The Defense Innovation
Readiness Gap Series

The Defense Innovation Readiness Gap Is Widening

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BCG + msc
Security
Innovation Board

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MSC's Security Innovation Board is tasked to connect the worlds of technological innovation and political decision-making in order to recognize the chances and challenges related to technological progress and come up with clear policy priorities earlier and in a more coordinated manner.

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The Defense Innovation Readiness Gap Is Widening

Introduction

In 2021, the Munich Security Conference (MSC) Innovation Board and Boston Consulting Group (BCG) conducted a comprehensive review of defense ministries' innovation activities across 59 countries. Our results, published in 2022, quantified for the first time the innovation readiness gap - the gap between ministries' aspirations for innovation and their ability to generate such results. This inaugural research also enabled us to identify five overarching actions that each of these ministries of defense (MoD) could take to create a step change in innovation and close the readiness gap.

In late 2022, we conducted a second comprehensive review. The MSC-BCG study team sent a survey to the same group of 59 ministries of defense, the European Union, and NATO to assess innovation readiness across 11 dimensions, enabling MoDs to compare their current innovation readiness to their previous year's performance, and to that of their private-sector counterparts. (See Exhibit 1.)

The results show that the defense innovation readiness gap significantly widened in the year since our first study. (See Exhibit 2.) Across 10 of 11 dimensions of readiness, MoDs fell below last year's results, by an average of 8 percentage points. (See the appendix, "Survey Methodology.")

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Exhibit 1

The 11 Dimensions of Innovation Readiness

Innovation ambition
Overall aspiration with quantitative and qualitative goals for innovation

Innovation domains
Strategic focus areas (e.g., end user or technology oriented) to prioritize

Innovation governance
System of decision bodies, mechanisms, and processes for allocating resources

Performance management
Decision-making methodology to establish an innovation portfolio and measure performance

Organizations and ecosystems
Organizational setup of innovation units; clarity of the position in a wider ecosystem

Talent and culture
Ability to attract and retain talent with the right skills and build an innovative culture

Idea to impact
Capabilities to ideate, validate, incubate, launch, and scale ideas to impact

Sustainability
Assurance that innovation is environmentally conscious and resource efficient

Projects
Adherence to leading project and product management best practices

Funnel
Shape of the innovation project funnel; quality and balance in decision making

Portfolio
Portfolio ambition and consistency and uniqueness of portfolio strategy

Sources: BCG Most Innovative Companies Survey, 2022; BCG analysis.

Exhibit 2

Ministries of Defense Report a Widening Innovation Readiness Gap
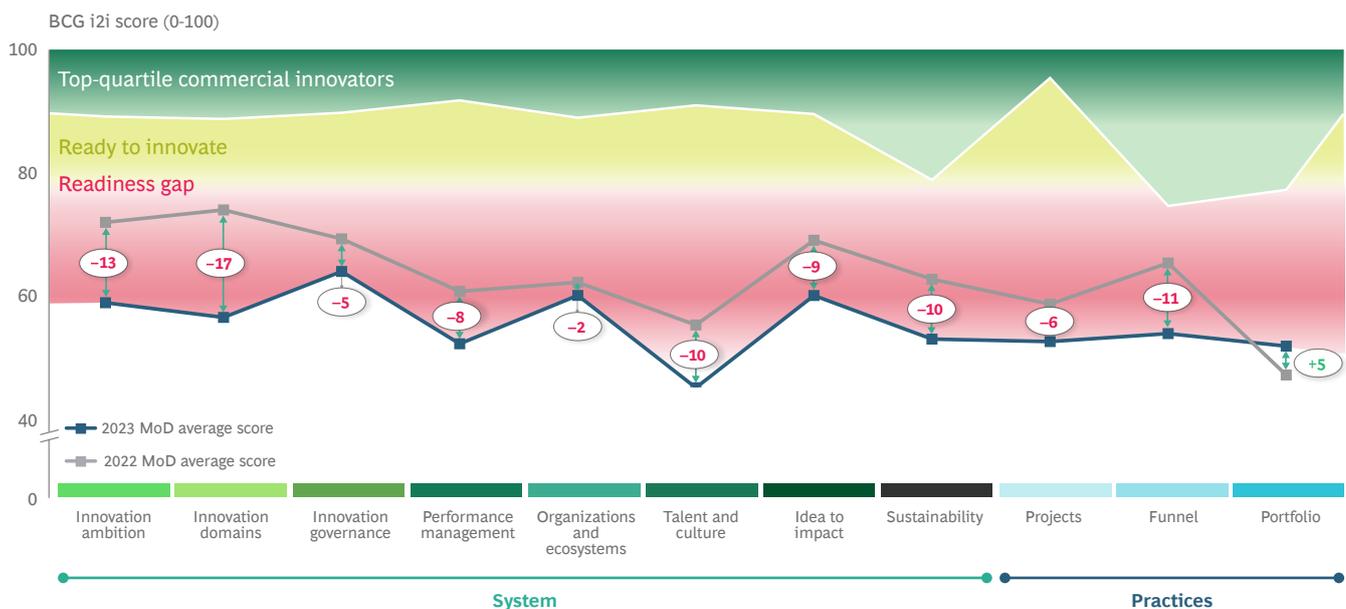
Sources: BCG Defense Innovation Survey, 2022, 2023; BCG Most Innovative Companies Survey, 2023; BCG analysis.

Note: The BCG i2i benchmark reveals an organization's relative strength on a 100-point scale that reflects best-practice maturity. Organizations that earn a score 80 or above are deemed ready to realize their innovation aspirations.

Interviews with more than two dozen leading public and private sector defense leaders worldwide validate these findings and highlight the role that several seismic shocks—particularly the war in Ukraine, supply chain vulnerabilities, increasing cyber threats, and major climate events—have played during the past year in shifting innovation priorities and exposing new cracks in innovation capabilities, contributing to a decreased level of readiness to innovate. These events not only exacerbated challenges identified in the previous year's report (such as difficulty in recruiting, training, and retaining talent) but also revealed additional stresses with regard to how ministries seek to innovate, reinforcing our earlier call to action.

In addition to implementing the recommendations that we made in last year's report, MoDs should take five tangible actions to reverse the widening of the innovation readiness gap:

In the remainder of this report, each of these five actions is considered in detail, and a series of more granular recommendations associated with each is identified.

1 Rebalance the innovation portfolio with a greater focus on operational outcomes and fielding fast.

2 Access untapped value and de-risk programs through superior insight into supplier economics.

3 Expand the definition of interoperability beyond the development of new technologies to include acquisition, operations, and sustainment of legacy products.

