mobilize other democracies that align

with the values that NATO strives to secure. In Asia, Taiwan, South Korea, Japan and Australia are actively seeking to bolster their level of technological preparedness to deter and defend.⁹¹ While multilateral defence efforts such as AUKUS and the Quad are important initiatives, collaboration on and investment in EDTs on a wider scale is now vital.⁹² To succeed in its ambitious innovation efforts, however, NATO will have to hold both itself and its member states accountable in order to keep engagement levels up. The greatest challenge therefore remains persuading member states to share their national inner workings in order to develop policies for the use of EDTs, which includes the sharing of practical use cases.⁹³ Ultimately, alongside the need to develop innovative technology there is a continued need to maintain the hard power elements of warfare. In Ukraine, we are witnessing elements of old and new warfare, from muddy First World War trench fighting to the use of advanced guided missile systems, at the same time and at many different levels. It has become very clear that survivability still depends to a great degree on hard power: on the ability to disperse ammunition stocks, on command and control, and on maintenance areas and aircraft.⁹⁴ At the *Folk och Försvar* national conference in Sälen, Sweden, NATO Supreme Allied Commander General Christopher G. Cavoli spoke about a hard power reality and the implications of the war in Ukraine for the needs of future militaries: while “an integrated deterrence relies on all elements of national power, the great irreducible feature of warfare is hard power”.⁹⁵ Drawing on the importance of maintaining hard power means, and a logistical and industrial capacity alongside the development of cutting edge innovative technology, he went on to say that while cyber, information and technological solutions are all important, “if the other guy shows up with that tank, you better have a tank”.⁹⁶

Part three - Defence innovation in the European Union

Russia's full-scale invasion of Ukraine in February 2022 has illustrated the inadequacy of the structures and norms that are traditionally described as the European security order. Rich in declaratory norms, rhetoric and expectations, the order was insufficiently backed by a security architecture able to project power and police its inherent commitments. The year that followed therefore became a race against time: how to backfill the security architecture in Ukraine, in the EU and in NATO so that the tenets of the order and its underlying norms, such as sovereignty and self-determination, would not be compromised. In practice, this to a large extent came down to incremental tightening of sanctions vis-à-vis Russia and a step-by-step increase in military assistance to Ukraine.

While the EU has travelled a long and winding road to become a defence industrial player, the need to assist Ukraine while at the same time replenishing domestic stocks and investing in new capabilities in the member states has increased calls for a stronger European defence technological and industrial base (EDTIB). This in turn demands the capacity to procure as well as to innovate, develop and produce. At the March 2022 Versailles summit, EU leaders agreed to “foster synergies between civilian, defence and space research and innovation, and invest in critical and emerging technologies and innovation for security and defence”,¹ as part of proposals to take more responsibility for EU security. Russia's full-scale invasion has thus added new momentum to the process of increasing European defence capacity, which had already seen rapid developments since the mid-2010s in the light of the insecurities of the Trump era, the opportunities unleashed by Brexit and more recently European helplessness as the US withdrew from Afghanistan.

A range of defence innovation initiatives – some existing, some in the pipeline, some new – was elaborated and presented later in 2022: But what do these defence innovation measures add up to and how do they relate to each other? The main elements, such as the Hub for EU Defence Innovation (HEDI) established within the European Defence Agency (EDA) and the EU Defence Innovation Scheme (EUDIS) within the European Commission, are discussed below.

Background and key policies

While defence industrial cooperation is not new to the EU it has had a convoluted development where phases of inaction or piecemeal progress have been succeeded by large-scale integrative leaps. After the planned European Defence Community was voted down in 1952, it was not until the turn of the millennium that the EU ventured back into defence policy. While this was a policy about crisis management rather than defence, it still affected capabilities and thus the defence industry. For this reason, the intergovernmental EDA was established only a few years after the Common Security and Defense Policy (CSDP) was instigated. In a parallel development, the European Commission made inroads into both defence research and the establishment of a European defence market in the early years of EU defence policy.

In the 2010s, the EU added a more power-based logic to its defence policy. The ambition to “learn to use the language of power”, as expressed by High Representative Josep Borrell in his Commission hearing, was assisted by mechanisms such as Permanent Structured Cooperation (PESCO) to increase defence capabilities and the European Defence Fund (EDF) to support R&D in the defence field. A European Peace Facility was established to allow external actors to draw on EU resources, including for weaponry, which turned out to be a key vehicle for providing support to Ukraine.

Amid accelerating technological development, increasingly driven by the innovation taking place in the civil domain, and other actors seeking to draw on civil research and innovation for military ends, the EU perceived the need to harvest its civilian research for defence-related issues. This ambition had already left an impressive paper trail.

The Commission’s Action plan on synergies between civil, defence and space (2021)² suggests “synergies” with and “spin-offs” from security research to wider society, as well as “spin-ins” from civil industry to defence cooperation projects, to ensure cross-fertilization between relevant industries. The Commission’s **Roadmap on critical technologies for security and defence (2022)**³ reiterates the importance of European research, tech and innovation to reducing strategic dependencies and outlines a path forward, including the establishment of an Observatory on Critical Technologies and the EUDIS (see below). The EU’s new defence strategy, **the Strategic Compass of 2022**,⁴ takes many of these ideas forward and incorporates them into a common vision of how the EU should meet current security and defence challenges. Responding to calls to accelerate this work, in particular following the EU’s growing role in supporting Ukraine, the Commission in the summer of 2022 presented its **Defence investment gaps analysis and way forward**,⁵ which analyses urgent needs and suggests remedies in the areas of innovation and procurement.

More strategic and legal documents^{6,7} can be expected in 2023, such as the Critical Raw Materials Act and a proposal for a regulation on a European Defence Investment programme. While these are still in the pipeline, a number of defence innovation initiatives have already commenced activities. These are discussed below.

