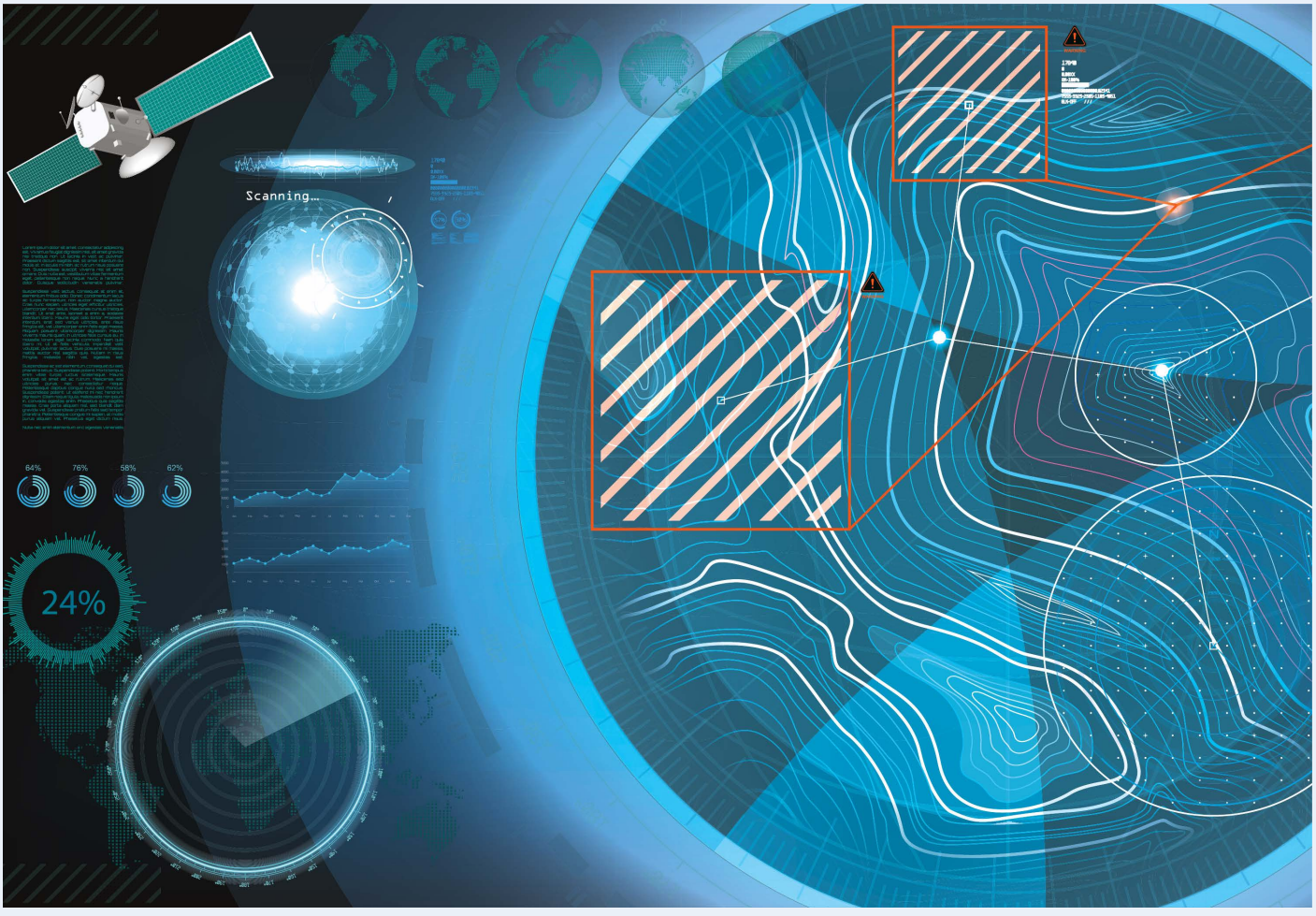
RESEARCH
BRIEF

Fostering Innovation in Military Technology

Strengthening DoD's Commercial Technology Pipeline



SergeyBitos/AdobeStock

Technological superiority is a key part of the U.S. military's advantage over its competitors. During the Cold War, the U.S. government played a key role in sponsoring science and technology research. In recent years, however, technological innovation has been driven by the commercial market, where other nations—particularly China—have narrowed the advantage held by the United States.