4 Reinforce cyber defenses across the entire innovation ecosystem.

5 Benefit from the increasing investments in climate and sustainability innovations.

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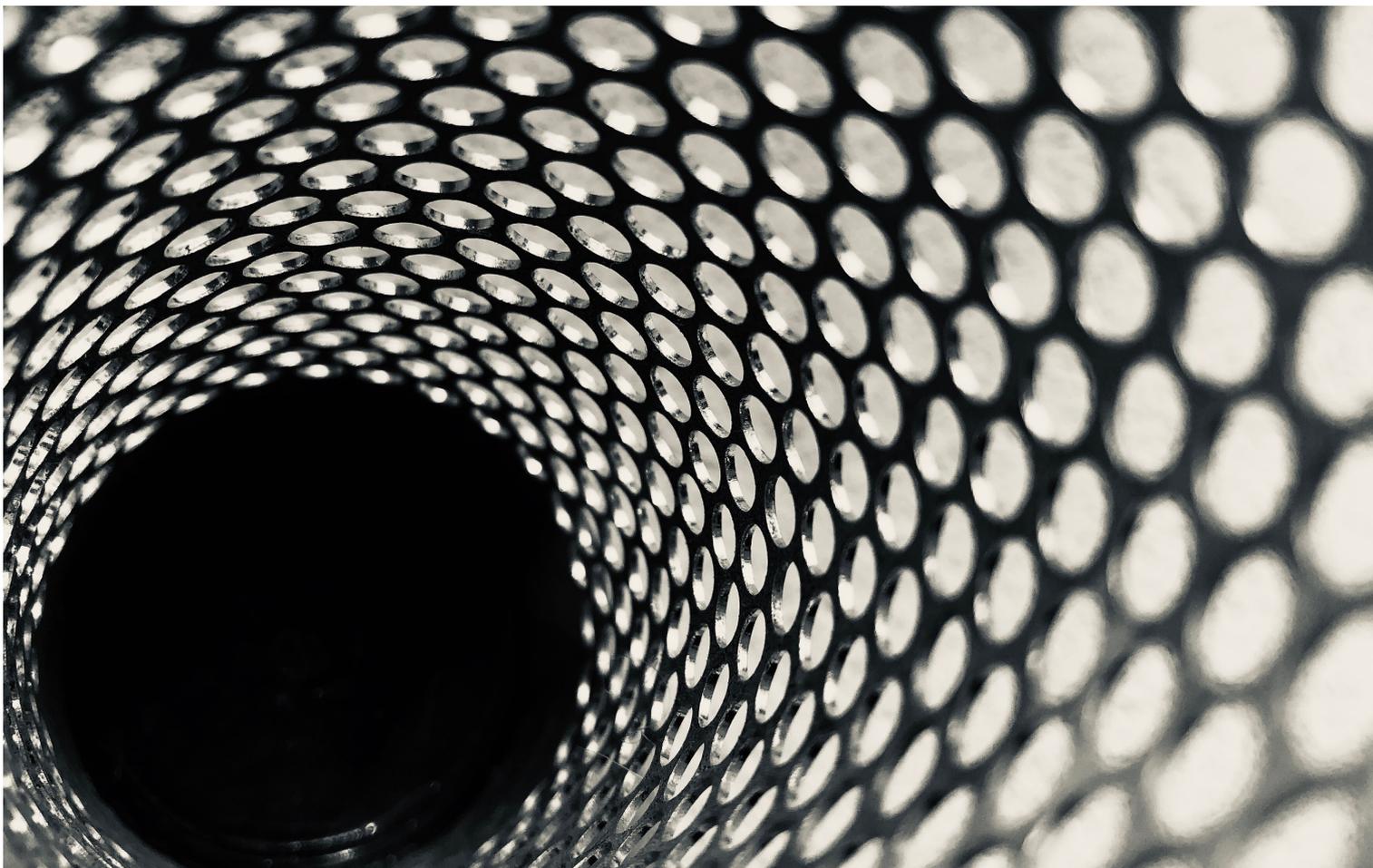
Action 1

Rebalance the Innovation Portfolio with a Greater Focus on Operational Outcomes and Fielding Fast

The capabilities to develop new technology and to field solutions quickly are key enablers of force readiness, yet survey results show that MoDs still face challenges in these areas. Among respondents, 56% report that their organization lacks the capability to scale innovations to the field, and 65% say that their acquisition policies do not enable fast fielding and deployment of new technology—a 21% decline in average score from the previous year. (See Exhibit 3.) Further, 78% of respondents report that their current pace of innovation is not sufficient to meet their goals and ambitions. Other research has reached similar conclusions; a review of major defense programs found that they were delivered up to 14 years later than originally planned.

In addition, survey respondents point to a decreasing focus on the outcomes of new capabilities. Only 45%

of respondents agree that their organization's projects proactively incorporate end-user input—a 14% decline in average score from the previous year—and only 33% agree that their organization incorporates the total cost of ownership into acquisition decisions. (See Exhibit 4.)

Only 29% of respondent report that their organization uses specific investment guardrails and performance metrics to steer innovation project decisions across their entire portfolio, which suggests a widespread lack of comprehensive strategy. Meanwhile, 68% of respondents report that their organization does not clearly define value criteria when determining which innovation projects to invest in, and 73% report lacking metrics or KPIs to evaluate the success of projects—29% below the private sector average. (See Exhibit 5.)

Exhibit 3   **MoDs Report Deficiencies in Fielding and Speed of Fielding**
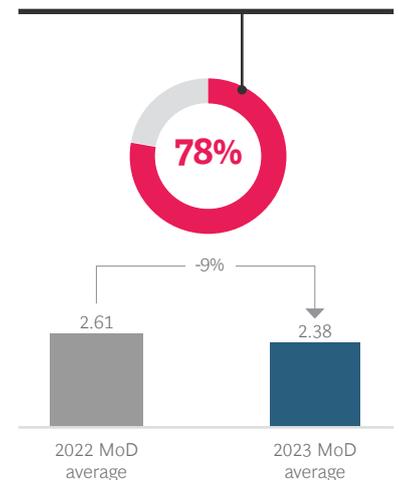
56% report that their organization cannot scale innovations to the field
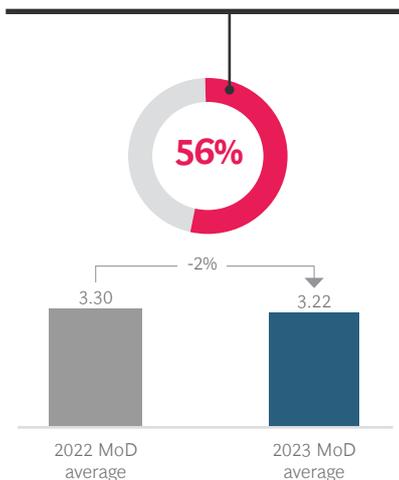
65% report that their MoD acquisition policies, processes, and mechanisms are not defined to enable fast and agile fielding/deployment
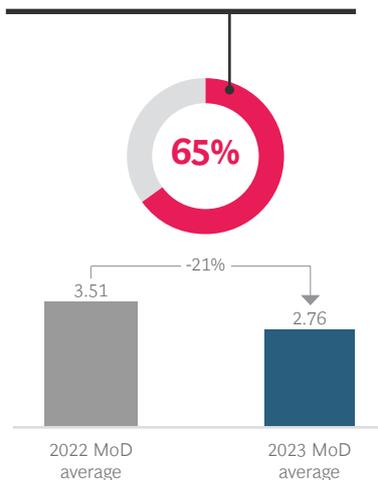
78% report that their pace of innovation is not sufficient (or more than sufficient)