The European Defence Agency and its Hub for EU Defence Innovation

The European Defense Agency was established in 2004 with a mission to “support the Council and the Member States in their effort to improve the EU’s defence capabilities in the field of crisis management and to sustain the ESDP as it stands now and develops in the future”.⁶ From the start, it has been an intergovernmental platform for voluntary cooperation that respects national prerogatives in the defence field. Following ratification of the Lisbon Treaty, the role of the EDA was widened to explicitly include strengthening the European defence industrial and technological base.⁷ The mission of the agency was reinforced after the EU global strategy and its follow-up documents put the spotlight on the defence industrial base. Hence, in the 2017 EDA review,⁸ member states set the following aims for the agency:

- Make the EDA the major intergovernmental prioritization instrument at the EU level in support of capability development, coordination with the EEAS (and the EUMS) and the EUMC in their respective areas of responsibility.
- Make the EDA the preferred cooperation forum and management support structure at the EU level for participating member states to engage in technology and capability development activities.
- Make the EDA the facilitator of the European Commission and EU Agencies, and the interface for member states' requests, exploiting wider EU policies for the benefit of defence and acting as a central operator with regard to EU-funded defence-related activities.

As is discussed below, the role of the EDA as the preferred cooperation forum and the central operator with regard to EU-funded defence-related activities can be said to be challenged by the parallel rise of another EU actor in the defence field: the European Commission. Given its mandate to further European defence capabilities, defence innovation has been part of the EDA's core business since its inception. Two main elements within the EDA have spearheaded the work on innovation. The 13 Capability Technology groups (CapTechs) draw their members from academia, the private sector and member state governmental agencies. They work to identify potential cooperation areas and pressing technology gaps in their respective thematic areas. To prioritize among European defence research needs, the Overarching Strategic Research Agenda (OSRA) provides a harmonized perspective informed by capability needs and an analysis of emerging technologies.

In the spring of 2021, EU foreign ministers tasked High Representative Josep Borrell – as Head of Agency for the EDA – to present options for reinforcing the role played by the agency in fostering defence innovation, including of disruptive technologies. One suggestion was the establishment of a defence innovation hub at the EDA, which was discussed during the autumn and eventually made its way into the March 2022 Strategic Compass. In this novel EU security doctrine, member states agreed to “invest more and better in capabilities and innovative technologies, fill strategic gaps and reduce technological and industrial dependencies”.⁹ The suggested hub was subsequently established by the EDA on 17 May 2022 with the aim to increase and coordinate cooperation on defence innovation among member states.

It is well known that the French EU Presidency pushed hard for progress on defence cooperation in the spring of 2022. At the first European Defence Innovation Day, organized by the EDA under the auspices of the French EU Presidency, the Director for Defence Strategy, Counter-Proliferation and Strategic Foresight at the Directorate General for International Relations and Strategy of the French Ministry for the Armed Forces, Bertrand Le Meur, stated that France would “be side by side with EDA to raise up this Hub and make it a success”.¹⁰ In practice, according to a European defence official, this meant that France took on part of the costs of establishing Hedi and getting it operational. This was probably needed as Hedi was not awarded any specific additional funding, although the EDA's 2023 budget increase could be seen as a strengthening of its defence innovation work.

To be clear, the defence innovation hub within the EDA is neither the start nor a substantial reform of innovation work within the organization. It is an organizational and communicative effort to unite and accelerate previous work streams and add a few new elements. Development is portrayed as following a sequence,¹¹ whereby HEDI will as a first step focus on networking and

situational awareness to inspire and promote innovation. For the purpose of mapping the field of European defence innovation, the hub aims to organize stakeholder groups and workshops, and to set up networks of defence innovation organizations and scholars. In a second and more operational step, the hub will operate within six clusters of activities:

- **Common picture.** Work with experts from member states to identify best practices, projects and major developments in the defence innovation field.
- **Innovation prizes.** Scale-up the EDA's existing innovation practice by increasing the number of competition prizes and working to incentivize the uptake of winning innovations.
- **Innovation challenges.** Design, oversee and manage a system of challenges that attract non-traditional defence actors.
- **Proof of concept.** Use EDA funding to advance the development of technologies to demonstration projects.
- **Innovation shows.** Increase awareness of innovation ecosystems through targeted outreach activities.
- **Innovation uptake.** Explore the potential for multinational concepts, development and experimentation, and for concurrent design campaigns with member states.

The third step is vaguely described as HEDI 2.0 – from innovation to capabilities, where Hedi is established as an EU-wide platform for “cooperative design and experimentation embedded in the EU capability development process”. The EDA notes that the modalities for this step need to be further defined and decided at a later stage.¹²

Structure of the defence innovation scheme and its role in the EU

The European Commission has made a definitive and rapid incursion into the defence field by way of the European Defence Fund and its precursors, drawing on its extensive experience of funding research over the years. The organizational embodiment of this ambition was the establishment in 2019 of DG DEFIS – a general directorate that brings together defence industry and space issues under the auspices of the Internal Market Commissioner, Thierry Breton. In the defence area, DEFIS is responsible for implementation and oversight of the EDF and for further development of the European defence equipment market. The fragmentation of the European defence market and the need for a stronger industrial base were stressed in the European Defence Action Plan, which the former Commission tabled as a follow-up to the EU Global Strategy and its implementation report. The most notable outcome of the action plan was the EDF but the strategy clearly states that this would not be enough:

The European Defence Fund will be a crucial step to support the competitiveness of the European defence industry. Additional actions are however necessary to allow the defence industrial base to remain innovative and competitive and, ultimately, be able to deliver Europe's capability needs. Particular attention must also be given to promote access to finance to SMEs

[small and medium-sized enterprises] *and to non-traditional suppliers and foster investments in the defence supply chains.*¹³

Hence, supporting smaller companies and facilitating civil-military synergies were already identified needs. Later documents on civil synergies accentuated and substantiated these needs, especially in relation to emerging and disruptive technologies. Under an ambitious Commissioner, DG DEFIS has made this agenda a priority task. An embodiment of this ambition is the establishment of the framework EUDIS, which can be seen as an umbrella under which a variety of tools and projects linked to defence innovation are grouped. Its overall aims are to:¹⁴

1. identify ideas, technologies and solutions that need support, for example because their potential for defence has not yet been fully exploited or because they face economic challenges;
2. support the maturation of ideas from a technological perspective or from a market development perspective; and
3. integrate ideas into capability development and support their spin-out to the civil sector.

