Debunking the Five Myths Behind the Munitions Gap

The Defense Innovation Readiness Gap Series

Input Report Prepared by Boston Consulting Group for the
Munich Security Conference 2026

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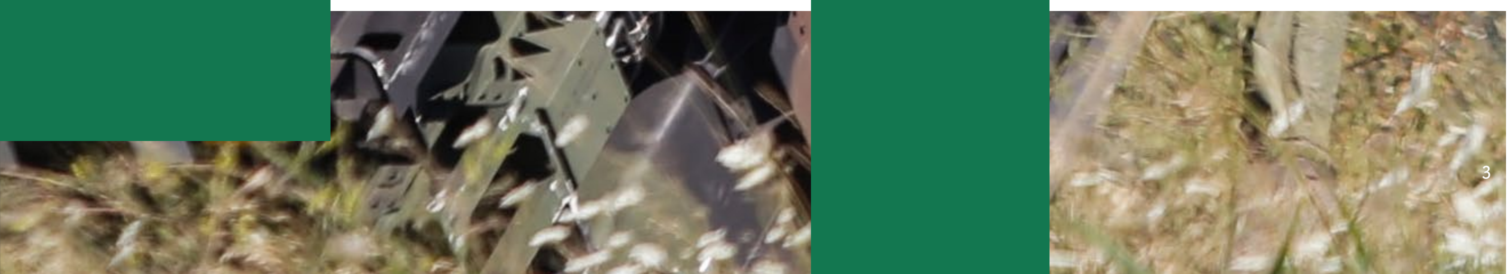


Introduction

Defense ministries continue to face an innovation readiness gap—the distance between their ambition and their ability to field new capabilities quickly. First identified in 2022 by the Munich Security Conference (MSC) and Boston Consulting Group (BCG), the gap has persisted even as the global security environment becomes more demanding.

This year's analysis—the fifth in our annual series—considers innovation readiness through the lens of munitions, an area where innovation is essential amid rising requirements. Munitions highlight the stark gap in innovative approaches to manufacturing, design, and commercial models necessary to meet surging demand. The results of our Defense Innovation Survey reflect these challenges: innovation is a key priority for 65% of respondents, but only 26% believe that the pace of innovation is sufficient.

Despite surging defense budgets and strong rhetoric, fundamental changes are essential to meet the requirements of ministries of defense (MoDs). Governments and industry must build a sustainable operating system to consistently produce the outcomes needed to meet calls for up to a 400% increase in air and missile defense. **(See Exhibit 1.)**

This report addresses five common myths related to munitions and offers practical steps that will enable MoDs and industry to innovate more effectively and strengthen munitions capacity and resilience where it matters most. **(See Exhibit 2.)**

Exhibit 1 US, European, and NATO Leaders Have Called for an Increase of up to 400% in Air and Missile Defense

The fact is, [NATO] needs a quantum leap … a **400% increase in air and missile defense.**

Mark Rutte
NATO Secretary General

We are now procuring weapons at or near maximum rates, but **industry is struggling to meet this rising demand.**

Adm. James W. Kilby,
Vice Chief of Naval Operations

Too many … weapons systems have been optimized for one metric, **performance [over] time and scale.**

Maj. Gen. (Ret.) John Ferrari
Former Commanding General, White Sands Army Missile Range

It will take **6 to 10 years** until all European munitions depots will be filled up again.

Armin Papperger
CEO, Rheinmetall

The war in Ukraine demonstrates that **we need to produce more** … we did not have sufficient weapons and ammunition available. No large stocks. And a lack of spare capacity.

Ursula von der Leyen
President, European Commission

It's our job … **to hold industry accountable, to deliver quickly, and to hold ourselves accountable** for giving industry the ability to deliver quickly.

Gen. Alexus G. Grynkewich
Supreme Allied Commander Europe

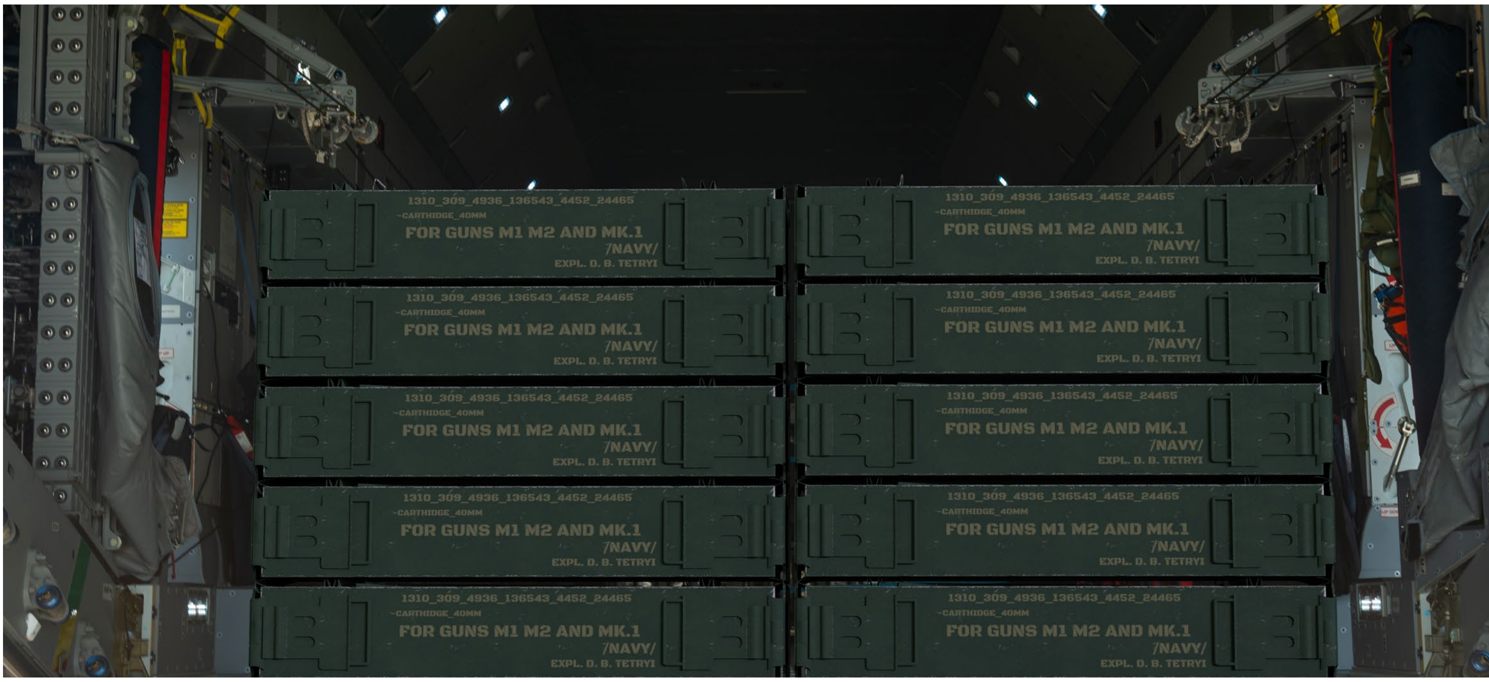
Source: Publicly available announcements, speeches, and media interviews.