	2022 MoD average	2023 MoD average
56% (−2%)	3.30	3.22
65% (−21%)	3.51	2.76
78% (−9%)	2.61	2.38

Sources: BCG Defense Innovation Survey, 2022, 2023; BCG analysis.
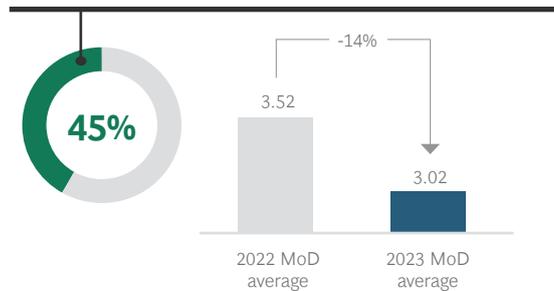
Note: "MoD average" is the average score for the specific question in that year's survey.
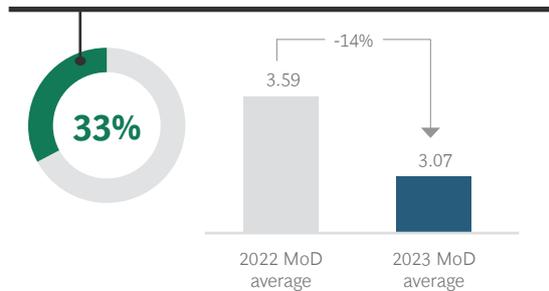
Exhibit 4

MoDs Report Low Incorporation of End-User Feedback and TCO

45% agree that their organization proactively and directly incorporates end-user feedback into idea validation

45%

-14%

3.52
2022 MoD average

3.02
2023 MoD average

33% report that their organization considers TCO in idea validation

33%

-14%

3.59
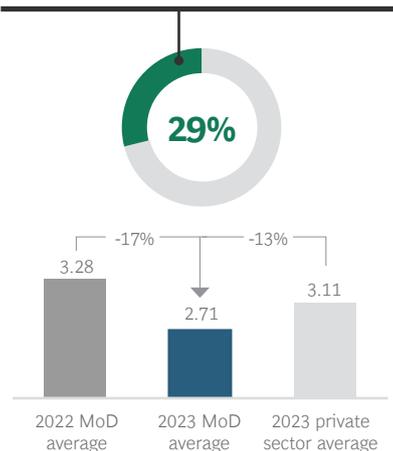2022 MoD average

3.07
2023 MoD average

Sources: BCG Defense Innovation Survey, 2022, 2023; BCG analysis.

Note: "MoD average" is the average score for the specific question in that year's survey. TCO = total cost of ownership.

Exhibit 5

## MoDs Report Deficiencies in Defining and Measuring Project Value

29% agree that specific investment guiderails and/or performance metrics steer innovation project decisions

29%

-17%   -13%

3.28
2022 MoD average

2.71
2023 MoD average

3.11
2023 private sector average

68% report that their organization does not clearly define and/or measure value criteria

68%

-13%   -21%

3.25
2022 MoD average

2.82
2023 MoD average

3.58
2023 private sector average
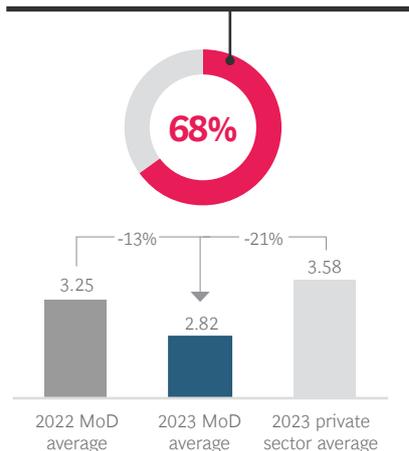
73% report that metrics and/or KPIs for innovation projects are not clear and well defined
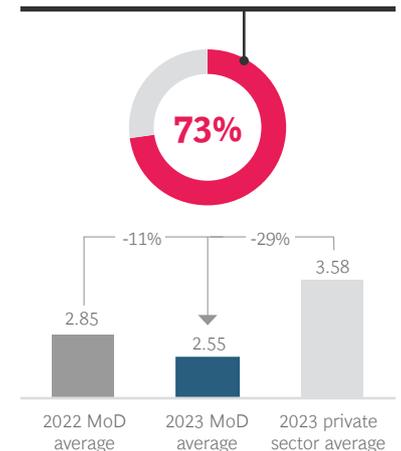
73%

-11%   -29%

2.85
2022 MoD average

2.55
2023 MoD average

3.58
2023 private sector average

Sources: BCG Defense Innovation Survey, 2022, 2023; BCG Most Innovative Companies Survey, 2023; BCG analysis.

Note: "MoD average" is the average score for the specific question in that year's survey.

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The following steps should be taken in support of the first action:

Recommendation 1A

Balance the organization's innovation portfolio to field technology faster. Ensure that innovation efforts balance long-term, breakthrough research and development, immediate operational needs, and sustainment activities, such as munitions. (See "Commercial Technology Is Changing the Landscape.") Align the innovation portfolio with the organization's overall strategic direction to leverage its comparative advantage. (See "Five Innovation Models.")

Recommendation 1B

Evaluate acquisition performance based on outcomes. Move beyond existing primary measures of project success compliance, timely delivery, and acquisition cost to include measures of operational impact such as end-user satisfaction, speed to the field, impact on force readiness, total life-cycle cost (encompassing not just the initial acquisition but also maintenance, sustainment, and upgrades), and economic useful life. Consider the long-term ROI to avoid artificial constraints of near-term budget cycles that might otherwise exclude game-changing innovations. Regularly review investments after development to ensure continued ROI and implementation in the field.

Recommendation 1C

Create an innovative culture that embraces risk and failure. Ensure that the acquisition workforce has both the ability and the power to deliver. Many of the processes necessary to rapidly acquire and field technology already exist but are not leveraged by those on the ground. Create a culture that embraces risk through an explicit expectation that some projects will fail. Set processes in place to learn quickly from failures, including questioning and testing ideas early to identify and learn from any issues that arise. Ensure that performance reviews, promotions, and other incentives reward innovative behavior with an expectation and a bias for risk taking. (See "A Culture of Strategic Risk Taking.")

Commercial Technology Is Changing the Landscape

Using cell phones' built-in GPS and Starlink satellite access to enable remote connectivity, military forces have transformed these devices into a surprising source of innovation for communications. By leveraging a civilian-conceived program and working with existing technology, forces have been able to create an operational advantage without a massive investment in research and development.

A Culture of Strategic Risk Taking

IBM strives to "fail early, fail often, and fail cheap" by creating a culture that embraces risk, eliminates the stigma associated with failure, and learns from failures. The company trains managers to encourage and recognize people for well-executed risks by evaluating employees on their execution of an entire portfolio of projects, from conception through completion—not just on the outcome of a single project.

Five Innovation Models

In our 2022 analysis, innovation practices of MoDs were classified across 40 key indicators and then grouped into five innovation models, drawing from BCG research into private sector innovation and applying the models that are most relevant for the defense context. (See the exhibit below.)

Each innovation model has corresponding resources and practices that an MoD can leverage to support its innovation strategy, along with informing acquisition strategies. (See the exhibit below.)