The most notable elements to be found under the EUDIS heading are:

- **Hackathons.** Inspired by the methodology used in the space arena, EUDIS will organize hackathons on specific topics with mentorship offered to winning teams.
- **Innovation test hubs.** To boost uptake of civilian technologies in the defence domain using thematically focused knowledge hubs. EDF funding will be provided to R&D consortia to test and accelerate innovation.
- **Spin-in calls.** To identify and support the results of civil EU research programmes on improving defence capabilities.
- **Technological challenges.** Allowing researchers and developers to compete to provide solutions to specific challenges. A precursor to such challenges was established in the 2022 workplan of the EDF where teams were asked to find solutions in the area of unmanned ground and aerial systems for detecting hidden threats.
- **Matchmaking.** Linking up R&D focused SMEs and providing coaching on legal, financial, human resources and market issues, among other things.
- **Defence Equity Facility.** A financial instrument that draws on EDF funds to match investments by the European Investment Fund, which, together with private sector investment, is intended to support defence SMEs and start-ups. Activities are also planned to build the capacity of fund managers. Modelled on the EU's CASSINI Space Entrepreneurship Initiative.

According to the Commission, EUDIS can draw on almost €2 billion in overall funding under the current Multiannual Financial Framework (MFF). This includes the funds available from the EDF, co-funding from member states and expected leverage from external private and public sector investors. As is the case with Hedi in relation to the EDA, EUDIS has built on existing elements within the EDF framework, such as use of technological challenges and open R&D calls to companies with a special focus on innovation in the field of defence technologies.

Risks and opportunities ahead for EU defence innovation

After years of underinvestment, amid a dire geopolitical situation and an increasingly ambitious Commission, there is every reason to believe that EU defence cooperation in general and defence innovation in particular will continue to evolve. *How* European defence innovation develops in the coming years, however, will be dependent on input factors – in terms of funding, innovation base and political will – as well as other parts of the defence industrial ecosystem, such as joint procurement and harmonization of export controls.

Funding. The scale of EU defence innovation funding is impressive but also hard to fully grasp. Most figures, such as the claimed EUDIS investment of €2 billion, is a creative mix of existing funds, planned future investments and hoped-for leverage from the private sector. Up against the innovation schemes of the US and China, however, the EU is still a marginal investor. In relation to other development areas, disruptive innovation appears not to have been sufficiently prioritized. For example, the Commission points out that ‘between 4% and 8% of the EDF budget is devoted to development or research for disruptive technologies having the potential to create game-changing innovations’.¹⁵ More dedicated funds such as the defence equity facility also lack the financial power to follow start-ups from seed investment to A and B financing. According to experts in the field: ‘It needs to have another zero on the end per annum to have a catalysing effect’.¹⁶ The question is whether sufficient funding for innovation and harnessing disruptive innovation for the future can be allocated when Russia’s war is painfully illustrating the lack of credible European resources and capabilities in the here and now.

Innovation base. It is worth noting that efforts to accelerate the transfer of civil innovation to the defence field or to nurture innovative start-ups engaged in dual-use technology will only be successful if there is a sufficiently strong civil innovation base underlying them. Hence, investment in basic research needs to increase both at the EU level and in the member states. Compared to the very public discussions on the need for NATO members to reach the 2% of GDP defence spending goal, there has been far less discussion surrounding the equally important R&D expenditure percentage of GDP where EU members range from 0.5% to 3.5%.¹⁷

Political will: The success of any governmental ambition to nurture and accelerate defence innovation will depend on the level of political will to support such ambitions. In the case of a multinational gathering like the EU, such political will needs to be channelled in a cohesive fashion. As an International Institute for Strategic Studies analysis argues, this is not entirely the case: “there is still not strong European political consensus for increasing the pace of defence innovation despite the significant capability gap between the EU and its competitors and the shock of Russia’s invasion of Ukraine in February 2022”.¹⁸ Member states are split on whether the main goal should be to steer innovation in order to fill already identified gaps in near-future capabilities or to foster a European Defence and Technological Industrial Base as a precondition for autonomous power projection. This is partly tied to the question of third party access, which is a divisive factor in PESCO and EDF projects and likely to attract differing opinions in the various defence innovation initiatives currently planned. Member states also have varying levels of national resources and industrial interests that might conflict with joint European or transatlantic measures. These diverse preferences call for leadership. Thus far, the Commission is the actor that has been most pertinently driving the process, but it is doing so at the very limit of its

mandate. With the UK post-Brexit investing predominantly in its own ecosystem and that of NATO, France has been the leading voice for more European integration in the field, as illustrated by its strong backing for HEDI. Its differences on Russia and the best way to support Ukraine, however, raise questions about its credibility in taking on this leadership role, and it is unclear just how joined up European states will be in the years to come. In a paradoxical turn of events, the US administration – while modestly engaged in NATO defence innovation work – has asked the Pentagon to draft an administrative arrangement with the EDA. Following signature and ratification, this will allow the US to cooperate with the EDA on issues such as military mobility, military standards and supply chain security. Perhaps it will be US engagement that proves the added value of EU defence innovation efforts to EU member states.