Exhibit 2 Closing the Munitions Gap Entails Overcoming Five Core Myths

Myth	Reality	Priority innovations
"Larger stockpiles ensure resilience"	Resilience comes from the ability to improve capability over time and scale production to meet shocks	• Flow production and rolling recapitalization to ensure regenerable capacity • Design for modular manufacturing and upgrades • Actively manage stockpiles and capabilities with data
"Large capital expenditures are required to increase production"	Optimizing existing facilities can double throughput	• Redesign flow and optimize production • Target labor constraints with upskilling, shift optimization, and selective automation • Align contracts to reward throughput and generate a clear ROI on new investments
"Lead times span multiple years"	Lead times can be reduced with specific investments	• Incentivize supplier investment ahead of critical constraints • Design for flexibility • Use digital mapping to spot constraints and fund solutions
"Demand for munitions is persistent and steadily increasing"	Historically, demand has been volatile; smarter long-term contracts can lower costs and unlock innovation	• Lock in multiyear, scenario-based demand signals for core product families • Quantify and communicate the cost of variants • Run joint MoD-industry S&OP initiatives to align portfolios, not programs
"Cost growth is inevitable"	Costs should decrease over time, in line with historical experience curves	• Ensure cost visibility across the value chain • Contract for learning, and resist redesign churn • Establish baselines and enforce pass-through • Structure portfolios for reuse and systemic cost-out

Source: BCG analysis.

Note: MoD = ministry of defense; S&OP = sales and operations planning.



Myth 1: Larger Stockpiles Ensure Resilience

The strategic environment has shifted. Shorter warning times, high consumption and readiness requirements, and interconnected munitions systems all make stockpile planning more complex. In response, many ministries are seeking benchmarks for resilience. One major MoD framed this as a need to have roughly 90-plus days of relevant supply for a given scenario, and a credible ability to replenish on a similar timeline. Static reserves alone will rarely deliver that outcome, and many replenishment plans fail to align properly with how demand unfolds.

Recent conflicts and high-intensity simulations have highlighted the challenge, leading to calls to rapidly increase production rates. **(See Exhibit 3.)**

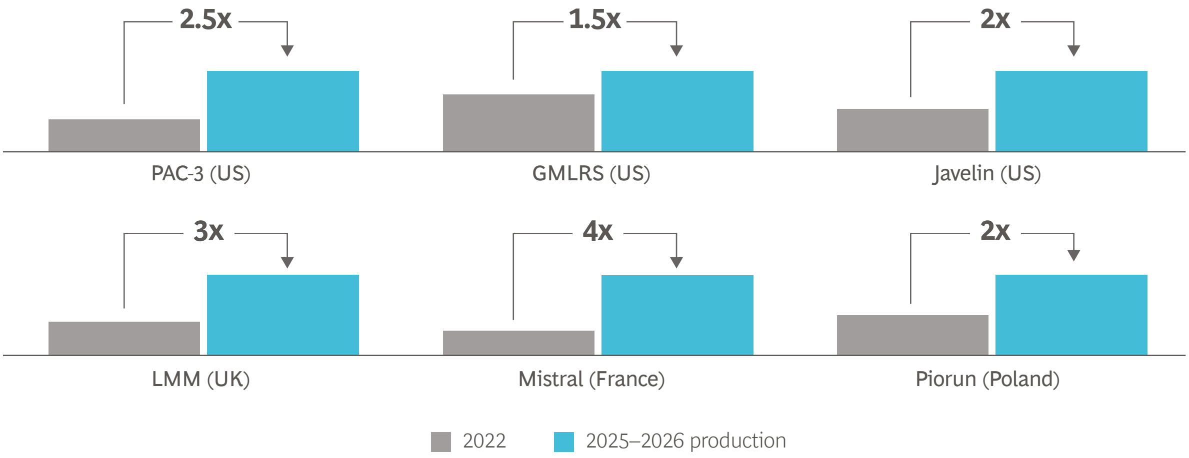
When requirements surge, inventories may be drawn down faster than they can be replenished through standard production and procurement timelines. Current production processes struggle to surge quickly, and contracting often arrives too late to shape supply chains. The result is a deterrence gap: inventories may look adequate on paper yet prove brittle under pressure.

A further, less-visible risk is relevance decay. As stockpiles age, those munitions may no longer match the threat, satisfy connectivity requirements, or prove effective against evolving countermeasures—requiring lengthy recertification, modification, and hardware/software upgrades.

