REVERSE INNOVATION IN GLOBAL DEFENSE

By Pete Modigliani

A reverse innovation is any innovation that is adopted first in the developing world. Surprisingly often, these innovations defy gravity and flow uphill.

The Idea

DoD and U.S. Allies apply Reverse Innovation strategies to design novel defense capabilities. The key elements of a Reverse Innovation strategy are design simplicity, unlearning, addressing the infrastructure gap, changing the management model, and fueling local growth teams. This approach provides Allies who have small defense budgets affordable solutions to address their priority military needs along with a prototyping and experimentation environment for U.S. defense solutions. The National Technology Innovation Base (NTIB) can then apply the lessons and solutions from the Allied environments to scale systems for U.S. defense solutions and Foreign Military Sales (FMS). These solutions could be at the low end of a high-low mix of U.S. capabilities. In many cases Clayton Christensen's Disruptive Innovation theory may apply when a simple product enters at the low end of performance and price, but over time displaces the market leaders. As part of U.S. defense security cooperation strategies, the DoD and defense industry conducts FMS. While only 13 international partners are buying the F-35, 189 countries and international organizations participate in FMS.

Reverse Innovation by Vijay Govindarajan and Chris Trimble is an insightful book that presents the blueprint for scaling growth in emerging markets and importing low-cost, high impact innovations to mature markets. I was fortunate to be able to collaborate via email with Vijay and Chris years ago to discuss the key themes from their related book, The Other Side of Innovation. They are world-renowned thinkers on management innovation, regularly appearing on top innovator's lists and in leading publications. The following offers excerpts from the book along with ideas for DoD applications.

Design Simplicity

"Consider an American company with a good-better-best product lineup with 80-90-100% performance at 80-90-100% pricing. When seeking to sell in an emerging economy, like India, the company may attempt to offer a watered-down version with 70% of the features and 70% pricing, yet that would only capture a small slice of the market. A breakthrough would be to offer a 50% solution at 15% price. It would be impossible for the company to achieve that if they began with the existing offering. The only way to get to an entirely new price-performance curve is by starting from scratch."

The leading example of reverse innovation was GE Healthcare's approach to selling equipment for performing electrocardiograms (ECGs) in rural India. GE's traditional ECG equipment cost US$3–10K, was heavy, and required a skilled operator. GE tried to offer its $3K version, which cost $5-10 per test, yet even that was unaffordable for a mainly poor population of 700 million in rural India. GE tasked its "local growth team" to design novel ECG equipment that placed emphasis on low cost, portability, battery power, ease of use, maintenance, and repair. The resulting MAC 400 solution sold for $800, weighed 2.6 pounds, cost $1-2 per test, and was easy to use. MAC 400 sales flourished across India and the product is sold in every country except the United States and Canada. It led to new product lines and innovative thinking.

When designing a new fleet of military drones for Allies, DoD should not start with a Global Hawk and try to strip away the costliest elements. Instead, design should begin with simple commercial drones and scale up. It should focus on developing software that enable many low-cost, single-purpose systems to work together in a network or swarm environment to achieve desired mission packages. Anduril won a recent contract for counter-unmanned aerial system capabilities "as-a-Service" that enable rapid upgrades in vendor-driven software and artificial intelligence. This is a proof of concept for not only the technologies, but also novel approaches to acquisition.

At present, when DoD develops a new weapon system, it starts with defining requirements, analyzing alternatives, and developing competing prototypes. In some cases, this process includes a flyoff where two or more companies develop a technology demonstration prototype for DoD to assess the performance of working systems. In many cases the DoD selects the winning vendor because it included additional features and performance. Vendors not selected are reimbursed for their prototype investments but fail to win the development and production contracts. This would keep many companies out of the market for a decade or more. A vendor who embraced design simplicity at a fraction of the cost and wasn't selected by DoD could be viable for FMS. If the runners-up stayed in the market by developing and fielding FMS solutions, that would create competitive pressure on the DoD's selected prime to perform more effectively. Competitors would continue to develop and deliver capabilities, giving the DoD a viable plan B, and reduce the vendor lock monopolies in many DoD systems. While DoD should take more of an enterprise portfolio management strategy with a mix of exquisite and simple solutions, this could also fuel novel international portfolio strategies (to include interoperability).