Procurement. Other parts of the European defence industrial landscape will also affect the fate of innovation. One important factor is joint procurement. Following Russia's full-scale invasion of Ukraine, and the increasing supply of weaponry to Ukraine from European countries, the European Council at its 2022 Versailles meeting tasked the Commission to find ways to help member states replenish stocks by way of joint arms acquisitions. One result of this process is the proposed European Defence Industry Reinforcement through Common Procurement Act (EDIRPA), whereby €500 million will allow for swift common procurement in 2023 and 2024. Just as the EDF has its small-scale experimental predecessors, the EDIRPA is planned to be succeeded by the larger and long-term oriented European Defence Investment Programme. These procurement programmes – although modest in relation to the planned defence expenditure of European states in the coming years – play an important role. Already in 2022, a range of quick off-the-shelf acquisitions – Korean tanks for Poland, Israeli howitzers for Denmark and a planned Air Defence System from various non-European suppliers – have increased the fragmented structure of European forces and might undermine the European industrial base. Financial incentives to procure jointly would be one way to reverse this trend. If these initiatives receive sufficient funding in the mid-term review of the EU MFF, they will also have an impact on defence innovation. If Europe could showcase a full defence industrial ecosystem from venture capital to procurement, this would probably make the incentives for European firms to engage in defence innovation more predictable.

Export controls. Finally, a harmonizing effort among Europe's disparate export control regimes would incentivize industry to engage in innovation and the production of controlled items. As of now, the EU's internal market is not level because actors are tied to different legal regimes and interpretations of common positions with vastly different conditions for exports and transfers. A joint regulatory framework would be likely to make the EU defence industrial base more competitive.¹⁹ Experience from the arms shipments to Ukraine, where permissions to send military hardware must be collected from a range of suppliers and subcontractors, each governed by different export control rules, has also strengthened calls for harmonization. While the issue can be mitigated by arrangements for specific rules to be put in place before joint development, this still places an administrative burden, particularly on smaller actors in the defence innovation system. Another solution would be to seek an EU-wide agreement, modelled on the German-French Aachen Treaty's *de minimis* rule, to limit the veto power of supplier states if their input into the finished product falls below an agreed threshold. The most ambitious, and possibly least likely, alternative would be to make the interpretation of the existing common position and the granting or denial of licence applications a community competence. The war in Ukraine has already brought with it some movement towards harmonization in practice, as countries such as Germany and Sweden agreed to export to a country in active conflict. Whatever future path is

chosen, it is clear that the more the EU develops as a defence innovation system, the more logic there will be in finding ways to further harmonize the rules governing the export of defence applications developed within the EU.

Part four – Synergies and competition in the Euro-Atlantic defence innovation ecosystem

In recent years, both the EU and NATO have invested considerable time and resources into developing and nurturing defence innovation. As political organisations, the EU and NATO have not sought to replace national defence innovation efforts, but rather complement them with Euro-Atlantic-wide initiatives designed to unlock defence innovation. In 2016, the EU decided to take a major step forward in its promotion of and support for defence innovation with the creation of the European Defence Fund (EDF). In May 2022, the EU used its first-ever defence strategy – the “Strategic Compass” – to create a Hub for EU Defence Innovation (HEDI) in the European Defence Agency (EDA). In 2021, NATO also decided to support defence innovation through the creation of a Defence Innovation Accelerator for the North Atlantic (DIANA). In 2022, NATO went further by creating a NATO Innovation Fund (NIF). Each of these instruments are designed to financially support defence innovation in the Euro-Atlantic region, but in a way that unlocks innovation *across* borders and *between* political, industrial, military and academic actors. Overall, EU and NATO defence innovation efforts have responded to the strategic need to ensure the military high-tech edge of the West and as a recognition of the critical role Emerging and Disruptive Technologies (EDTs) play in geopolitical competition.

The emergence of disruption: EU and NATO efforts

One of the key issues that should be reflected upon is how best to leverage the accelerator and test centres created as part of DIANA. With the Defence Innovation Accelerator, NATO hopes to connect with organisations focusing on EDTs and defence innovation through 9 accelerator sites and over 60 test centres based in Alliance member nations¹. This gives NATO the potential to concentrate its efforts geographically across the Alliance. The EU’s approach, however, is more decentralised than this and funding under the EDF does not prejudice the precise location of defence innovation efforts, other than to insist on the involvement of a minimum number of Member States and entities in project work. There is, therefore, a need to ensure the maximum possible level of complementarity between the EU’s and NATO’s defence innovation efforts, even if the precise participating states of each initiative do not always align. To this end, the EU has already sought to promote complementarity by establishing HEDI in the EDA, as HEDI is charged with the task of facilitating cooperation between the EU Member States working through the EDF and to ensure coherence with NATO efforts through DIANA and the NIF.

An important question emerges about how far NATO and EU efforts can be simultaneously coordinated, however. Ultimately, this is a political question of how best to organise the interface between the EU and NATO in defence innovation. In theory, this should not be a major issue as many participants of DIANA and the NIF are EU Member States. Yet, there are important differences in terms of the participants of each EU and NATO defence innovation initiative. For example, EU defence innovation efforts include the EU27 but they exclude major industrial non-EU states such as the United States (US) or the United Kingdom (UK). The new NATO innovation initiatives do not necessarily make cooperation with these non-EU partners any easier. True, all NATO allies signed off on DIANA’s Charter and they are all represented on DIANA’s Board of Directors. However, the NIF has a more limited participation level of 22 Allied countries that

presently does not include the US or France. This makes it more difficult to coordinate EU and NATO efforts.

However, EU-NATO cooperation is often reduced to thinking about which body or agency should take charge of ensuring complementarity. One could make a case for NATO to follow the EU's lead, especially as EU initiatives are older and better financed than the NATO's own endeavours. Yet, such a proposition would be entirely unacceptable to NATO nations, especially for those that are not members of the EU. So, while HEDI offers a potential interface for the EU and NATO to discuss their respective defence innovation efforts, there is today no single political body that can mutually steer EU-NATO efforts. True, HEDI offers an opportunity for defence ministers in both the EU and NATO to coordinate, but the more traditional interface for EU-NATO relations – i.e. joint meetings of the EU's Political and Security Committee (PSC) and the North Atlantic Council (NAC) – is not endowed with the specific technical knowledge required for defence innovation.