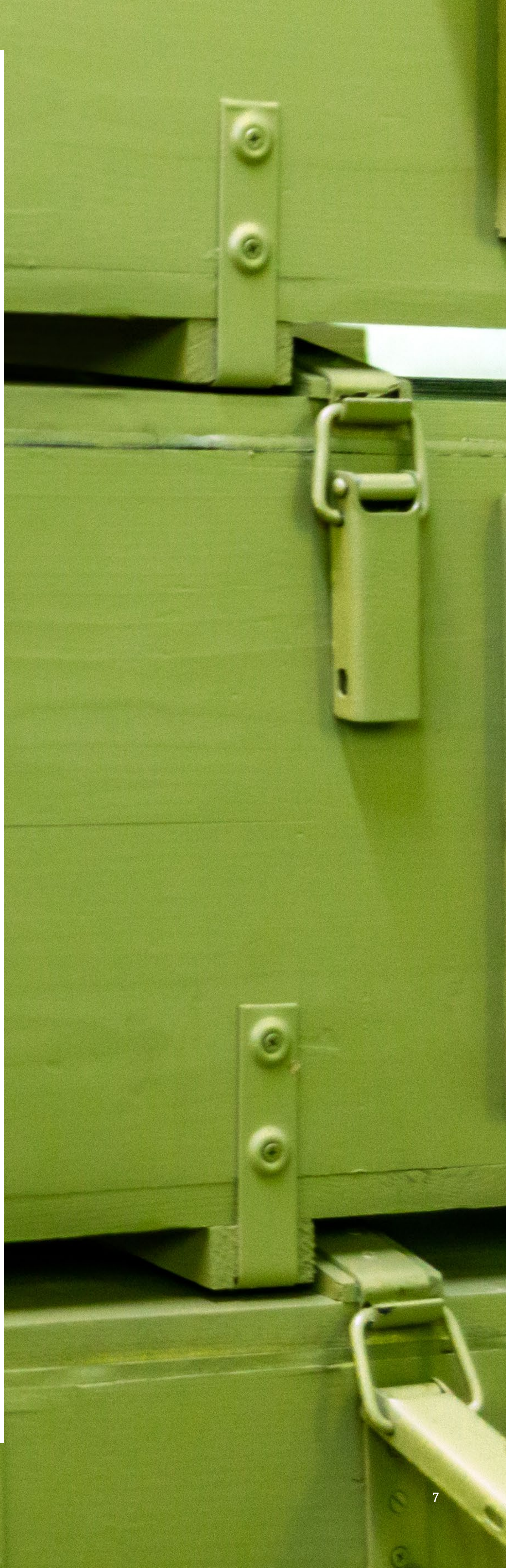
Life-cycle outcomes are often overlooked. Few of our survey respondents believe that decision makers consistently consider total cost of ownership in the innovation process. When such discipline is lacking, ministries risk optimizing for near-term buys while accumulating inventories that are slow and expensive to adapt.

Exhibit 3 **Production Rates Have Accelerated, with Commitments for Two- to Threefold Increases Across Many Assets out to 2030**

Estimated annual production target rates



Source: CRS Report on Defense Production for Ukraine.
Note: GMLRS = Guided Multiple Launch Rocket System; LMM = Lightweight Multirole Missile; PAC-3 = Patriot Advanced Capability.



Resilience cannot simply be a warehouse metric. It depends on an industrial base that can sustain supply and refresh configurations as threats evolve for credible deterrence. We see three priorities for MoDs and industry in this area:

- **Flow production and rolling recapitalization to ensure regenerable capacity.** Arrange for continuous keep-warm production of designated priority munitions, with planned surge bands so that throughput can rise quickly without incurring restart penalties. Use coordinated, multiyear demand commitments to make modernization and supplier diversification investable.

- **Design for modular manufacturability and upgrades.** Shift from bespoke units to munitions families based on modular open systems architecture (MOSA) and designed for common tooling, common testing, and block upgrades. Standardize configurations where possible, design for manufacturability (DFM) with commercial off-the-shelf (COTS) components to shorten lead times and reduce the qualification burden. The payoff will be faster upgrades and fewer one-off variants, as industry can flex production output across a munitions family without disruptive retooling.

- **Actively manage stockpiles and capabilities with data.** Oversee stockpiles as portfolios tied to scenarios. Maintain accurate histories of serial or lot-level configuration and testing, forecast recertification and life-extension needs, and link those signals directly to procurement and production plans. Use targeted automated test and inspection processes to accelerate recertification, and route viable lots into refurbishment or upgrade. The goal is to establish a clear inventory with a planned refresh cadence, in place of dead stock and uncertain performance in the event of a conflict.

Myth 2: Large Capital Expenditures Are Required to Increase Production

When demand spikes, the instinct is often to invest in new factories. New buildings and machines are visible. But for many munitions programs, greenfield expansion may be the slowest and least efficient path to near-term output. **(See Exhibit 4.)** New capacity can take years to design, permit, certify for safety, and staff—and because suppliers know that demand can swing, they may hesitate to commit capex without certainty.

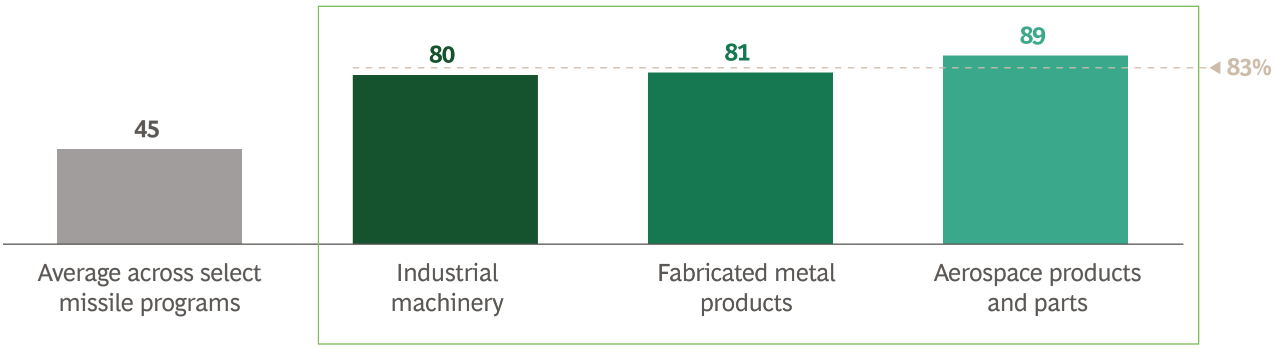
This creates a paradox: governments call for rapid increases in production, while the industrial system responds with multiyear timelines.

Often, the binding constraint is not square footage but throughput within existing plants—how efficient workflows (including testing and quality configuration) are, and whether operators can reliably staff bottleneck stations.