Similarly, many organizations across DoD and the U.S. government have constrained budgets. This constraint, which can often be beneficial, restricts the organization from spending a billion dollars and taking a decade to develop and produce a major new system. Organizations often must adopt commercial solutions, leverage mature solutions, or acquire solutions that DoD and other agencies already have. While many companies that sell defense solutions also market to and bid on contracts with the Intelligence Community, Department of Homeland Security, and related agencies, rarely does the government develop a whole-of-government enterprise portfolio strategy.

"Overarching the entire design process was an imperative to keep things as simple as possible — never more complicated than was absolutely necessary. Complexity would be the enemy of economy. Simplicity demanded better alignment between the new system's feature sets and real-world usage patterns."

DoD would benefit by embracing simplicity in designs and processes. Dan Ward has written extensively about it in his books and articles. One of our favorite rapid acquisition success stories is the MC-12W Liberty Aircraft. To address an urgent demand for intelligence, reconnaissance, and surveillance (ISR), the Air Force's Big Safari program rapidly integrated existing sensors and communication datalinks on a commercial aircraft. It delivered Liberty to the theater in **less than eight months** from funding approval, at a low unit cost of $17 million. Liberty provided a balanced force mix to complement high-end systems such as Joint STARS and Global Hawk. The aircraft flew over 300,000 combat flight hours in Afghanistan and is credited with 73% of all Air Force ISR sorties and the kill or capture of hundreds of high-value individuals in Afghanistan during 2012.

Unlearning

"Reverse innovation begins not with inventing, but with forgetting. *You must let go of what you've learned, what you've seen, and what has brought you your greatest successes. You must let go of the dominant logic that has served you well in rich countries. If you want to use today's science and technology to address unmet needs in the developing world, then you must start with humility and curiosity."*

How many of DoD's weapon system requirements were written by those who operated the legacy systems? How much do the new systems look and feel like the legacy systems, only with 25% greater performance, operating within the same CONOPS? How many are dominated by biased wargames or consensus-seeking by senior board members with frequently changing priorities? As DoD writes requirements, how do the authors avoid biases to enable true greenfield solutions? How does DoD clearly identify operational objectives before defining system solutions? How often do DoD requirements writers challenge assumptions and rely on the first principles for operations? How does DoD enable the DoD Science and Technology community and industry to propose novel solutions for maximum mission impact?

Similarly, DoD's acquisition, requirements, and budget enterprises still apply Industrial Age processes. For DoD to operate in the Digital Age, executives and practitioners must forget many of these 60-year-old practices such as defining all requirements upfront and holding programs to strict cost, schedule, and performance baselines. In the current environment, DoD writes requirements and obtains budgets (in partnership with Congress) for a new weapon system. DoD identifies operational needs, conducts analysis, and then defines system-specific requirements in RFPs. Thereafter, based on source selections and/or flyoffs, it will select a winning design and vendor.

What if defense companies developed more solutions with their own R&D investments, based on active engagement with DoD and foreign customers and seeking the right mix of features and affordability? If global markets shaped designs, technology development, and investments, how would defense primes change their business model? Instead of competing for a winner-take-all DoD contract that will shape the industry for the next decade, where could companies develop solutions for FMS markets and enable DoD to select from the most promising industry offerings (with upgraded features)?

Companies are not going to spend billions to design, develop, and produce major weapon systems in the hope that DoD will buy them, and if it does not, they are left with wasted infrastructure and systems. However, if designed with appreciation of global market opportunities, companies would be more willing to invest in R&D and production. The market factors and industry-led R&D will often prove more effective and innovative than government-directed R&D.