Seen from a NATO perspective, however, it might not be entirely clear which EU body or institution is in charge of driving forward EU defence innovation efforts. Currently, the issue of defence innovation is shared over intergovernmental and supranational political bodies. We have already flagged the role of the EDA's (intergovernmental) HEDI, but the European Commission (supranational) is increasingly relevant for defence innovation. For example, directly after HEDI was announced the European Commission took the decision to create an EU Defence Innovation Scheme (EUDIS). The Commission hopes to leverage the EDF, co-funding from EU Member States and public and private funding worth €2 billion up to 2027 to create a dual-use incubator, cross-border innovation networks and a defence equity facility. To this end, the Commission seeks to build on cooperation with the EDA by establishing links with the European Innovation Council (EIC) and the European Investment Fund (EIF), which could see the Commission tap into a further €145 billion of investment.

The differences between the EU's supranational and intergovernmental approaches to defence innovation is not solely related to issues of governance. In fact, one could argue that the Commission is better placed than the EDA to ensure cross-fertilisation between civil and defence sectors. As the EDA and NATO seek to develop closer ties between the defence and civil research communities, the Commission already manages a range of civilian programmes that can be leveraged for defence innovation. This is why in February 2021 the Commission released its Action Plan on synergies between civil, defence and space industries² and why in February 2022 the Commission went on to publish a Roadmap on critical technologies for security and defence³. In these documents, the Commission not only decided to create its own Observatory of Critical Technologies but it detailed ways to use civil programmes (e.g. Horizon Europe, European Structural Investment Funds, etc) to help blend finance for dual-use technologies such as semiconductors, autonomous systems, cloud computing and others.

One positive aspect of EU and NATO defence innovation efforts, however, is that the two organisations increasingly view defence innovation and EDTs in a similar fashion. Through its Capability Development Plan (CDP), Overarching Strategic Research Agenda (OSRA) and key Strategic Activities (KSAs), the European Defence Agency has been able to draw up a list of critical technology priority areas for the EU. Indeed, the EDA has already classified Artificial Intelligence (AI), big data analytics, robotics and autonomous systems, hypersonic weapon systems and space, new advanced materials and quantum-based technologies as six critical domains for investment and cooperation⁴. Through its investments under the EDF, the European Commission has also been able to prioritise financial support for autonomous systems, cyber defence technologies,

precision-strike capabilities and situational awareness capacities.⁵ EU priorities in the area of defence innovation and EDTs bear a striking resemblance to NATO's own innovation agenda.

For its part, NATO has made it clear that it wants to focus on nine priority areas for defence innovation and technology including: AI, data, autonomy, quantum-enabled technologies, biotechnology, hypersonic technologies, space, novel materials and manufacturing and energy and propulsion⁶. The Alliance has also developed specific technology strategies for AI and Data Exploitation, with NATO Defence Ministers calling for the Alliance to further integrate such technologies into NATO's decision-making and deterrence frameworks. Overall, however, NATO's efforts are guided by the February 2021 NATO Implementation Strategy on EDTs. It is through this Strategy that the Alliance is able to set priorities in the frameworks of the NIF and DIANA, and this is why DIANA is already tasked with prioritising innovation in the areas of energy resilience, secure information sharing and sensing and surveillance technologies in 2023⁷.

When EU and NATO defence innovation priorities are taken together, there is considerable overlap. Nevertheless, there are some important differences between the EU and NATO approaches to EDTs. For example, NATO has moved swiftly to draft and release its AI Strategy in order to guide the alliance on the use and development of AI-related technologies for defence. To this end, NATO has even made clear that AI and defence should adhere to six principles of responsible use including lawfulness, responsibility and accountability, explainability and traceability, reliability, governability and bias mitigation. To this end, NATO has established a Data and Artificial Intelligence Review Board to ensure that Allies adhere to the principles of responsible use, while also steering efforts to integrate AI into NATO's defence and deterrence efforts⁸. Where a gap in understanding and ambition exists, therefore, is when we compare NATO's efforts to the EU's approach to defence and AI.

Indeed, the EU has been far more cautious about integrating AI into its defence innovation efforts, even though Union bodies such as the EU Satellite Centre already use AI-enabled technology and the EDF is funding AI-relevant innovation projects. Nevertheless, the EU has not always been very keen in dealing with the issue of AI-enabled defence technologies head on. For example, in its proposed Regulation for harmonised rules on AI the Commission underlines how military applications of AI are directly excluded from proposed EU rules⁹. This implies that the EU is not yet prepared to develop its own overarching strategy for AI and defence, and this in many ways limits the degree to which the EU and NATO can engage on AI-related matters associated to defence innovation. Even though AI and defence represents an issue of split competences in the EU, and while the European Parliament will have its own views on how far AI should be integrated into defence, there is certainly a substantive gap in how the EU and NATO approach AI, defence and innovation.

On the military technology frontier: EU and NATO competition

Both the EU and NATO are hoping that their respective governance models can lead to effective defence innovation. Yet the two organisations are basing their defence innovation efforts on two different types of governance formats. For example, the "research window" of the EDF funds a consortium of partners in the EU and a project coordinator is selected that deals directly with the European Commission on behalf of all project partners. This model does not prejudice the location of research in the EU but it does insist on a strong link between the European Commission and project partners. For NATO's DIANA, however, the governance model somewhat resembles the US Department of Defense's own Defence Innovation Unit (DIUx), which has a

leadership structure composed of individuals that were previously recruited in academia, Big Tech and the military¹⁰. Indeed, DIANA has been established as a separate body within NATO with its own board of governors and managing director, and the board of governors is composed of 'members of academia, the private sector and government'¹¹. Whereas the EU's defence innovation includes the presence of a governmental body such as the Commission, DIANA is run more akin to a private company within NATO. This makes ensuring complementarity between the EU and NATO more difficult as it assumes that any closer EU-NATO cooperation would involve the European Commission, NATO and a range of private actors.