Many companies organize their facilities around legacy processes rather than paced flow. Constraints vary widely by munition type, but in our analysis of several key programs, testing and qualification consumed roughly 25% to 50% of total production time, with frequent bottlenecks in quality steps, hazardous operations, and a few constrained stations or tools. Batched work, schedules fragmented across programs, and underused performance data are signs that a plant is not being managed as an end-to-end throughput system. If those constraints aren't identified and stabilized, adding a new line may simply subject more of the plant's production to the same bottleneck.

Exhibit 4 Munitions Plant Utilization Rates Are Often Lower Than Those of Peer Industries, Despite Increasing Order Backlogs

Average utilization rates across select missile manufacturers vs. top-quartile industry comparator benchmarks (%)



Sources: Army and Navy 2026 budget requests compared against American Productivity & Quality Center industry benchmarks; BCG analysis.
Note: Plants evaluated: Lockheed Martin, Orlando, Florida; Raytheon, Tucson, Arizona; BAE Systems, Aberdeen, South Dakota; Northrop Grumman, Northridge, California.

From our work with manufacturers, we see that targeted optimization can deliver up to twofold gains in throughput–faster and at lower cost than constructing new production facilities. The highest-impact levers include the following:

- **Redesign flow and optimize production.** Treat throughput as a system constraint—not a square footage constraint. Rebalance the line around the true bottleneck, then modernize or parallelize the constraint steps (such as qualification, testing, or inspection) where they bind. At the same time, prioritize design-for-manufacturability to remove avoidable build and test steps in block upgrades. When coupled, these moves can unlock 15% to 30% gains in throughput.

- **Target labor constraints with upskilling, shift optimization, and selective automation.** Deal with the most constrained stations first—typically, stations related to testing, quality, and hazardous steps. Add second shifts and targeted weekend coverage where it matters, supported by fast certification pipelines and standardized work to quickly build the competence of new labor. Automate only where doing so removes dependence on scarce specialists and stabilizes uptime or quality.

- **Align contracts to reward throughput and generate a clear ROI on new investments.** Make smart investments to address bottlenecks in areas such as test capacity, tooling, second shifts, automation, and supplier qualification. Use incentive contracts that share savings and penalize overruns, backed by multiyear demand corridors and explicit capacity or surge fees, so suppliers can confidently fund near-term brownfield upgrades.

Myth 3: Lead Times Span Multiple Years

Most munitions programs treat supplier lead times as a fixed constraint. (“The long pole is always the supply chain.”) That mindset turns upstream delays into accepted planning assumptions rather than problems to engineer down. In reality, long or variable lead time is rarely a given: it is the result of design choices, qualification rules, sourcing strategy, and economic signals that determine whether suppliers invest in capacity and inventory ahead of demand. When those elements are misaligned, long lead times usually follow.

The issue is often concentrated among Tier-2 and Tier-3 suppliers that provide critical inputs yet rely on highly specialized, small-batch, single-shift operations that weren’t built to handle a surge in demand—leading to long queues and minimal recovery margin.

Only 32% of our survey respondents believe that suppliers have clear and specific incentives, and only 53% say that they can identify and address supply-chain constraints. The combination of limited visibility and weak incentives makes resolving bottlenecks more difficult.

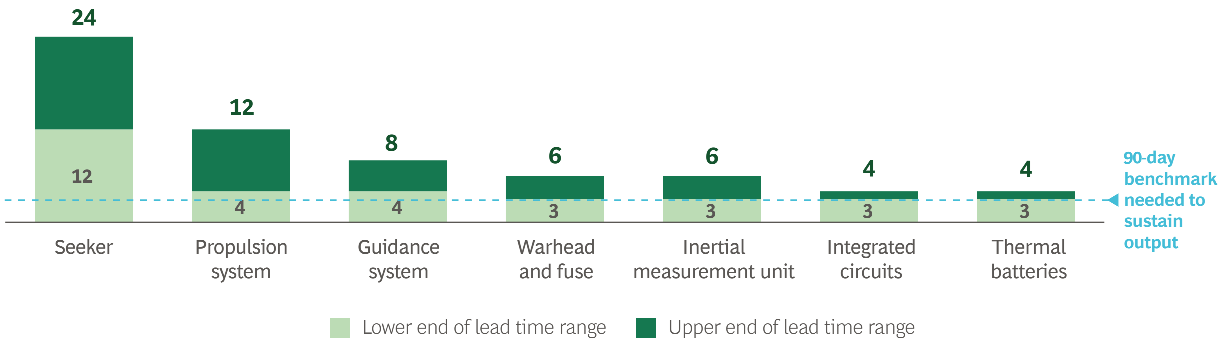
Frequently, the root causes differ by subsystem—for example, energetics (hazmat and safety constraints), seekers or inertial measurement units (precision machining and specialized testing), thermal batteries (niche chemistries), and microelectronics (concentrated global supply). The result is wide dispersion in component lead times, which can swing sharply as demand surges—evidence that the bottlenecks are not always fixed constraints but sometimes outcomes shaped by design, qualification, and investment choices. **(See Exhibit 5.)**

Exhibit 5

Long and Variable Lead Times Can Slow Production, but MoDs Can Improve by Focusing on the Most Problematic Systems and Components

Length and variance in lead times can slow final assembly; focusing on the most bottlenecked subassemblies and components strengthens flow

Illustrative lead time ranges of constrained missile subassemblies and components (number of months)



Source: BCG industry analysis.

Assigning a heightened priority status to the constraint (such as with formal priority ratings or expedited order classifications) rarely fixes this. Additional funding may shorten queues at the margin, but it does not change the underlying constraint structure. Tooling and testing capacity, qualification pathways, and subtier economics still set the pace. Final assembly may improve while upstream components remain the governing constraint, preventing the system from surging on operational timelines. Reducing lead times entails approaching the supply chain as a system—measuring constraints, managing queues, redesigning for interchangeability, and making targeted investments bankable.