Innovation Models Shape MoDs' Fielding Strategy

Creators and expanders	Solution builders	Fast adopters	Deployers	Specialists
Focus on "big bet" efforts to create new capabilities	Base innovation on end user needs and feedback	Rapidly tailor and scale others' innovation practices	Maximize value from other nations via procurement	Develop a specialized focus in key technology domains

Comparative Advantage

Significant private and public capital	*Superior end user insight*	*Rapid learning and agility*	*Procurement and nation partnership*	*Superior insight into a few domains*

Measurable outcomes for acquisition

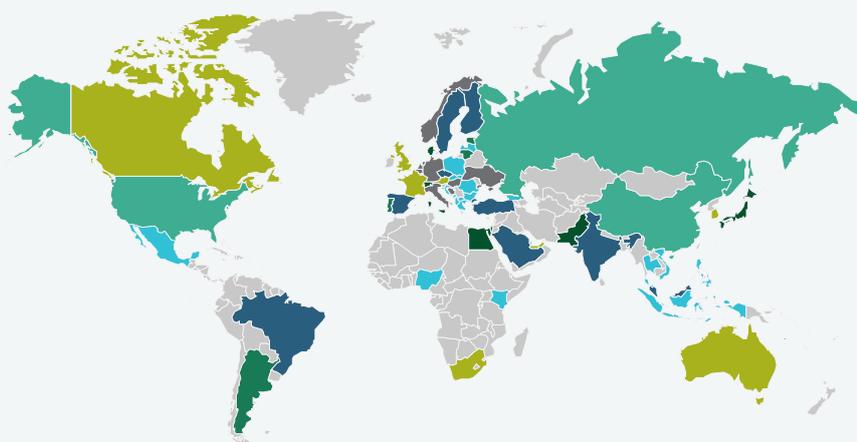|				
Enhanced capabilities in disruptive technology	High satisfaction scores and adoption rates by end users	Speed of adoption and number of continuous improvement initiatives	Technologies and equipment imported, purchased, and fielded	Patents and perceived leadership in selected areas

Sources: Fact base of 40 publicly available key indicators; BCG analysis.

Innovation Models Demonstrate a Range of MoD Strategies

Creators and expanders
China, Russia, US

Solution builders
Australia, Austria, Canada, France, South Africa, South Korea, UAE, UK

Fast adopters
Brazil, Czech Republic, Finland, India, Malaysia, Saudi Arabia, Spain, Sweden, Turkey

Deployers
Albania, Bulgaria, Croatia, Georgia, Greece, Indonesia, Kenya, Latvia, Montenegro, Mexico, Nigeria, North Macedonia, Philippines, Poland, Qatar, Romania, Slovakia, Thailand, Vietnam

Specialists
Argentina, Estonia, Israel, Lithuania, Portugal

Multiple
Denmark, Egypt, Japan, Pakistan, Switzerland

Not surveyed
All other countries

Undefined
Belgium, Germany, Hungary, Italy, Luxembourg, Netherlands, Norway, Singapore, Slovenia, Ukraine

Action 2

Access Untapped Value and De-risk Programs Through Superior Insight into Supplier Economics

MoDs often lack insight into suppliers' incentives, priorities, business models, production capacity, and other factors that drive the true cost of new technologies. Even in peacetime, the defense industry is particularly vulnerable to unstable supply chains because they rely on subtier suppliers, leading to an opaque view of all members of the supply chain, vulnerabilities, and areas for consolidation or investment. In many cases, the incentives of one participant in the supply chain conflict with those of another. The lack of transparency forecloses some innovation opportunities and creates vulnerabilities due to shortages of critical supplies. Overall, 79% of survey respondents expect that moderate to severe supply chain issues will impact their organization's acquisition goals in the next year.

These conditions have worsened as a result of recent disruptions—most notably the war in Ukraine. (See "Vulnerable Supply Chains.") Suppliers' production rates have not been able to meet MoDs' needs during systemic conflict. At current lead times, suppliers would need two to three years to replenish the donations to Ukraine since early 2022, let alone supply new, innovative technologies.

At the same time, MoDs are struggling to broaden their network to include nontraditional suppliers and thus gain access to groundbreaking technology, a goal cited by 72% of survey respondents. (See Exhibit 6.) MoDs have fallen short in this effort because their acquisition processes tend to be inflexible and difficult for nontraditional suppliers to understand. Fully 72% of survey respondents have acquisition timelines that exceed 18 months (well beyond startup funding cycles), and 68% say that their proposal processes are complex and require significant time and effort. Moreover, 69% do not provide feedback to suppliers on proposals, so vendors unfamiliar with the defense acquisition process often have no insight into why they lost a contract or what they could change to win the next one. (See Exhibit 7.)

These issues— opaque supplier costs, potential vulnerabilities due to shortages faced by suppliers, and the need for better partnerships—share a common root cause. MoDs lack insight into the suppliers' economics and incentives, which leaves them unable to fully unlock value and de-risk programs.
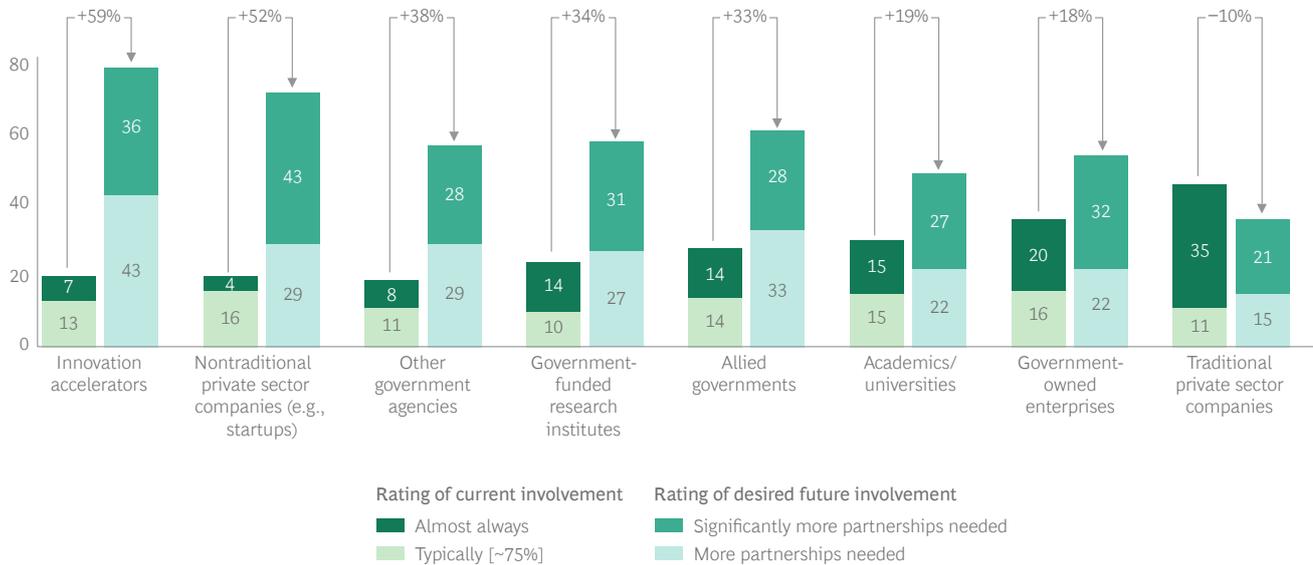
Vulnerable Supply Chains

Volatility risk in raw materials, caused either by seismic shocks or by supply-and-demand forces, is occurring across a variety of materials with impacts on defense. For example, a combination of historic underinvestment in production capabilities and demand spiking from technological advances is straining the global semiconductor supply chain. Geographic consolidation of chip fabricators has created single points of failure that are vulnerable to natural disasters, infrastructure failures, cyberattacks, or geopolitical friction.