Another area of friction between the EU and NATO on defence innovation relates to the constituent members of each organisation. For example, the EDF Regulation makes it very clear under Article 9 that the eligible legal entities for EDF support must be 'established in the Union or in an associated country'¹². DIANA, on the other hand, includes all NATO Allies and the NIF which is supported by 22 NATO nations, including 18 EU Member States but not France or even the US. In theory, not having the US onboard as part of the NIF could actually sooth defence innovation efforts for those European states that are benefiting from EU and NATO innovation efforts. More concretely, without the US it may be easier to share the Intellectual Property Rights (IPRs) and information derived from defence innovation efforts between European allies without falling prey to extra-territorial US legislation such as the International Traffic in Arms Regulation (ITAR) and/or the Export Administration Regulations (EARs). On the other hand, the US' absence from the NIF creates difficulties for those EU Member States and NATO allies that have close technology and industrial partnerships with the US. In this respect, NATO and EU innovation efforts come with formal and informal rules that inhibit cooperation between the two organisations and the companies and research centres they are home to.

Additionally, another area of potential competition between EU and NATO relates to the security and ownership of IPRs. Indeed, both organisations have the challenge of ensuring that research bodies and small and medium-sized enterprises (SMEs) will continue to benefit from their IPRs as technologies are integrated into defence systems. In this respect, there is a need to ensure that prime defence firms or systems integrators do not "swallow up" the IPRs of SMEs and research organisations, especially when these larger firms are state-owned. Here, individual EU and NATO governments can potentially seize control of IPRs for defence innovation projects that they deem "critical" for national security. Whether these projects are, in reality, "critical" for national security needs to be assessed, as IPRs can be seized or captured for industrial rather than security interests. This is a particular risk when state-owned prime firms are involved in defence innovation and capability programmes, as governments play a more direct role in managing technology, research results and IPRs. In this respect, it remains to be seen whether European SMEs and research centres find the EU or NATO approach to IPRs more appealing.

However, the protection of IPRs differs in an EU and NATO context. For example, the EDF Regulation clearly makes 'the autonomy of the EDTIB' a key factor in its award criteria and this implies that EDF defence innovation efforts should contribute to 'increasing the non-dependency on non-Union sources and strengthening of security of supply'¹³. To date, it is unclear what role IPR protection will play in projects supported by DIANA or the NIF. Here, it is worth investigating whether DIANA or NIF projects will develop similar, tightly regulated, IPR regimes for defence innovation or whether a more flexible regime will emerge among participating NATO allies. In any case, it will be necessary to eventually study the compatibility of DIANA, the NIF and EDF as overlapping consortia for defence innovation projects are likely to raise several technical questions, including: 1) can EDF financed defence research projects be organised and completed at designated DIANA accelerator sites and test centres?; and 2) how will the EU and NATO avoid

duplicating defence innovation projects? As DIANA and the NIF progress, it will be important for participating NATO nations that are also part of the EU to clarify the association and links between NATO and EU efforts.

Finally, another area of competition between the EU's and NATO's defence innovation efforts relates to financial resources. While both the EU and NATO insist that respective member states and nations meet the agreed benchmarks for R&D investments (i.e. 20% of defence expenditure should support equipment procurement and R&D), and despite recent increases in defence spending in Europe, there are only finite resources available for defence innovation. Under the EDF, the financial resources dedicated to defence innovation are fixed under the terms of the EU's Multi-Annual Financial Framework (MFF), which currently runs from 2021 to 2027. Under the EDF Regulation, the overall amount of the Fund is €7.9 billion with €2.6 billion or approximately 33% of the total amount focused on defence innovation and research. The Regulation also stipulates that between 4-8% of the €7.9 billion up to 2027 should be invested in disruptive defence technologies.¹⁴ It should be noted that the €7.9 billion allocated under the EDF is resourced directly from the EU budget and MFF, and up to 100% of eligible costs for research and innovation under the Fund is financed directly by the Union.

EU funding is not formally accessible to NATO for either its DIANA and NIF initiatives. For NATO, this means identifying and raising additional financial resources, yet the financing involved in certain NATO initiatives is unclear. True, the NIF will see a state-backed investment of €1 billion for start-ups and venture capital funds over a 15-year period. Although NIF is a new initiative, the test for the scheme over the longer-term is whether participating allies will increase the initial €1 billion funding stream, and whether or not the initial funding can be smartly allocated over the 15 years to allow for meaningful innovation efforts. In this regard, there are even questions about the relationship between the NIF and DIANA – which are separate initiatives. Whereas NIF is based on state-backed investments, DIANA has been established to work with investors to unlock commercial venture capital and to thereby connect investors with innovators and government/military bodies and agencies¹⁵. This is new terrain for the Alliance, and there is nothing automatic about venture capitalists wanting a direct link with public bodies or initiatives like the NIF, but it echoes an approach taken in the US to help encourage private and venture capital funds to invest in defence innovation. DIANA represents a “high-risk, high-return” approach that bets on private capital as an additional source of defence investment for innovation. How this potential additional capital will find its way into defence research project and, eventually, capability programmes remains to be seen.

Fusion Theory: bringing EU and NATO efforts together

Clearly, the EU and NATO have come some way in the manner in which each organisation supports defence innovation for its members. Yet, the EU and NATO could potentially fall victim to their own success in the area of defence innovation. By institutionalising defence innovation cooperation, there is a risk that innovative technologies remain “stuck at the drawing board” stage. In this sense, both organisations need to avoid simply investing in innovative ideas and instead look towards pulling innovation efforts through to prototyping, development and eventually commercialisation (i.e. avoiding the “Valley of Death”). Here, the EU and NATO must not lose sight of the necessity of ensuring that defence innovation projects result in financial results for the parties involved in any project. While it is true that political and military actors may not only be motivated by financial rewards, industrial and research partners will want to ensure a return on investment for their innovation efforts. Without a decent financial return on

investment, the incentive to continue investing in defence innovation is reduced which is a troubling prospect given that industrial and research actors can switch their innovation efforts to the civil sector.

