Pillar III: Public Procurement

“The federal government is the largest buyer in the world ... we need to think about how to leverage this purchasing power strategically to shape markets.”

—Brian Deese, Director of National Economic Council
June 23, 2021
Section Overview

Our nation’s hands-off approach to market innovation assumed the government would lead the funding, development, or support of tomorrow’s most critical technologies. But now, with private-sector R&D investments substantially outpacing government R&D spending, there is little guarantee of the United States achieving essential capabilities in nationally important technological areas, let alone at scale. Governments have grappled with this strategic uncertainty through varying degrees of hands-on involvement. China, for example, sends clear priority signals and targeted resources to its R&D ecosystem. In the defense context, China’s military-civil fusion (MCF) endeavor allocates nearly $70 billion to address the persistent disconnect between military-procurement and R&D ecosystems. But the “scientific” top-down direction of China’s national innovation ecosystem has proven difficult to actualize. MCF fund managers have drawn criticism for alleged “turmoil and greed”. It is also too early to assess the efficacy of China’s approach. Massive government investment may simply be wasted attracting entrants into overstimulated markets.

Fortunately, America need not direct the orchestra. Our nation understands that intensively guiding markets can be counterproductive—and that the most innovative technologies and products are often found on the experimental “edges” of industry, where individuals can take disruptive risks. A renewed commitment to innovation will require investing in emerging technologies and experimenting with new ways of activating industry to meet government needs. The administration can use both market-shaping mechanisms (MSMs) and regulatory guidance to stimulate richer, more creative, and productively competitive markets in key technology sectors.

Market-Shaping Mechanisms

Supply-side incentives, such as direct R&D funding, industry tax credits for R&D, and Small Business Innovation Research (SBIR) grants can and have steered innovation. However, the administration can complement these efforts with a suite of underutilized procurement strategies known as “demand-pull” or market-shaping mechanisms (MSMs). MSMs position the government as a buyer to correct market failures, spur entirely new industries, and/or generate spillover effects to boost other sectors. Half of projects supported by SBIR grants fail to reach commercialization because market demand is too small. MSMs help to create the demand. Over time, federal agencies using MSMs could create a “marketplace of outcomes”—a marketplace wherein agencies issue clear and succinct descriptions of problems to be solved and outcomes to be achieved; private-sector teams work to solve those problems, and investors back the teams most likely to be successful. While a range of MSMs are available—including volume guarantees, advanced purchase agreements, advanced market commitments, milestone payments, and prizes or challenge-based acquisitions—we focus on the latter three below.
In an advanced market commitment (AMC), the government places an open call to the private sector to purchase a certain quantity of a specified technology. Rather than picking winners and losers, AMCs communicate to the R&D ecosystem by setting a desired target amount or technology and then letting companies freely compete to win the AMC. AMCs for a pneumococcal vaccine resulted in the immunization of 150 million children and saved the lives of 700,000 people. AMCs also enabled Operation Warp Speed to negotiate agreements with multiple companies to purchase millions of doses of COVID-19 vaccines should they meet FDA approval. But AMCs are not a silver bullet. To work efficiently, AMCs must have a target end goal (e.g., a number of vaccines to be produced) and be used when there is a range of competitors available and strong rationale for government involvement (e.g., when there is an obvious market failure or nationally strategic need). Examples of sectors where AMCs could be useful include:

- **Microelectronics.** Robust domestic manufacturing capabilities are of the utmost strategic importance, but it is currently much cheaper to outsource fabrication of microelectronics because of the economies of scale that established semiconductor manufacturing companies have. An AMC could set technical specifications on desired microelectronic chips, thereby providing the direction and incentives needed to bolster U.S. commercial fabrication facilities.

- **Biomanufacturing.** Certain biomolecules are critical to the biotechnology supply chain but are costly and risky to purchase. A Biomedical Advanced Research and Development Authority (BARDA) AMC could be launched to organize large-scale procurement of critical biomolecules for low-cost use in key sectors of the bioeconomy.

- **Quantum computing.** Quantum computing is a national security priority, but it is also a nascent, unproven technology without a well-developed market or a near-term commercial use-case. An AMC delineating clear milestones based on NIST’s quantum-computing benchmarks would drive commercialization of certain QIS systems.

- **Autonomy and robotics.** The United States lags China, Japan, and South Korea in the deployment of robotic systems. An AMC could be launched to direct software and hardware efforts towards government priorities by providing specifications for needed autonomous systems.

- **Additive manufacturing.** Additive manufacturing is crucial to U.S. competitiveness, yet companies cite costs of additive-manufacturing equipment as the top challenge for adoption. DoD could launch an AMC identifying equipment specifications for advanced additive manufacturing among a variety of use cases in order to bring down prices.