Supply chains that have historically remained stable show signs of potential volatility as well. For example, domestic steel production in Europe and North America has begun to shrink and will probably further contract as a result of competition from China, which can produce steel at 10% to 15% lower costs. This economic pressure will increase the likelihood of future dependency.

Exhibit 6

MoDs Report Gaps Between Actual and Desired Levels of Partnerships, Especially with Innovation Accelerators and Startups

Current and desired level of involvement with partners (%)

| | +59% | +52% | +38% | +34% | +33% | +19% | +18% | −10% |

Rating of current involvement
- ■ Almost always
- ■ Typically [~75%]

Rating of desired future involvement
- ■ Significantly more partnerships needed
- ■ More partnerships needed

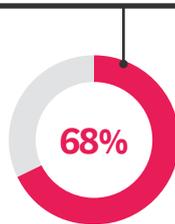**Sources:** BCG Defense Innovation Survey, 2023; BCG analysis.

Exhibit 7

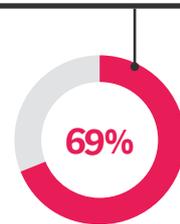## Opportunities Exist for MoDs to Improve Their Acquisition Processes

72% report that their acquisition timelines exceed 18 months

72%
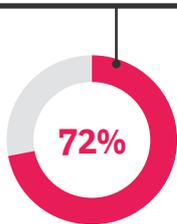
68% report that their proposal processes are complex and require significant time and effort

68%

69% report that feedback is not provided as part of the acquisition/proposal process

69%

Source: BCG Defense Innovation Survey, 2023.

The following steps should be taken in support of the second action:

Recommendation 2A

Understand the economic priorities and imperatives of suppliers. Assess supplier economics to correct asymmetries of information. Set contractual reporting requirements that create transparency throughout all parts of the defense supply chain, including subtier costs (such as standardized, easy-to-complete cost templates). On the basis of these insights, manage relationships with suppliers by aligning incentives with overarching mission/program objectives, and establish KPIs that track the true impact on readiness. Tailor incentives to each supplier's profit pools and behaviors. Use innovative terms and conditions to support enforcement of incentives (for example, shifting a greater portion of contract payment to post-delivery to help ensure that suppliers meet quality standards). (See "Innovative Terms and Conditions.")

Recommendation 2B

Identify and eliminate single points of failure in supply chains. Establish new reporting requirements that identify all suppliers for a given program (including those at lower tiers), in order to spot potential choke-point vulnerabilities and areas for consolidation. In partnership with suppliers, invest in capabilities to identify hidden vulnerabilities that the partner supplier may not be able to find on its own. Look for areas to strategically invest in and build up newly identified supply chain players. Adopt a segmented approach to intellectual property (IP), with stricter policies to prevent the most advanced domestic IP from being exported and replicated and with more lenient policies to promote open trade and foster investment for more mature technology.

Recommendation 2C

Create faster, more flexible acquisition processes to attract nontraditional suppliers. Streamline contracting to establish awards within 18 months (or less), to support startups typical 18-month funding cycles. (See "Australia Streamlines Contracting Processes to Attract SMEs.") Create clear, simplified proposal processes including moving beyond paper-based submissions to incorporate such other models as model-based systems engineering, digital submissions, oral working sessions, and multiple rounds. Provide feedback before and throughout the proposal process to encourage additional submissions even by those not awarded contracts.

Innovative Terms and Conditions

MoDs try to incentivize superior supplier performance through various innovative terms and conditions, including the following:

- Condition acceptance, which may entail withholding or eliminating final payment pending full resolution of quality issues

- Adjustment of interim payment schedules on the basis of quality performance measures; for example, automatically revising payment terms to decelerate payments and worsen the cash flow position of the supplier under the contract if quality issues arise

- Automatic warranty extensions to deal with poor-quality products or material

- Establishment of past performance reporting requirements to discourage and correct poor quality through its impact on the awarding of future contracts

- Objective performance incentives; for example, technical objectives such as "reach" capabilities that exceed threshold performance requirements

- Adoption of cost performance "share lines" to incentivize partnering on continuous cost reduction efforts

Australia Streamlines Contracting Processes to Attract SMEs

The Australian government set a target of sourcing at least 20% of its procurement from small and medium-size enterprises (SMEs), beginning in 2022. To incentivize SMEs to participate in proposals, Australia simplified its regulations for proposals under $200,000 with its Commonwealth Contracting Suite and introduced a pay-on-time policy for contracts of up to AU$1 million. In the 2021 fiscal year, the government paid 96% of all Australian Defence Force (ADF) invoices up to $1 million within 20 days. That same fiscal year, ADF surpassed its procurement target, with $11.5 billion of its approximately $46 billion in defense spending going to SMEs.

Action 3

Expand the Definition of Interoperability Beyond the Development of New Technologies to Include Acquisition, Operations, and Sustainment of Legacy Products

MoDs recognize the value of interoperability—the ability to interchange parts, components, and systems across platforms, services, and partners—to make programs more affordable, reduce duplicative efforts, and enhance capabilities. Interoperability also stimulates competition and attracts new suppliers by sending a clear demand signal to the market. Almost all survey respondents (98%) agree that interoperability has clear operational, financial, and schedule benefits. Despite that consensus view, 44% of respondents report low interoperability across technology (including platforms and capabilities), and 39% report low interoperability with key partners and allies. (See Exhibit 8.)
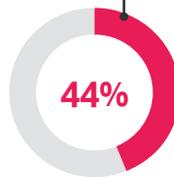
Exhibit 8 **MoDs Report a Gap Between the Perceived Benefits of Interoperability and Their Implementation of It**

98% report that interoperability has clear operational, financial, and scheduling benefits

44% report low interoperability across technology platforms and capabilities

39% report low interoperability with technology of key partners/ allies

98%

44%

39%

Source: BCG Defense Innovation Survey, 2023.

One persistent force inhibiting widespread interoperability is "customization creep"— the growing customization of technology, which renders interoperability between key partners and allies more difficult. A case in point is the NH-90 helicopter, which was designed in the 1990s for NATO forces, with one main variant for naval operations and a second for transport. MoDs procuring their own versions of the NH90 expanded the requirements significantly, and as a result there are an estimated 47 variants in existence today. Because the program became so complex (with variants specifying different cockpits, cargo holds, and even engines), maintenance costs have risen, and production delays have become more frequent, leading Australia, Norway, and Sweden to cancel orders.

The concept of interoperability must go beyond the traditional emphasis on highly technical standards for new products and include practical steps that span legacy products, operations, and sustainment. Common parts and standardized munitions can create a force advantage by making shared maintenance depots and stockpiles feasible. Setting interoperability standards across the entire product life cycle can also reinforce shared capabilities among forces. There is a massive opportunity across MoDs to implement open systems and standards across platforms to increase readiness. (See "Potential for a New Wave of Interoperability.")

The following steps should be taken in support of the third action:

Recommendation 3A

Expand the definition of interoperability. Look beyond interoperability in innovations and apply the concept to legacy platforms still in operation. All aspects should be in scope, including components (such as the modular avionics components on next-generation fighters), operational exercises (such as establishing common fuel standards and standard munitions for weapons platforms), and product sustainment (such as common parts to enable shared depots in strategic locations).