In practice, three innovative ways to unlock munitions capacity by reducing lead times stand out:

- **Incentivize supplier investment ahead of critical constraints.** Lead times shrink when suppliers can reliably invest ahead of demand. Portfolio-level sales and operational planning (S&OP) and multiyear demand corridors—backed by capacity underwriting (such as surge fees and co-investment) and faster payment terms—make tooling, test capacity, inventory buffers, and extra shifts economically rational, especially for Tier 2 and Tier 3 suppliers. Combine this with second sourcing at true constraint points and with allied suppliers under shared standards, so substitution is possible when disruptions hit.
- **Design for flexibility.** Designing around modularity and open interfaces enhances flexibility, allowing faster substitution, upgrades, and second sourcing. MOSA standardizes interfaces, enabling faster second-source qualification and reducing lock-in. Open-system architecture for munitions applies open-interface principles across weapon subsystems and integration, improving interchangeability and sustainability. COTS componentry can shorten lead times and reduce costs in unstable demand environments.
- **Use digital mapping to spot constraints and fund solutions.** Map Tier-*n* bottlenecks across test, materials, transport and subtiers. Use a simple control tower to manage queues and works-in-progress, fast-tracking investments on aggressive timelines to unblock supply constraints.

Myth 4: Demand for Munitions Is Persistent and Steadily Increasing

Although the headline trend is rising demand, inconsistent and short demand signals are often central challenges in munitions production. Historically, defense spending has been cyclical over time, and munitions demand can be particularly volatile—surge buys followed by lulls, emergency contracts followed by cancellations or quantity slips to the right. **(See Exhibit 6.)** This volatility can erode the industrial and innovation base that governments rely on when scenarios deteriorate. In European and multibuyer defense ecosystems, fragmentation that is as much structural as it is technical contributes to volatility.

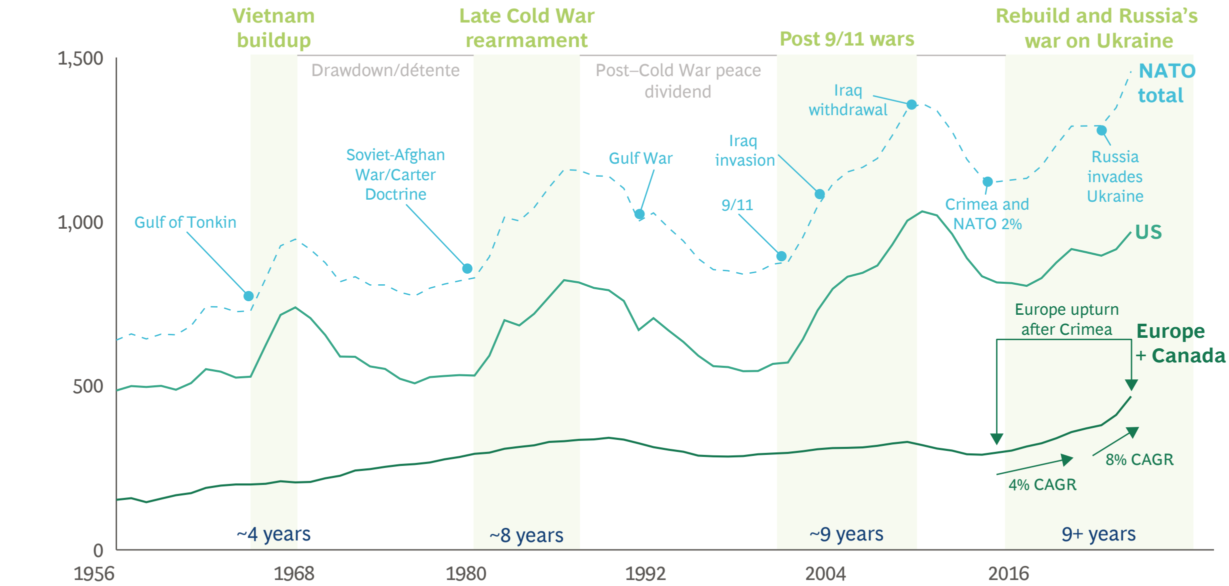
Sovereign ordering decisions reflect differing national priorities and threat perceptions, and they are often shaped by industrial participation, workshare, and jobs—factors that encourage national variants and dispersed production rather than coordinated scale.

Without credible multiyear demand, it makes sense for primes and subtiers to avoid capital commitments such as extra tooling, second shifts, supplier qualification, workforce pipelines, and long-lead inventory. Instead, they defer capex, limit hiring and training, and allow niche capabilities to atrophy.

Exhibit 6

Spending Cycles and Order Volatility Can Limit Contractors' Ability to Make Long-Term Investments in Production Capacity

NATO defense spending in constant 2023 US dollars ($billions)



CAGR								
NATO	1%	9%	–1%	4%	–2%	5%	–3%	4%

Sources: SIPRI Military Expenditure Database of country military spending for the period 1949–2024; BCG analysis.
Note: CAGR = compound annual growth rate.

Lines cool, capacity shrinks, and learning resets—so when the next surge arrives, the system must relearn how to build at scale. In many countries, the funding model amplifies underlying volatility: MoDs may receive annual appropriations and periodic strategy resets, limiting their ability to issue bankable multiyear munitions demand to industry. Our survey data reflects the gap: only 31% of MoDs agree that acquisition policies and mechanisms enable fast ramp-up for existing technologies.

At the missile system level, demand can fluctuate drastically year-to-year, further challenging production capacity and planning. **(See Exhibit 7.)** The risk becomes even more pronounced as portfolios shift toward more software-defined, networked, and diverse munitions (for example, loitering systems, collaborative weapons, and more capable interceptors).