- **Energy storage.** DOE’s Energy Storage Grand Challenge Roadmap aims to domestically manufacture energy storage technologies for all of U.S. market demand by 2030, with specific target goals already listed (e.g., $80/kWh manufactured cost for a battery pack to power a 300-mile-range electric vehicle by the year 2030). An AMC aligned with this
Milestone-based payments reward innovators for intermediate progress towards a specific goal. The best recent example of this is NASA’s partnership with SpaceX. Structured as a series of payments once development milestones were met for the Falcon9 rocket delivery of cargo and astronauts in space, the SpaceX partnership reduced U.S. dependence on Russian rockets to send resources and people to the International Space Station (ISS). For an investment of roughly $400 million, NASA gained access to a capability that would have cost them $1.7 billion to $4 billion using a “business as usual” approach. The SpaceX partnership has also propelled our nation to a leadership position in commercial launch services. The United States had 0% of the global commercial-launch market in 2010, but SpaceX had captured 65% of that market by 2018. This idea could be expanded but would require regulatory fixes. The Federal Acquisition Regulation (FAR) specifies that the executive branch only has authority to use contract financing when it is in the public interest (no financing is the first preference). The DoD’s Performance Based Payments (PBP) Guide similarly defines PBPs as not an incentive arrangement—though it may be acceptable to provide industry with an accelerated PBP payment schedule for innovative solutions. In general, milestone payments could shape markets, but policies need to clearly specify when and how such payments can be used and oversight mechanisms need to be established.

Government prizes or challenge-based acquisitions allow agencies to select solutions based on demonstrated capabilities as opposed to written proposals. While prize competitions are geared towards the demonstration of an ability, challenge-based acquisitions are a relatively new concept where the “prize” is the guaranteed government or industry purchase of the winning solution. The lines may also blur between the initiatives as the process matures. For example, one Ansari XPrize competition awarded a $10 million prize to a privately funded reliable, reusable spaceship able to carry three people into space (100 km above the Earth’s surface) two times within two weeks. Nearly 30 teams competed in the competition, investing a total of $100 million into finding a solution. The prize competition turned into an acquisition when the winner was licensed by Virgin Galactic—and the solution has become part of the commercial space-flight industry today. With every federal agency possessing the authority to support competitions of up to $50 million, challenge-based acquisitions could shape a variety of sectors if federal agencies were required to transition, or buy, a certain percentage of winning solutions. The acquisition itself would then de-risk follow-on development by sending a clear signal to industry of administration priorities.

These rewards and acquisition efforts could also creatively be used to shape global markets by setting the ethical baseline for the administration’s priorities. Consider the surveillance-technology industry. With advances in AI, video analytics, internet spyware, and more, crushing dissent is arguably easier now than ever before. In the last few years alone, demand for new-age surveillance technologies has skyrocketed, posing serious threats to the future of democracy and human rights.
President Biden has remarked on the dangers of the modern authoritarian, and surveillance technologies are the most important tools in their arsenal. Moreover, the market for surveillance technology is highly unregulated. There is little to no oversight of the misuse of surveillance technologies exported from China, Israel, the United Kingdom, the United States and elsewhere. The Israeli-based NSO group, for example, has supplied Saudi Arabia, Kazakhstan, and many other authoritarian customers with powerful surveillance software, including information on heads of state, government ministers, activists, journalists, and human rights defenders. But a surveillance technology prize competition, supported by DARPA’s Measuring the Information Control Environment, could induce a paradigm shift in the global export market for surveillance technology. This effort would call upon U.S. surveillance vendors to develop real-time software and hardware controls to monitor technology misuse and lock operations when and where needed. Along with award money, the “prize” could include a special class of export license authority. Eventually, the nascent features would become prerequisites for acquisition and conditions for export, setting the basis for multilateral agreements that hold companies accountable for the use of their technology.

Regulatory Guidance

Unclear regulatory guidance often inhibits innovation—or results in innovation that imposes serious social costs. The development of AI applications underscores this point. Without requirements for engineering or adjacent teams to evaluate the ramifications and biases of their technologies, ethical considerations within most AI firms have taken a backseat. The existing laissez-faire approach to AI is precisely the opposite of what is needed. AI applications are dynamically responsive to new training data and user feedback; hence even initially verified algorithms may not be immune to the emergence of underlying or new forms of bias that reduce the fidelity of procured systems post-acquisition. With the U.S. government poised to become the largest single customer of AI, we have a strategic and ethical imperative to shape the AI market. Creating a National Framework for AI Procurement could ensure the performance, security and ethicality of publicly acquired AI tools, and could encourage adoption of similar standards by state and local governments. In addition, the Office of Federal Procurement Policy (OFPP) and OSTP could coordinate the range of ongoing interagency AI vetting efforts to ensure consistent evaluation criteria. At a minimum, evaluation of an AI application should include an analysis of the model architecture, use cases, data types, and developer team profiles prior to acquisition.

Another approach would be to target specific applications of AI, such as its use in surveillance in the United States. These digital-surveillance techniques pose severe implications for equity, justice, and liberty. And yet the industry is widely described as the “wild west”, free of accountability or transparency. At a minimum, the OFPP should amend the Federal Acquisition Regulation to require that federally procured surveillance technologies receive approval under NIST’s face-recognition vendor test. A more fundamental, holistic, and long-term approach would be to create a Digital Surveillance Oversight Committee (DSOC) to certify all surveillance
technologies prior to acquisition, based on meaningful involvement from historically surveilled communities, law-enforcement officials, and retired industry experts. This would create a class of approved and unapproved surveillance technologies, establishing \textit{de facto} standards for state and local government entities acquiring these technologies.

China’s market-oriented, government-guided model appreciates the strategic importance of communicating national priorities to the R&D ecosystem. Such communication is equally important in our own country, where industry supports the bulk of innovation, but need not be as prescriptive. Playing to our strengths in this competitive environment will require embracing previously underutilized market shaping techniques. Advanced market commitments, milestone-based payments, prizes or challenge-based acquisitions, and regulatory guidance can communicate foundational national priorities while simultaneously incentivizing industry to compete to achieve them.