Recommendation 3B

Quantify and prioritize a long list of interoperability opportunities. Assess the organization's ability to leverage the existing standards of partners and key allies. Prioritize opportunities on the basis of their value (such as cost reduction and increased capabilities), feasibility, and timing for both MoDs and industry partners.

Recommendation 3C

Incorporate proven implementation steps from successful, interoperable systems. Establish a multidisciplinary governance structure for implementation—enabled with an enterprise remit—that includes technical standards, industry engagement, financial management, and operational changes. Define a segmented business case for industry by determining the market for new, interoperable solutions, and openly communicate both the intention and the business case for interoperability to industry. Test requirements and establish a set of common standards across the new, open system. After testing requirements, identify roles in the innovation ecosystem and acquire the new system through partners via innovative contracts—for example, incentives that spur suppliers to adopt the new approach, along with protections for any critical IP. Progressively implement industry standards in close collaboration with partners, consistently update and manage standards, and ensure that new standards emerge through an empowered central governance structure enabled by a designated liaison to each program or platform. Industry adoption can make or break an interoperability initiative. (See "Interoperability in the Automotive Industry.")

Potential for a New Wave of Interoperability

The UK, Japan, and Italy are collaborating on a sixth-generation fighter jet, the Global Combat Air Programme, with an opportunity to set shared standards with other fighter jet programs, including Airbus's Future Combat Air System and various US programs.

Similarly, France and Germany are collaborating on a European Main Battle Tank that uses components from currently deployed tanks (the chassis and hull of the German Leopard 2A7 and the turret of the French Leclerc). By adopting these common features, the countries may be able to establish rapid maintenance, repair, and operations hubs across Europe for all three tanks.

Latvia and Estonia publicly stated their need for air defense capabilities. Recognizing the time, cost, and scale challenges involved in developing individual solutions, the countries issued a joint letter of intent to procure medium-range air defense systems. The two Baltic countries' MoDs expect to be able to share parts, train together, and invite other countries into the program in later stages.

Interoperability in the Automotive Industry

In the automotive industry, an open architecture system for some key parts and components initially met with low supplier adoption and minimal interoperability of hardware and software. As recognition of the standards spread, supplier adoption broadened, leading to increased savings through competition among suppliers and through significant price transparency to automotive OEMs, driving accelerated upgrade cycles as suppliers' incentives to spur innovation increased.
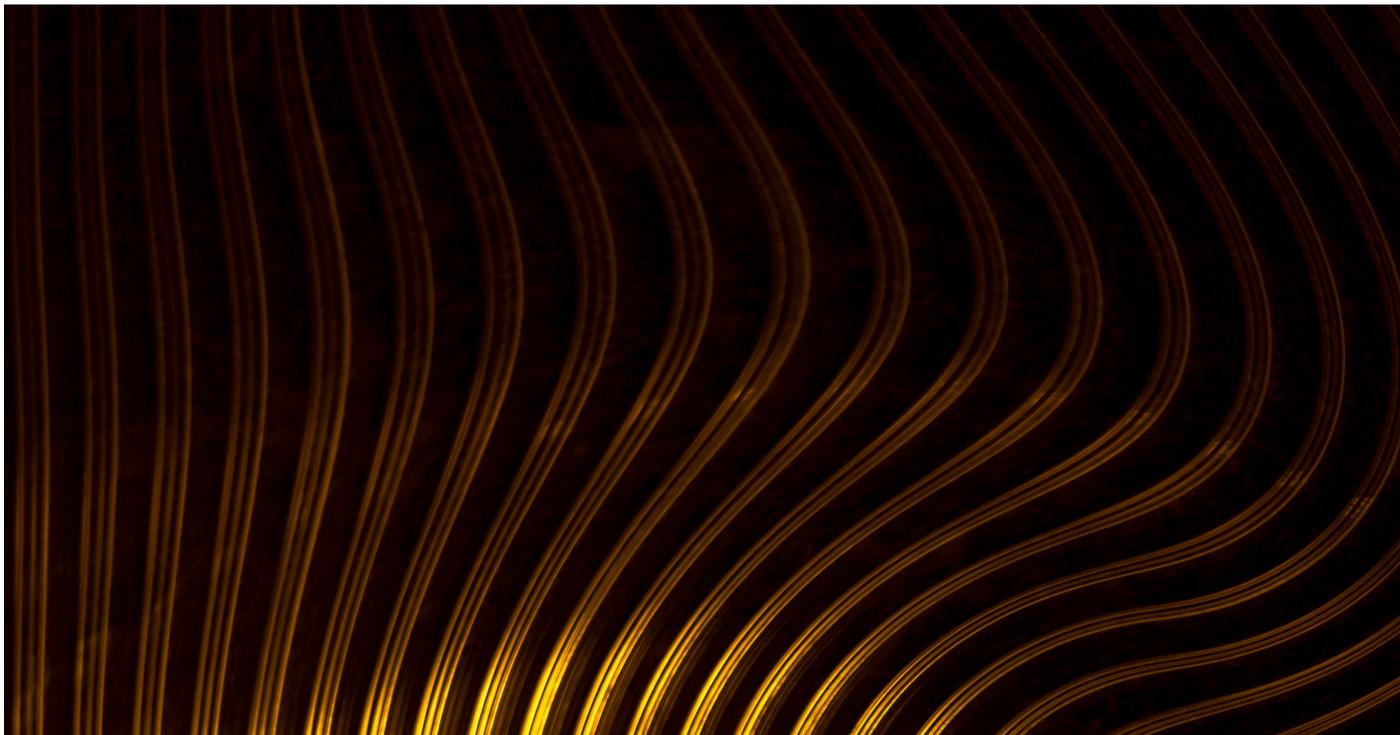
Action 4

Reinforce Cyber Defenses Across the Entire Innovation Ecosystem

Cybersecurity is fundamental to innovation, but threats are growing more frequent and more severe. In 2022, 14 of the 59 MoDs surveyed were publicly impacted by cyber attacks, and defense contractors have been targeted, too. Hackers linked to a criminal organization in Cuba targeted government institutions in Montenegro, including the ministry of defense, and demanded a ransom of $10 million to restore access. Another cyber attack forced the Slovenian MoD's Incident Reporting System for Protection and Rescue to go offline for several days.

The surface area for potential cyber attacks is expanding exponentially through increased uptake of software-based innovations. Partnerships with nontraditional suppliers that typically have less experience in mitigating threats have also increased cyber vulnerabilities throughout the innovation ecosystem.

Even when ministries have existing cybersecurity programs, practices, and innovations, they may not adequately or consistently apply or implement them. Partnership, new innovative technologies, and a proactive posture are essential to secure data, technology, and innovation.

The following steps should be taken in support of the fourth action:

Recommendation 4A

Use a three-tiered maturity model to assess traditional and nontraditional partners' cyber capabilities. Segment suppliers across the entire ecosystem according to their cybersecurity level, using the following three-tiered maturity model: minimum (suppliers meet existing standards and requirements, but do not tailor their approach to their organizations' unique needs, leading to low to moderate coverage of existing threats); intermediate (suppliers address all known and common threats, enabling full coverage of documented threats); and advanced (suppliers holistically apply best practices to prepare for emerging cyber needs, predicting threat trends and potential security issues). Segmentation will enable a more tailored approach to improve cybersecurity for each supplier, yielding greater efficiency than a one-size-fits-all approach can achieve.