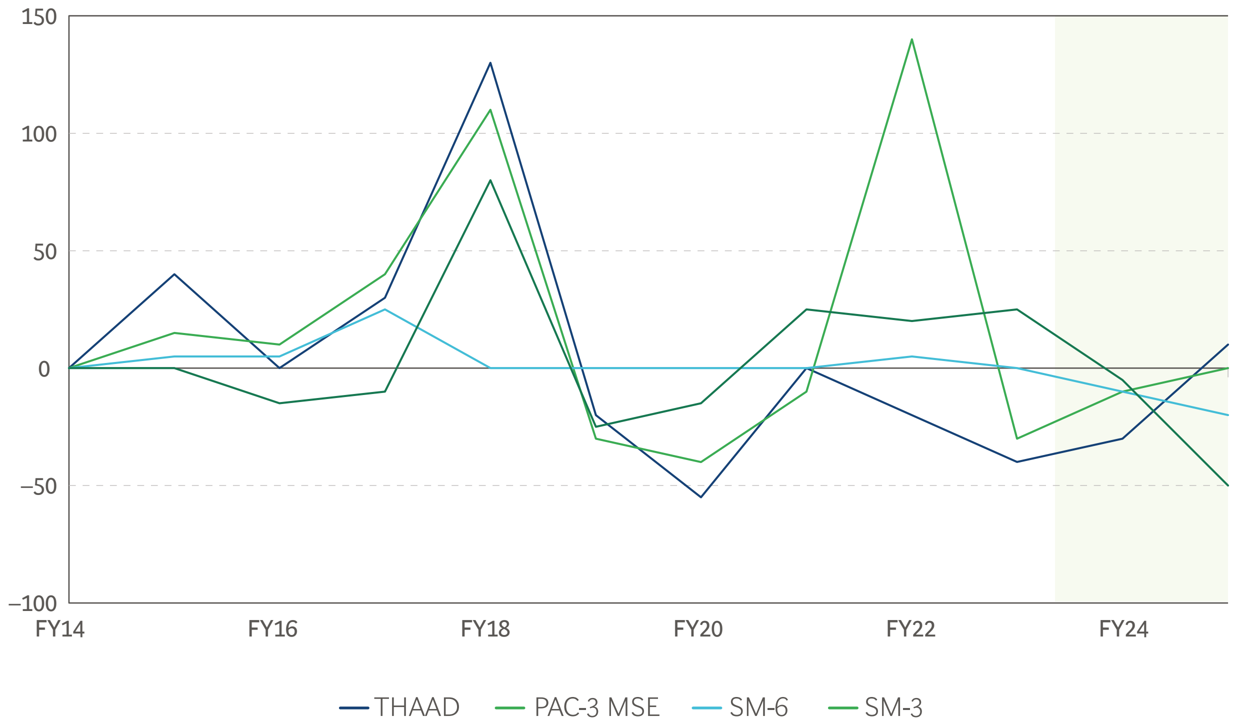
These systems are harder to stop and start because they depend on sustained investment in architecture, integration, test capability, and subtier electronics and energetics.

Volatility poses a persistent challenge, but it can be mitigated. Although it is too early to assess the impact of recent initiatives, procurement models are shifting. The recent US 2026 PAC-3 MSE seven-year framework to triple production and and European joint procurement projects (such as ASAP and EDRIPA) aim to address a number of symptoms related to demand, production efficiency, and supply chain optimization. Governments and industry can design mechanisms that smooth demand and aggregate it where it is fragmented—while converging on fewer variants and on interoperable components to concentrate volume and increase certainty for subtiers.

Exhibit 7

Despite Consistent Spending Increases Since 2014, Annual Volatility Persists Across Many Munitions Systems

Annual change in selected procurement quantities (%)



Sources: CSIS analysis of DoD comptroller documents; BCG analysis.
Note: Variance does not include PAC-3 estimated from Ukraine supplemental. FY24 data excludes supplements and DoD actuals for 2024 and beyond. THAAD = Terminal High-Altitude Area Defense; PAC-3 MSE = Patriot Advanced Capability Missile System Enhancement; SM = Standard Missile.

Three demand-side levers are particularly powerful in responding to these challenges:

- **Lock in multiyear, scenario-based demand signals for core product families.** Move from annual buys to multiyear order corridors for priority families to create a guaranteed baseline plus a paid surge band that stays warm. Make it investable by rationalizing variants—standard configurations and upgrade blocks—to concentrate volume in common bills of materials (BoMs), tooling, and testing. In multinational buying environments such as Europe, prioritize early coordination to align requirements and structure workshare, enabling joint procurement without fragmenting variants, qualification, or interoperability.

- **Quantify and communicate the cost of variants.** Each additional configuration can increase qualification/test burden, multiply supply-chain and sustainment complexity, and dilute learning/scale by splitting volume. Quantify these costs to give MoDs and treasuries a clear idea of the price tag for complexity so that they can allocate budgets to fewer, longer, and standardized configurations that sustain volume, reduce churn, and improve unit cost over time.

- **Run joint MoD-industry S&OP initiatives to align portfolios, not programs.** Program-by-program planning typically identifies constraints too late in the process—especially for Tier-2 and Tier-3 suppliers. Institute joint S&OP across a munition's portfolio so that MoDs, primes, and critical subtier suppliers can align on demand, capacity, and inventory. Then make explicit calls: concentrate volume on a smaller set of qualified subtier suppliers and standard BOMs, fund the key constraint nodes (testing, energetics, and electronics), and sequence upgrades to avoid churn. Use the forum to prune low-value variants, cut changeovers and requalification, and turn fragmented demand into stable, investable throughput.

Myth 5: Cost Growth Is Inevitable

Across many munitions programs, headline unit costs appear to be rising, even for systems that have been in production for years. Historically, munitions often followed an 80% to 90% experience curve, implying a unit-cost reduction of roughly 10% to 15% for each doubling of cumulative production. **(See Exhibit 8.)** Today, though, many of those curves are flat or inverted as variant counts grow, designs become more bespoke, and upgrades take the form of one-off engineering efforts. It is tempting to conclude that the experience curve no longer applies and that modern capabilities will always get more expensive.