Recognizing the need to harness innovation from the private sector, the U.S. Department of Defense (DoD) and the military services have created a number of defense innovation organizations (DIOs) to help foster communities of innovators and accelerate the military's identification, development, and adoption of commercial, private sector–developed technology. But have these organizations been able to achieve their stated aims? A RAND National Security Research Division study examined how well DoD is identifying, developing, and transitioning innovative commercial technologies from the private sector to the military and how the defense ecosystem can more effectively support this process.

A Model of DoD's Commercial Technology Pipeline

To understand the process through which DoD currently accesses commercial technologies, researchers developed a model of the *commercial technology pipeline* (CTP)—that is, all the activities, functions, and processes required to move a technology from idea to fielding under the current set of DoD organizations and requirements, acquisition, and budgeting processes (see figure). The model is divided into three phases—identification, development, and adoption—which roughly correspond to the maturity of a technology as it moves through the pipeline. Each phase contains a set of *core functions* (activities that normally occur within that phase of the CTP) and *enabling functions* (such as policies and guidance, funding, coordination, and oversight), which occur within and across each phase.

The researchers used the model to characterize the current functioning of DoD's CTP, including the role of DIOs, and found the following:

- **There is no single "pipeline" or pathway for technologies through the CTP.** The path that an innovative technology, product, or service takes from idea to fielding can differ depending on the characteristics of the technology and business, financial considerations, and alignment with other DoD processes. There are many on- and off-ramps at every phase, and there are feedback loops both within and between CTP phases.
- **CTP functions are distributed across multiple stakeholders; no single organization performs them all.** Given this, collaboration and handoffs between CTP stakeholders are essential to accelerate the identification, development, and adoption of commercial technology for military use.
- **DIOs perform multiple CTP functions but have limited ability to facilitate adoption.** Many DIOs concentrate on early CTP functions, such as conducting acceleration programs or offering support to develop solution concepts. However, these organizations have limited ability to facilitate the adoption of new technology in the final stages—i.e., the procurement and fielding of technology.

Approach

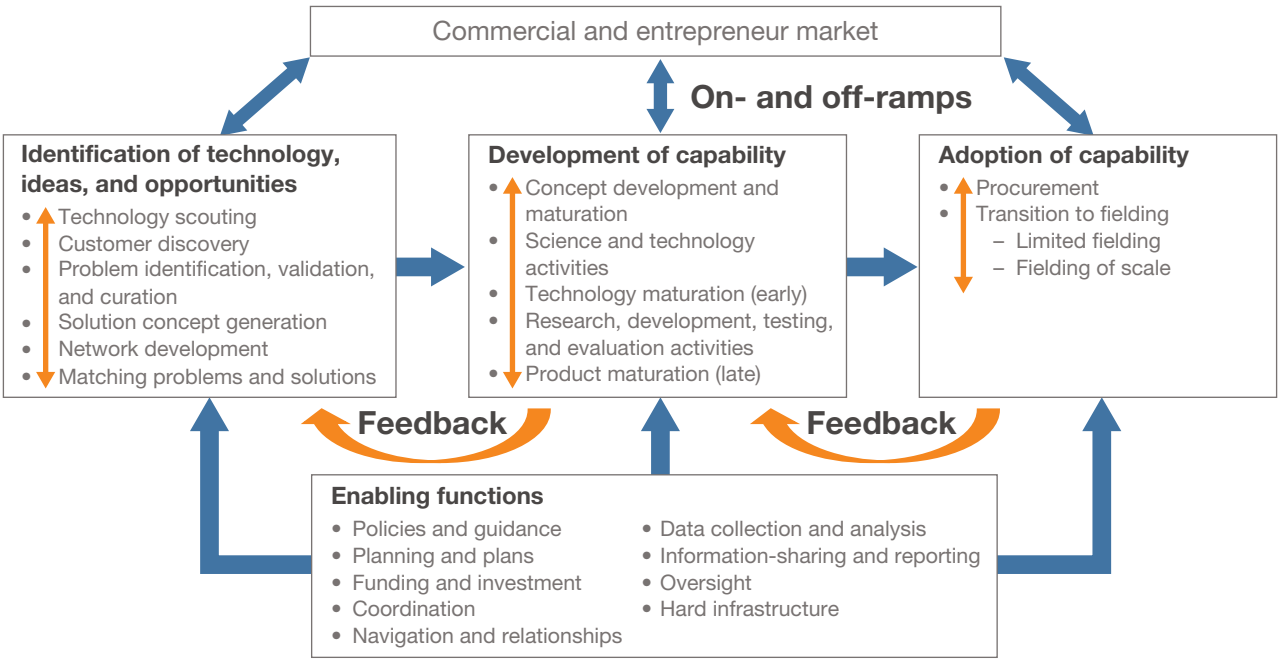
The study used a mixed-methods approach combining

- a literature review
- interviews with 70 individuals representing 18 DIOs, seven other innovation stakeholders, and seven commercial businesses
- organizational "deep dive" profiles of 12 DIOs
- six case studies of new-entrant technology companies
- an acquisition policy game to examine the effectiveness of potential reforms.