Recommendation 4B

Communicate expectations to partners, and look for opportunities to invest. After using the maturity model to assess suppliers, communicate the standards that partners need to meet. Help partners at lower maturity levels—especially nontraditional suppliers—meet higher organizational standards and requirements by providing coaching, establishing KPIs, and setting contract incentives for improved performance.

Recommendation 4C

Institute a continuous improvement process that elicits best practices from all partners, and disseminate them across the ecosystem. Go beyond baseline compliance by systematically rolling out lessons and best practices across all partners. (See "Proactive Deterrence of Cyber Attacks.") Prepare for inevitable cross-ecosystem incidents by running realistic scenarios to identify risks across the entire defense innovation ecosystem. (See "NATO's Cybersecurity Scenario-Planning Exercise.")

Proactive Deterrence of Cyber Attacks

MoDs can resort to three methods to deter future cyber attacks: the threat of punishment or retaliation, protection of critical cyber resources, or investment in resilience and recovery. Many hospitals invest in deterrence through resilience and recovery by creating multiple standby sites with preloaded electronic medical record (EMR) software. In the event of an attack on an EMR record system, a backup system immediately becomes available, minimizing disruptions to hospital operations and thus undercutting the attractiveness of such assaults to potential attackers.

NATO's Cybersecurity Scenario-Planning Exercise

NATO regularly conducts cybersecurity exercises and supports cyber scenario planning and training through a massive cyber incident simulation known as Locked Shield. The simulation immerses experts in a scenario in which they must defend approximately 5,500 virtualized IT, military, and critical infrastructure systems in the face of more than 8,000 attacks. In 2022, 32 nations participated in the exercise.
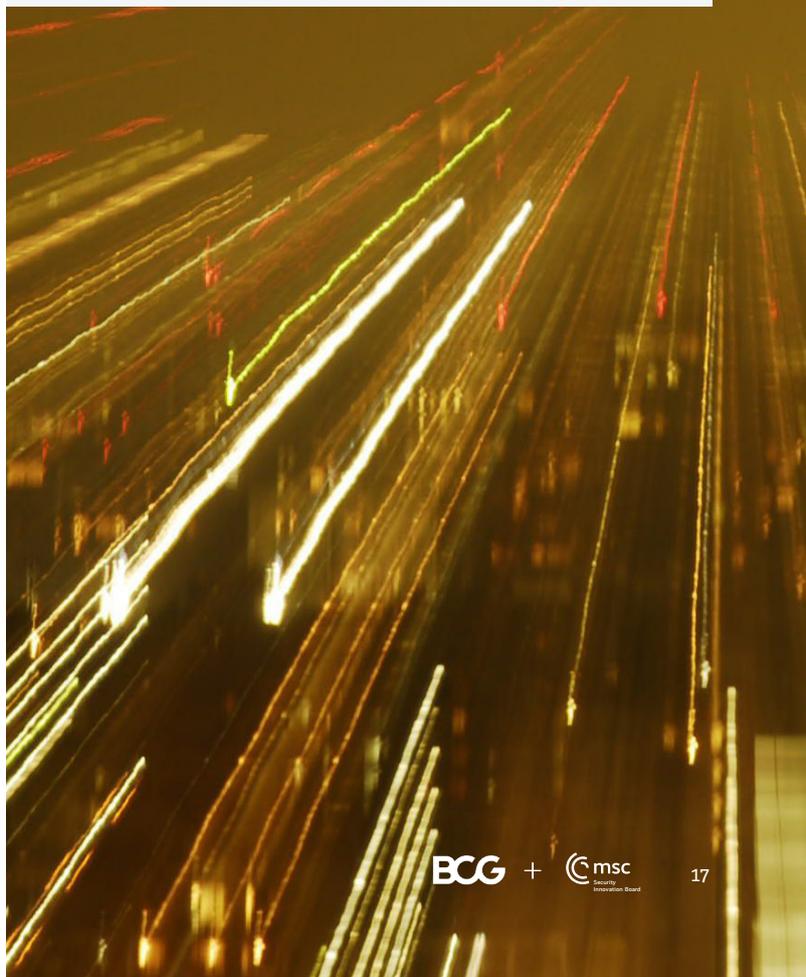
Action 5

Benefit from the Increasing Investments in Climate and Sustainability Innovations

Although some defense leaders consider climate change a near-term threat to their forces, many others still view climate change as a long-term issue that doesn't yet impact force readiness or require immediate action. Recent global conflicts have pushed climate issues farther down the list of priorities and, in some cases, reversed recent progress. Rising natural gas prices caused by the war in Ukraine have led Germany to begin burning coal again, backtracking from earlier commitments to reduce emissions.

Among survey respondents, only 35% report that their organization's innovation investments are linked to climate and sustainability (C&S) considerations (a 15% decline in average score from the previous year), and only 28% of projects focus on near-term priorities. (See Exhibit 9.) When MoDs do invest in C&S initiatives, most (69%) say that these projects do not improve military capabilities, resiliency, or readiness, and 68% report not having adequate resources to achieve their C&S goals. (See Exhibit 10.)
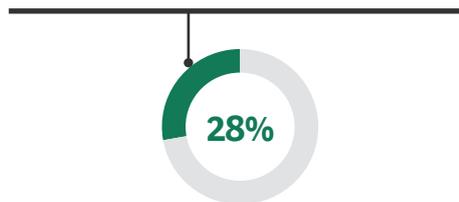

Exhibit 9   **MoDs Report Deficiencies in Sustainability Investments**

35% report that investments are linked to sustainability/climate change priorities

35%

-15%

3.15

2.67

2022 MoD average   2023 MoD average
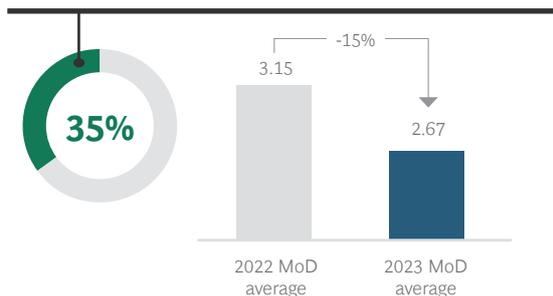
28% report that climate and sustainability projects are focused on near-term priorities

28%

Sources: BCG Defense Innovation Survey, 2022, 2023; BCG analysis.

Note: "MoD average" is the average score for the specific question in that year's survey.

Exhibit 10   **MoDs Report That Sustainability Projects Lack Real-World Military Impact and Have Insufficient Resources Dedicated to Them**

69%

69% report that climate and sustainability goals do not improve military capabilities, resiliency, and/or readiness

68%

68% report not having the resources (financial, personnel, etc.) to prioritize sustainability and climate goals

Source: BCG Defense Innovation Survey, 2023.