As Christian Brose highlights in The Kill Chain: "Rather than small numbers of larger systems, the future force should be built around larger numbers of smaller systems. The future force must be defined more by its software than its hardware. It must be, in every way, a digital force." The marketplace of companies who can design and produce smaller systems is vastly larger than the defense primes who have an oligopoly on the major weapon systems.

Similarly, Eric Snelgrove recently highlighted open innovation at AFWERX: *"Rather than relying solely on research ideas generated from within the upper echelon of the Air Force, AFWERX provides 'Open Topic' opportunities to allow small firms and entrepreneurs to propose any idea or technology that may have an Air Force application. They hypothesized that they might well discover new technologies by letting commercial industry and innovative startups do what they do best – innovate new technology solutions and original applications. While recognizing the need for requirements that meet a specific defense need, these Open Topics provided a new approach to engage a broader cross-section of the innovation ecosystem. Over the last two years, the Air Force has awarded more than 2,200 contracts under the Open Topic program."*

Infrastructure Gap

"The rich world has extensive infrastructure in place; the poor world does not. Rich countries have highly developed physical infrastructure such as roads, telecommunications networks, power plants, and airports; social infrastructure

such as schools, universities, and hospitals; and institutional infrastructure such as banks, courts, and stock markets. In poor nations, these foundations for economic development are under construction. However, a lack of infrastructure can actually be an advantage in the innovation game. Difficult constraints, such as unreliable electric power, inspire creative workarounds that sometimes lead in unexpected directions. Developing countries, unencumbered by legacy systems, have the flexibility to leapfrog to breakthrough technologies."

When DoD develops or acquires a new system or service, one of the greatest challenges and constraints is that the new system must interoperate with all the existing systems and infrastructure, many of which are decades old. Interoperability presents a massive challenge across the DoD bureaucracy and becomes even more complex with Allies and international partners. With exciting new technologies emerging each year, investments made decades earlier constrain the pace of adoption and enterprise performance. In addition to decades-old hardware platforms, DoD suffers from ancient IT infrastructure and software, as well as fewer and fewer people able to maintain these legacy environments.

While DoD cannot afford to develop entirely new portfolios of systems, services, and infrastructure in parallel with maintaining and evolving the current ones, it must continue to remove these legacy constraints. Adopting a Modular Open Systems Approach (MOSA) has been DoD policy for decades (and now a priority in statute), yet DoD has been unable to apply it for a variety of reasons, which include transforming the prime contractor's business models. A MOSA environment (along with Open Mission Systems and application program interfaces) enables integration of new solutions, including from non-traditional vendors and international partners. Similarly, Digital Engineering and the Air Force's Digital Century Series are fueling rapid designs, integration, and innovations. Shifting DoD from system-centric to more capability portfolio environments enables investments, resources, and continual evolution of architectures, infrastructure, and platforms to serve as the foundation for rapidly evolving systems, software, and components.

Changing the Management Model

"In the early stages of a reverse innovation effort, it is less important to deliver on plan than it is to state hypotheses about the future, test them, convert uncertainties into knowledge, and apply the lessons learned to develop a workable business model. In the battle to capture new markets, the winner is not necessarily the company that starts with the best strategy. It is often the one that learns and adapts the smartest and fastest. The battle for the emerging markets is not about market share. It's about creating the market."

In this area Steve Blank's efforts over the last 20 years to fuel the Lean Start-up movement within the DoD is critical. Hacking for Defense has trained countless innovators to get out of the building, talk with many people, use a Mission Model Canvas to frame the strategy, and continuously improve strategies and solutions. In shaping the DoD's culture to embrace and manage risk smartly, more people must watch and absorb the messages in this 2-minute video by Simon Sinek on falling vs. failing.

DoD needs to modernize its requirements system to enable starting acquisitions based on hypotheses and to accelerate learning via prototypes, experiments, fly-offs, and challenges. With the rapid pace of change in operations, threats, technologies, and budgets, DoD can no longer afford to spend over a decade to develop the next major weapon system. It needs DoD and Allied operational environments to shape capability developments with greater speed and flexibility.