In reality, though, learning still happens. Cumulative volume typically improves yield, cycle time, and labor productivity, but the benefits do not consistently pass through to MoDs or primes. Instead, savings are often absorbed by higher input costs, bespoke engineering, fragmented or multiple variants, and opaque overhead allocations. Weak cost benchmarks and contract structures that focus on output volume without giving due weight to production efficiency can allow suppliers to move down their internal learning curves without having to accept a corresponding decline in price. **(See Exhibit 9.)**

Exhibit 8 **Historically, Missile Systems Have Followed an 80% to 90% Experience Curve**

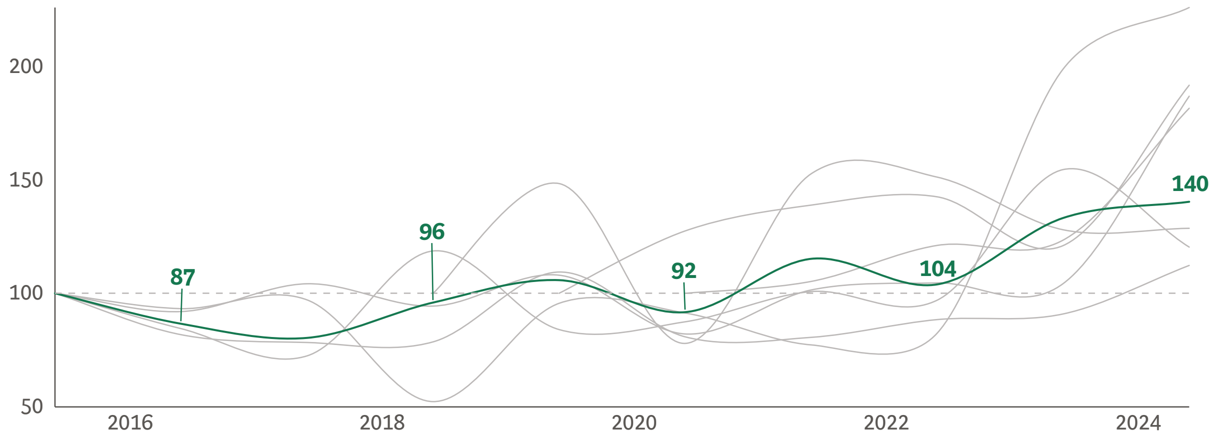
Historical experience curves (% cost saving[1])

Source: "Does Dual Sourcing Lower Procurement Costs?" Thomas P. Lyon, The Journal of Industrial Economics, 2006.
[1]Cost savings as cumulative volumes double.

Exhibit 9 Unit Costs Have Steadily Increased Across Several Priority Missile Variants

Unit cost of several missile systems

Average unit cost of several missile systems (indexed to 100)[1]



Sources: DoD budgets for FY2018 through FY2024; BCG analysis.
[1]From the US Army: MSE – Patriot, M-SHORAD, JAGM, Javelin. From the US Air Force: Sidewinder AIM-9X, small-diameter bomb II, JASSM.

Three correctable issues typically drive unit-cost growth: poor visibility into true cost drivers across tiers, commercial structures that don't enforce cost-out, and portfolio choices that dilute learning through variant proliferation and repeated redesign. MoDs and industry can rebend the curve by making economics more transparent, explicitly contracting for cost-out, and shaping portfolios to concentrate volume and compound reuse. In our work with industry and MoDs, we see four high-impact actions:

- **Ensure cost visibility across the value chain. Make the cost curve visible end-to-end.** Standardize cost breakdowns, build should-cost models to identify the biggest drivers, and map bottlenecks across tiers. Then pull the levers with discipline: cut rework and yield loss, reduce test and touch time, remove expediting churn, and attack overhead rather than just unit price.
- **Contract for learning, and resist redesign churn.** Use multiyear deals with pricing glide paths tied to cumulative volume and target cost curves, and offer shared incentives to help achieve them. Structure upgrades as planned blocks (not ad hoc redesigns), so that learning compounds rather than resets, and isolate capacity and surge fees from unit prices to make readiness costs more transparent.
- **Establish baselines and enforce pass-through.** Define a clear cost baseline and a small set of tracked drivers (labor hours, yield, test time, material indices) so that MoDs and contractors can see where savings arise. Use selective open-book only where needed (for example, at true constraint nodes or fragile subtiers), and write explicit pass-through rules so that automation and productivity investments translate into lower unit cost over time.
- **Structure portfolios for reuse and systematic cost-out.** Design the portfolio to scale. Prune low-value variants, enforce modular and open architectures, and avoid resets that restart qualification and learning. Reuse common modules (such as for motors, seekers, and control sections) to spread nonrecurring engineering costs and speed upgrades. To reduce costs, use a roadmap of initiatives—DFM, part consolidation, simpler configurations, common testing—so that reductions are continuous, not one-off.

Conclusion

Munitions lie at the heart of credible deterrence, but the obstacles that slow munitions production—fragmented architectures, opaque supply chains, stop-start demand, and misaligned incentives—are the same ones that prevent governments and contractors from fielding defense innovation at speed and scale.

This year's innovation readiness assessment shows that higher budgets and stronger rhetoric alone will not close the gap—a lesson that extends beyond munitions. What matters is whether ministries and industry can convert ambition into an operating system that consistently meets demands.