Gaps in DoD's Commercial Technology Pipeline

During their review of CTP activities, functions, and processes, researchers identified several characteristics of a well-functioning CTP, as shown in the box labeled "Characteristics of a Well-Functioning CTP." The researchers used these characteristics to assess the functioning of DoD's CTP as it exists today. **The characteristics of a well-functioning CTP are largely lacking in DoD's pipeline.** The assessment found that DoD CTP stakeholders are not aligned to a shared

Representation of the Commercial Technology Pipeline



Characteristics of a Well-Functioning CTP

- Stakeholders have a shared mission of pushing promising technology through the innovation life cycle from idea to fielding.
- Goals, objectives, and desired outcomes for the pipeline are established, understood, and shared by all CTP stakeholders.
- Each organization understands its roles and responsibilities and has an awareness of the roles and responsibilities of others.
- All key functions are performed by stakeholders (i.e., there are no gaps in individual functions), and handoffs of technologies from one function or activity to the next occur appropriately.
- Information-sharing (promising technologies, available resources and programs, priorities/focus areas, collaboration opportunities) occurs appropriately across the CTP. Coordination and collaboration between CTP stakeholders and feedback mechanisms between CTP functions and stakeholders are established and functioning.
- Incentive structures for CTP stakeholders are aligned to CTP goals, objectives, and outcomes, including metrics and accountability mechanisms to check progress.

> The pipeline is broken because of incentive structures, a lack of unified DoD strategy, and mission [for innovation].
> —DoD interviewee

mission or common goals, objectives, and outcomes. There is no DoD-wide strategy or policy guidance for innovation, and, other than broad statements of modernization priorities, no specific goals and objectives have been articulated for the CTP.

Roles and responsibilities are also unclear. DoD includes a large number of DIOs—some put the number as high as 100—but few prospective partners in the government and new entrant businesses know that they exist or understand what they do. DIOs have disparate missions, and, while many view themselves as playing a role in the identification, development, and adoption of commercial technologies, they do not view themselves as part of an integrated system. Other key stakeholders in the traditional acquisition, requirements, budget, and

end-user communities do not see themselves as part of the CTP at all, and DIOs lack consistent buy-in from these traditional communities.

Given that no single organization performs all the key functions required to effectively accelerate the identification, development, and adoption of technology for military use, links between DIOs are essential. However, there are no formal mechanisms or requirements for information-sharing, coordination, or collaboration across CTP stakeholders, and when such activities do occur, they are typically ad hoc and often based on personal relationships.

Incentive structures for CTP stakeholders are not aligned to CTP goals, objectives, and outcomes, and there are no DoD-wide metrics or accountability mechanisms. Where metrics and mechanisms do exist, they are focused mostly on outputs for a DIO—such as the number of solicitations posted, proposals received, and prototype projects initiated.

There are also significant gaps in core and enabling functions. For example, DIOs do not have a systematic means to identify commercial business partners, and most of those with whom we spoke lack an institutionalized approach to storing and sharing data. In addition, there is little communication with DoD end-users about capability needs and problems. Stakeholders from industry are often unable to identify and access DoD opportunities or understand how their technology might apply to DoD missions. Moreover, there are no warm handoffs, clear routing, or obvious next steps for businesses once they have come through a particular DIO's programs.

Although DoD has funding available to support technology development, much of that funding is concentrated in the early stages of development, and there is limited support for testing and the proof-of-concept demonstrations that can help sustain a company. As a result, much technology languishes in the "valley of death"—that is, the technology has been demonstrated and is technically ready to be transitioned to production and fielding but does not make it to the adoption stage. This occurs for the following reasons:

- No DoD organization has visibility into CTP activities or responsibility for CTP outcomes.
- Adoption is hindered by gaps between the following:
  - innovation organizations
  - requirements and capability developers
  - end-users
  - program managers (PMs) and program executive officers (PEOs)
  - procurement and decision authorities
- There are no incentives to encourage stakeholders to overcome these gaps.