"Regulatory systems can also be needless barriers to innovation when they become labyrinthine, technologically obsolete, or captured by vested interests that seek to sustain the status quo. Under such conditions, innovation in the developing world may enjoy the advantages of lower friction and faster progress. In making this observation, we do not mean to suggest that low levels of regulation in an emerging market are either a good thing or a bad thing; it simply is what it is, and it may sometimes provide an advantageous medium for certain innovations."

DoD's bureaucratic regulatory environment represents one of the biggest risks to delivering military solutions to deter and win future conflicts. Innovators may find a more fruitful environment to design and deliver solutions in other, less

regulated agencies or countries. They can then demonstrate mature operational solutions to the DoD to shape future program strategies and investments. Thereafter, DoD can acquire and rapidly field these solutions and iterate the capabilities based on operational needs and user feedback.

Local Growth Teams

"Commission local growth teams (LGTs) with full business capabilities for each reverse innovation opportunity. LGTs should act like brand new companies: They must conduct clean slate needs assessments. They must develop clean slate solutions. They must practice clean slate organizational design. Enable LGTs to leverage your company's global resource base through carefully managed partnerships. Manage reverse innovation initiatives as disciplined experiments, with a focus on resolving critical unknowns quickly and inexpensively."

DoD should assemble local growth teams from DARPA, DIU, AFWERX, DSCA, NSIN, and the NSIB to work with Allies to fuel their defense innovations and leverage the most promising ventures for the DoD. Like education with industry tours, entrepreneurial DoD personnel should have opportunities to work with Allied nations, partnering with Hacking for Defense's international program Hacking4Allies, to fuel global defense solutions.

NATO recently announced its Defence Innovation Accelerator of the North Atlantic (DIANA), meant to speed up trans-Atlantic cooperation on critical technologies and help NATO work more closely with private-sector entities, academia, and other non-governmental entities. DIANA includes a NATO Innovation fund of 1 billion euros over 15 years to be managed as a venture capital fund like In-Q-Tel.

In the FY17 National Defense Authorization Act (NDAA), Congress expanded the NTIB from the cooperating solely with Canada to include the United Kingdom and Australia. It also directed the Secretary of Defense to develop a plan that reduces current barriers between the countries and allows seamless integration between the persons and organizations comprising the NTIB.

In the FY22 NDAA, the United States Senate Committee on Armed Services version requires the Secretary of Defense to develop and implement security cooperation strategies for each of the geographic combatant commands. Furthermore, it requires the Secretary of Defense, in coordination with the Secretary of State, to submit a detailed plan for enhancing security cooperation in the Western Hemisphere.

Summary

Even with an annual budget of more than $700B, the DoD cannot afford and is unable to design, develop, and produce all the defense capabilities required to deter or win future conflicts with near peers. It must expand its innovation pipeline and development environment to an international scale. The DoD has major opportunities to rapidly design and demonstrate low-cost defense capabilities with our Allies and then scale up the most promising solutions for our Warfighters. The DoD can apply many Reverse Innovation strategies to transform the massive defense bureaucracy and exploit novel solutions. In doing so, it can co-develop solutions with Allies, tapping global innovation centers and driving interoperability for the joint fight. This environment, which has greater fiscal constraints but fewer regulatory constraints, will fuel a novel suite of mission-impactful capabilities that the Pentagon would have never imagined on its own.

About the Author

Pete Modigliani is MITRE's Software Acquisition lead for the Office of the Undersecretary of Defense for Acquisition and Sustainment. He has spent 24 years championing strategic acquisition reforms and digital transformations across DoD and the Intelligence Community. He is a former Air Force Program Manager and Assistant Vice President at Alion Science.

For more information about this paper or the Center for Data-Driven Policy, contact policy@mitre.org