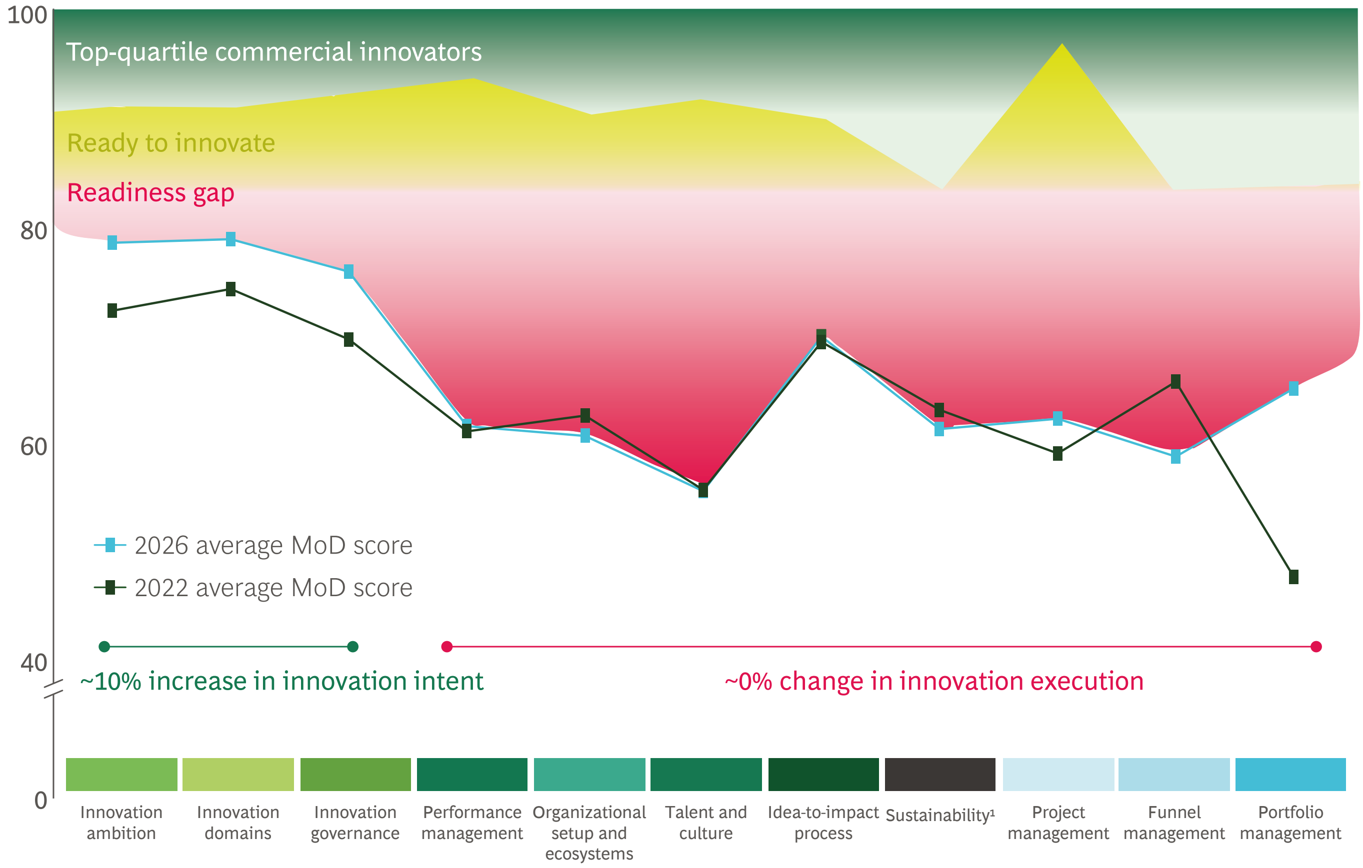
Monday Morning Actions for MoDs and Contractors

Through our work with industry and government, BCG has identified, mapped, and qualified over 50 specific levers to systemically increase throughput, reduce costs, and strengthen resilience across the munitions chain. On the basis of that experience, we believe that the most productive Monday-morning conversations inside ministries and across industry are ones that focus on a short set of actions designed to convert ambition into delivered volume. Decision makers can anchor discussions to five starting points:

- **Define resilience, stockpile, and throughput scenarios.**
  - **MoDs.** Develop priority families and scenarios. Reach agreement about what "ready" means (baseline plus surge), and optimize orders for modularity and upgradability.
  - **Industry.** Quantify today's steady-state and no-regrets choke points, with options to increase modularity, upgradability, and interoperability to improve long-term flow.
- **Prioritize internal constraint diagnostics and resolution.**
  - **MoDs.** Pinpoint bottleneck stations, and approve a fast-track plan to expand or parallelize them within existing facilities.
  - **Industry.** Run a line optimization sprint (covering such details as flow rebalance, shift coverage at bottlenecks, test and quality capacity, and yield and rework), with an explicit target to increase throughput.
- **Develop investment plans for subtier bottlenecks.**
  - **MoDs.** Require a Tier-*n* map and ROI assessments for the top components to develop acceleration plans.
  - **Industry.** Establish queue management for supply nodes, and propose the investments to pull lead times forward.
- **Stabilize demand where it matters most.**
  - **MoDs.** Table a draft multiyear corridor for the core family—aligned with prime and critical subtier capacity plans—and identify which variants can be frozen or retired.
  - **Industry.** Propose a consolidated standard BOM and variant set across the portfolio and the flexible manufacturing plan to concentrate volume.
- **Target cost-out and reclaim the learning curve.**
  - **MoDs.** Set the commercial structure to lock in cost-out and modularity, while also underwriting near-term constraint investments and readiness where required.
  - **Industry.** Put forward two or three discrete ROI cases, including cost, timing, and payback.

BCG's 2026 Innovation Survey Highlights the Gap Between Innovation Intent and Reality

BCG i2i innovation benchmarking score (0–100)



Source: BCG Defense Innovation Survey, 2026–2025.
Note: MoD = ministry of defense.
[1]We imputed the commercial benchmark for sustainability from BCG's sustainability work.

About the Authors

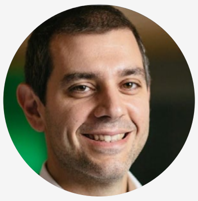
Marc Giesener is a Managing Director and Partner in the firm's Chicago office.
Giesener.Marc@bcg.com.

Diana Dimitrova is a Managing Director and Partner in the firm's London office.
Dimitrova.Diana@bcg.com.

Pilar Landon is a Managing Director and Partner in the firm's Chicago office.
Pilar.Landon@bcg.com.

Greg Mallory is the Global Leader for Defense and Security in the firm's Washington, D.C. office.
Mallory.Greg@bcg.com.

Brian Hirshman is the Global Leader for Aerospace and Defense in the firm's Dallas office.
Hirshman.Brian@bcg.com.



Fabio Dal Pan is a Managing Director and Senior Partner in the firm's Milan office.
DalPan.Fabio@bcg.com.

Andrea De Blasi is a Managing Director and Partner in the firm's Milan office.
DeBlasi.Andrea@bcg.com.

Daisuke Sohta is a Managing Director and Partner in the firm's Nagoya office.
Sohta.Daisuke@bcg.com.

Joe Kesseler is a Project Leader in the firm's Chicago office.
Kesseler.Joe@bcg.com.

Contributors

Hannah Coatsolonia
Mishaal Hassan
Mike McGraw
Ally Bhadoria
Jason D'Souza
Andrew Trzcinski
Ulrike Strauss
Teresa Boeselager
Kristina Schnell

Acknowledgments

The authors also wish to acknowledge the following individuals for their valuable support: Peter Bacon, Jeff Garigliano, Jack Spasiano, and Samantha Kirsch.

Finally, the authors thank the public- and private-sector leaders who participated in confidential interviews, and everyone who responded to the survey.

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