However, the EU and NATO are public bodies that are destined to want to justify public investments in defence. This leads to the potentially worrying situation of an extremely low risk approach where organisations only fund those defence innovation projects that they deem to have a high chance of success. It is difficult for public bodies such as the EU and NATO to justify resources spent on innovation projects that do not result in any tangible outcomes. Yet, defence innovation is traditionally marked by a willingness to “fund failure”, which implies accepting the risk that innovation efforts may not result in technologies that can be integrated into defence systems. Yet, the current approach to risk by the EU and NATO is not effectively suited to bold defence innovation efforts and more can be done to highlight how “funding failure” is in the interests of the EU and NATO members. For example, the time spent proving that a technology will not result in any military added value means that adversaries and rivals cannot exploit the same technology either. Furthermore, “funding failure” should not be viewed as waste as the researchers involved in such defence innovation projects are still developing and generating the scientific knowledge needed to future innovation projects.

It is an inescapable observation that there is considerable overlap between EU and NATO efforts on defence innovation, even if the EU first launched its own efforts and has more financial resources to support innovation than NATO. However, if harmful competition between the two organisations is to be avoided there is a need for more EU-NATO senior level political guidance. True, the 2023 EU-NATO Joint Declaration does specifically underline the need for the two organisations to deepen cooperation on EDTs¹⁶, but it provides no clear roadmap or timeframe for doing so even though research and innovation form part of the 74 common proposals set out by the EU and NATO following the first Joint Declaration in 2016.¹⁷ Indeed, the latest progress report on EU-NATO cooperation details that there has been staff-to-staff contacts between the EDA, NATO Allied Command Transformation (ACT), the NATO Science and Technology Organization (STO) and the European Commission’s Joint Research Centre (JRC)¹⁸. Although staff-to-staff engagement is necessary, it cannot be a substitute for top-down political steering on the issue of defence innovation.

Having said this, we should not overlook the growing bilateral defence relations between the EU and the US. Although these bilateral efforts do not formally involve NATO, there is an opportunity to use the EU-US Defence Dialogue and/or the EU-US Trade and Technology Council to raise the issue of defence innovation. In particular, the Defence Dialogue can be used to discuss issues such as cyber defence and disruptive technologies, yet greater ambition is required here to maintain the focus of meetings beyond regular diplomatic discussions. More interestingly, perhaps, is the recent approval of an Administrative Arrangement (AA) between the EDA and the US. This AA will allow the US to be part of EDA meetings such as the Steering Board, and for EDA participating states to be invited to US Department of Defense meetings. The AA will also allow the EU and US to engage in consultations on issues related to security of supply and standardisation, which are important elements of innovation. Politically, while the AA is relatively new it is up to EU governments and the US to push the agenda on defence innovation more specifically.¹⁹

There is also potential to clarify the EU and NATO’s understanding of defence innovation. To date, the two organisations do not share a taxonomy or vocabulary on defence innovation. Indeed, there are key differences between “defence innovation” and “EDTs”, plus there is even some debate on whether we can realistically treat “emerging” and “disruptive” technologies as the

same thing. This may sound like an academic debate but getting the terms of engagement right is fundamental if the EU and NATO are to develop defence innovation cooperation. For example, the reference to EDTs implies that there are as yet undiscovered technologies that may be of use to Western militaries. Any objective to discover EDTs would assume a capacity for technology horizon scanning, as is the case with bodies like HEDI, NATO ACT, DIANA and more. However, any serious focus on defence innovation takes us away from simply discovering new technologies towards a need to invest in the production of standards, upskilling in critical technology domains, integrating EDTs into existing defence procurement processes and more.

Therefore, if the EU and NATO are genuinely serious about developing stronger cooperation in the area of defence innovation, both organisations should move away from the relatively easy task of prioritising EDTs for defence. Instead, the two organisations need to pay far more attention to how the key constituents of their efforts – i.e. militaries and Ministries of Defence – are able to rapidly and effectively integrate new technologies and processes into traditional military-bureaucratic processes. Of course, one way of examining the relevance of new technologies is through certification and testing processes, and this can be greatly aided by the testing of new technologies during exercises and training. A complementary practice that builds on this that is currently missing in EU-NATO cooperation is the standardisation for EDTs.

In fact, both the EU and NATO members would stand to benefit from the rapid uptake of standards for EDTs as this would give militaries in the Euro-Atlantic region the benefit of “first mover” advantage. In turn, this means that standards can assist with greater interoperability between militaries and ensure that they have a military-technological edge over adversaries and rivals. Both NATO and the EU have significant experience in developing standards for both defence and the Single Market, but members and nations in each organisation are at risk of losing out to adversaries, rivals and competitors that have become far more assertive in developing and promoting international standards²⁰. Thus, the EU and NATO need to think about defence innovation in more strategic and comprehensive terms.

Part five - Managing interdependent innovation systems

Interdependent innovation systems

This report set out to analyse emerging Euro-Atlantic defence innovation systems and the extent to which EU and NATO efforts in the domain overlap, are in conflict or have potential synergies. The overarching finding is that the EU and NATO systems are separate but heavily interdependent. They are separate in terms of membership, governance structures, legal regimes and the way financial resources can benefit innovation in non-member markets. However, they are interdependent in the sense that they cover similar fields, their memberships are similar, investments – both financial and human – in one setting will affect the resources available in the other and the end-product can benefit the security of both.