Failing to realize the impact of C&S on military force readiness, as well as failing to leverage the benefits that are emerging from potential dual-use C&S-military innovations, is a mistake. It is imperative that MoDs include C&S initiatives as part of their broader set of innovation activities—not only to improve their innovation readiness, but also to address the growing impact of climate change on force readiness. The climate crisis already directly affects military force readiness, through impacts due to energy and resource scarcity, landmass changes and rising sea levels, increasingly frequent extreme weather events, and water and food scarcity:

- Extreme weather events affect MoD operations and increase the burden of disaster response obligations. In the UK, an unprecedented heat wave in July 2022 caused runways to melt, requiring the UK Royal Air Force to reroute flights for two days. In 2017, members of Switzerland's armed forces had to support recovery operations for more than two months after severe landslides and floods, reducing their operational readiness.

- The US Energy Information Administration projects that prices for fossil fuels and rare-earth minerals will roughly double by 2050 as a result of unstable supply chains and diminishing finite resources, threatening MoDs' ability to procure necessary technology and equipment.

- Rising sea levels will reduce landmass and increase the extent of annual flooding, threatening MoD installations, property, and logistics. In the US, six of the nation's 22 most strategic seaports, collectively responsible for deploying approximately 90% of its military equipment and supplies, are at risk of significant annual flooding by 2050, according to projections from NASA.

- UN Water projects that water scarcity will double by 2050, and agricultural productivity is declining worldwide, leading to increased migration and conflict.

Militaries have a unique opportunity to test and coinvest in climate innovations that could solve national security issues. To date, MoDs have not approached these innovation issues systematically and have not capitalized on the opportunity to leverage the many potential dual-use technologies that the private sector has developed. Among survey respondents, 66% report a lack of partnerships with key mission partners to jointly reduce emissions. To prevent a future decline in innovation readiness as environmental threats grow, MoDs need recognize climate change as a force readiness issue and take more proactive measures, including leveraging the private sector's large, preexisting climate change community.

The following steps should be taken in support of the fifth action:

Recommendation 5A

Leverage existing research and investments in climate change innovations by adopting dual-use technology to improve innovation readiness. MoDs today can leverage significant developments in renewable energy and other innovations, which can benefit from the militaries' unique test beds. More direct collaboration could deliver a range of benefits and enable MoDs to make faster progress. Try to leverage the climate community's progress through direct acquisition of dual-use technologies, demand signaling to industry to spur new investments, and direct partnerships with organizations working on breakthrough technologies such as carbon capture technology, fusion, and related advances. (See "Investments in Climate and Sustainability.")

Investments in Climate and Sustainability

In the past year alone, ten top climate tech investors have invested more than $7 billion in climate and sustainability technology. Many of these technologies have potential military applications, including the following:

- Sustainable fuel for air vehicles

- Sustainable solar and wind power

- Sustainable batteries

- Innovative grid technologies

- Decarbonized industrial heat

- Green hydrogen production

- Green hydrogen transport and storage

- Green chemicals

- Long-duration energy storage

Recommendation 5B

Prioritize initiatives to address both environmental impact and force readiness impacts. Consider military capabilities, environmental threats, productivity and efficiency, and environmental impact in determining where to focus efforts. (See Exhibit 11.) Ensure that efforts focus on the largest drivers of climate change and threats to national security. (See "The UK's Sustainability Strategy.")

Recommendation 5C

Remove organizational roadblocks. Identify and eliminate any processes within the MoD that may inhibit or otherwise adversely impact the prioritized initiatives and strategy. For example, ensure that acquisition metrics either include an assessment of long-term environmental effects or set the timeframe for value-for-money calculations to truly determine value, including negative externalities.

The UK's Sustainability Strategy

The UK Ministry of Defence has recognized environmental concerns as an urgent priority and developed a sustainable support strategy to deliver on climate change mitigation measures and develop a more resilient force. The ministry's supply chain strategy is shifting from a focus on cost reduction and efficiency toward a more balanced approach that factors in cost, service, reliability, and environmental sustainability. This approach has allowed the UK to prioritize innovations that may have been overlooked in the past because they were assessed only in terms of their potential effect on sustainability or only with regard to their impact on force readiness, rather than on the basis of both factors together.

Exhibit 11 | **Structuring Climate and Sustainability Initiatives to Focus on Readiness and Environmental Impacts**

Environmental impact | Reduce environmental impact (CO_2 emissions, fossil fuels, etc.) to achieve broader MoD or country's emission goals

Environmental threat | Increase comparative advantage through mitigation and reduction of current and future environmental threats (e.g., rising sea levels)

Military capability | Increase operational advantage through increased military capabilities (readiness, resiliency, etc.)

Productivity and efficiency | Reduce one-time and life-cycle costs through increased productivity and efficiency

Sources: UK Sustainable Support Strategy 2022; BCG analysis.

Conclusion

As highlighted in last year's report, efforts to close the innovation readiness gap cannot succeed unless MoDs implement them at every level of the organization. Too often, the people implementing day-to-day processes do not take up leadership strategy and end-user priorities, which results in strategic goals being set by bureaucracy instead of leadership. Working groups, long-term studies, and directives without an implementation roadmap will not deliver the behavior changes needed across the entire organization to improve innovation outcomes.

To implement the five recommendations discussed in this report, MoD leaders must ruthlessly prioritize implementation and ensure that everyone—from leadership to day-to-day program executors— has direction and a role to play in achieving these strategic objectives. Leaders can avoid past difficulties in implementing innovation actions by communicating and creating a culture of innovation through education, training, and incentives for all employees.

The measures discussed above provide a playbook for how to improve innovation capabilities. The stakes are rising, and MoDs must act now before the innovation readiness gap widens further.

Appendix: Survey Methodology

MSC and BCG developed these recommendations from the results of an in-depth survey and analysis of 59 ministries of defense (MoDs), with participating countries on every continent except Antarctica. We also analyzed the defense activity of the European Union and NATO in this context.

Survey respondents included senior ministry leader; members of innovation units; and representatives of user and operator groups, testing groups, and acquisition communities within the ministries. We asked respondents to assess their ministry's readiness to innovate by filling out a BCG benchmarking instrument, the Innovation-to-Impact Readiness Assessment (i2i). The i2i assessment consists of about 40 questions that illuminate aspects of the 11 dimensions of innovation readiness. In total, these 11 dimensions describe two broad categories of each ministry's approach to defense innovation: elements of the innovation system (that is, how a ministry is organized and governed to support innovation at scale); and innovation practices (that is, the daily work of navigating processes and systems within the ministry to achieve innovation outputs). Scoring is based on a 100-point scale that reflects best-practice maturity; a score of 80 or higher indicates that an organization is ready to realize its innovation aspirations. (See Exhibit 1.)

Analysis of the survey responses enabled us to gauge the progress of each ministry along the overall path of innovation readiness. We averaged those results to develop our view of the overall readiness of ministries in aggregate and of the size of the innovation gap. We then compared the defense results from the new survey to the results from the previous year in order to assess the progress of MoDs' innovation readiness over the past year, comparing average scores for each survey response in each year on a five-point scale. We also compared the results to private sector benchmarks from the current year, to see how far behind (or ahead of) the private sector the MoDs were. These benchmarks—this year gathered across 19 industries representing 2,249 private sector respondents—have been part of BCG's "most innovative companies" research for more than 15 years.

We next interviewed more than two dozen leading public and private sector leaders worldwide to validate these findings and to assess the leading innovation issues facing MoDs and the progress they have made over the past year.

Future studies will continue to track MoDs along their path to innovation readiness.

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