> There is no senior leader in the executive branch who cares about what innovation organizations are doing, which leaves innovation organizations with only one customer left to impress: Congress. So you try, three to four times a year, to show Congress you're doing something interesting. There is no incentive structure for innovation organizations to show how many of their claimed 12 "transformative" projects have transitioned to programs of record, how many are in the FYDP [Future Years Defense Program]. If the answer is none, what are we doing? Congress doesn't have the time to do that deep dive, so no one is asking those hard questions. —DoD interviewee

> [Most innovation organizations] have no real sense of what the actual capability requirements are because almost every innovation organization does not talk to PMs or PEOs. The upshot of this disconnect is that innovation organizations have lost the bubble on where decisions are being made.
> —DoD interviewee

Recommendations to Strengthen the CTP

CTP throughput and effectiveness can be enhanced by policy levers that cultivate desired CTP characteristics, encourage and incentivize coordination and collaboration, and strike balance among organizational independence, free-market style competition, and more-centralized direction of the CTP.

Researchers made the following recommendations to DoD to support these ends. These recommendations are designed to be interdependent, mutually supportive, and implemented as a package.

Cultivate Desired CTP Characteristics

- Identify ways to align CTP stakeholders to a common understanding of the CTP and a shared mission of identifying, developing, and pushing promising technologies all the way through the pipeline.
- Develop and promulgate strategy, plans, policies, and guidance for the CTP to support common goals, objectives, and outcomes, while continuing to support flexibility in execution.
- Clarify and formalize roles and responsibilities for CTP stakeholders (including traditional acquisition stakeholders), specifying which entities are expected to perform which CTP functions and clarifying and formalizing the relationships between stakeholders.
- Establish mechanisms to improve information-sharing, coordination, and collaboration across CTP stakeholders.
- Implement incentive structures, including meaningful metrics and accountability mechanisms, to align CTP stakeholders to CTP goals, objectives, and desired outcomes.

Strengthen CTP Identification, Development, and Adoption Functions

- Develop rigorous, comprehensive, and coordinated approaches to technology scouting, and share this information widely across the DoD enterprise.
- Encourage CTP stakeholders at all levels—requirements and capability developers, acquisition organizations (PMs, PEOs, system commands), budget offices, and end-users—to share DoD problems across the enterprise.
- Establish a comprehensive, integrated, and searchable portal for new entrants to access DoD opportunities, using the portal to explain how commercial technologies can be identified, developed, and adopted; describe CTP stakeholder roles; and publicize funding opportunities.
- Establish DoD navigation support services to help new entrants understand and navigate DoD.
- Assign responsibility for oversight of the CTP, including transition outcomes, to an organization and give it the authority and budget to execute this responsibility.
- Establish a flexible funding pool to facilitate transitions and support maturation of promising technologies and incorporation of those technologies in a program of record, where

> We built [the technology] . . . and when they went back into the Navy laboratory system and it became pretty clear [the technology wasn't going] to come out of the laboratory system and . . . became "Hangar Queens," not because of technical reasons but just because there was no transition mechanism.
> —Commercial sector interviewee

appropriate. DoD will need congressional approval to implement this recommendation.

- Implement DIO best practices, including the following:
  - Be led by a DoD problem rather than by innovative dual-use technologies.
  - Include transition planning as early as possible and revisit that transition plan continually.
  - Recognize that an engaged DoD customer is critical for success.

DoD should carefully assess the costs, benefits, and unintended consequences of any potential change to the system. In addition, adopting innovative commercial technology for military use is not just a technical problem but also a cultural one. Innovative technology often requires adaptation—behavioral changes in how a problem is addressed. DoD should explore this aspect of technology adoption further to improve CTP outcomes.

This brief describes work done in the RAND National Security Research Division and documented in *Strengthening the Defense Innovation Ecosystem* by Brodi Kotila, Jeffrey A. Drezner, Elizabeth M. Bartels, Devon Hill, Quentin E. Hodgson, Shreya S. Huilgol, Shane Manuel, Michael Simpson, and Jonathan P. Wong, RR-A1352-1, 2023 (available at www.rand.org/t/RRA1352-1). To view this brief online, visit www.rand.org/t/RBA1352-1. The RAND Corporation is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors. **RAND**® is a registered trademark.