Both systems also contain internal frictions or even subsystems. In the EU, this takes the form of interinstitutional bargaining between supranational and intergovernmental elements, as well as the rivalries between member states and their national systems. In the case of NATO, the main divide is between members and their national systems – the tightly guarded US defence innovation system being a case in point. This is not something that is mitigated by common market or regulatory regimes as it is in the EU.

Another form of division is between policy level development of innovation structures, the predominantly civilian and private sector entities that hope to innovate and the defence establishments that plan to make use of the innovation produced. While this is not a bug but a feature of a market-based defence innovation system, measures are needed to effectively connect and find synergies between the elements of the system.

Given all the above, a few areas of activity would enhance the benefits of the transatlantic defence innovation systems for the actors involved.

Systems integration

Close cooperation between NATO members and the EU member states is a stated ambition. Even for countries that only belong to one of the organizations, there would be obvious benefits from cooperation, as the EU-NATO declaration has shown by making emerging and disruptive technologies a designated area. While such cooperation has its challenges for well-known political reasons, it would still be possible to pick low-hanging fruit. One such way would be to increase staff-level coordination between NATO's DIANA and the EU's HEDI and EUDIS. Such cooperation currently amounts to ensuring that calls on tech challenges do not conflict, but a more strategic approach could be envisaged where agendas are more thoroughly synchronized without interfering with each organization's specific characteristics.

Another example would be to establish more common ground on the policy and regulatory issues surrounding critical technologies by using existing avenues such as the EU-US TTC, which would

benefit defence innovation in both systems. In pursuit of this, the EU and the US could work jointly on securing access to the raw materials required for many emerging technologies, such as rare earth minerals. In the case of the EU and the United Kingdom, it would be helpful to follow-up the EDA-US administrative agreement with a similar arrangement between the EDA and the UK to allow for better post-Brexit cooperation.

Nurture national ecosystems

Neither NATO nor the EU can muster all the elements of an innovation ecosystem. NATO lacks a common market and regulatory environment, and its common budget is relatively modest. The EU lacks a direct link to defence planning, which in some areas affects the outputs required from an innovation system, although the CARD process provides some valuable insights. The only level where all the elements exist – albeit sometimes at an inadequate volume – remains the national level. Members of either organization should invest in their own systems and see this as leverage for international cooperation. The war in Ukraine has put a spotlight on the value of short innovation cycles and experimental production. Most national systems would be faster than any formal multilateral setting and efforts should be made to allow swifter uptake of innovation and novel procurement procedures that are more accommodating to smaller companies entering the defence market. Another example are the links between public agencies such as procurement and R&D, military forces, traditional defence industry prime contractors and smaller companies and start-ups in the field of emerging and disruptive technologies. The more that cultural and knowledge barriers between these actors, which are all central to defence innovation, are bridged at the national level, the more competitive they will be in an international innovation system. Denmark's Center for Defence, Space & Security (Censec) is one example of how a business cluster can be established and work to bridge these divides.¹ Another state-driven model is jHub Defence Innovation, the part of the UK Ministry of Defence which works to connect defence innovation actors across sectors.² Finally, the international potential of any national defence innovation system will in many cases be affected by its export control regimes. The daunting tasks of supporting Ukraine are likely to lead to reform of both procurement and export control systems in several EU and NATO member states.

Managing the politics of innovation

Both the EU and the NATO systems have political and bureaucratic drivers that must be taken into account in order to maximize the utility of cooperation. On the EU side, cooperation is to a large extent driven by the leitmotif of European sovereignty, the need for European capabilities and an ambition to promote Europe's defence technological and industrial base. France has been an ardent supporter of development as has the European Commission, especially under Commissioner Breton and the newly established Directorate-General for Defence Industry and Space. At the bureaucratic level, the EU's innovation system is non-disruptive as it follows the modus of the larger bureaucratic entities that are host to its activities. In NATO, the UK has clearly taken a leading role as part of its post-Brexit ambitions. The US is less of a driver, with a powerful innovation system of its own and a strict regulatory environment that has made international

tech cooperation cumbersome even in settings with higher levels of trust, such as AUKUS. At the bureaucratic level, the NATO system itself is disruptive as DIANA challenges established ways of working, not without friction in relation to officers accustomed to traditional chains of command.

Member states that want to benefit from either defence innovation system need to work with these characteristics in mind. This means a thorough assessment and prioritization of the sort of innovation they hope to achieve or require, the value that can be added to each or any available innovation system, and which organization and mode of working are best suited to the national innovation system and its industrial set-up. Actors that know what they can offer and know what they need, and are able to adjust engagement and national measures to these ends, are likely to be more successful at both EU and NATO cooperation. The benefits of multilateral cooperation will also increase if it is matched by bilateral or mini-lateral cooperation that allow some aspects of innovation to be taken further in tighter circles with higher levels of trust.

Outreach and engagement

Given that the target audiences for most defence innovation measures are commercial entities and research organizations, it should be assumed that most are not geared to the defence sector. A country that wants to see its private sector benefit from the various EU and NATO schemes would therefore do well to actively link its domestic actors to international efforts. In the UK, for example, the Defence and Security Accelerator (DASA) has hosted seminars to introduce DIANA to relevant industry actors.³ This task will be easier for actors that have already linked actors up within their national innovation system, as suggested above. EU member states that are keen to link up their national systems effectively should also prioritize the EU and NATO innovation structures for the secondment of national staff, who can bring back valuable knowledge and horizon-scanning to their national systems. Finally, engagement is a question of reaching not just relevant innovators, but also the end-users of such innovation. Ensuring that the armed forces are engaged when strategies for international defence innovation cooperation are written, and actions implemented, will be key to the successful use of cooperative outputs.

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About Politea

Politea is an analysis company focusing on international political risk, geoeconomics, and technology, based in Stockholm, Sweden. With research, foresight, and strategy development, Politea helps companies and authorities to navigate in an increasingly turbulent environment and position themselves for the future.

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