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Better Buying Power or Better Off Not? *Purchasing Technical Data for Weapon Systems*

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In September 2010, then-Under Secretary of Defense for Acquisition, Technology and Logistics Ashton Carter directed program managers (PM) to routinely analyze the business cases behind procuring the technical data packages and rights to new weapon systems. In this article, the author recounts some of the historical difficulties with procuring technical data for fielded systems, and presents a heuristic economic model outlining the problems that PMs should consider before making an offer.

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In September 2010, then-Under Secretary of Defense for Acquisition, Technology and Logistics Ashton Carter issued a broad memorandum on acquisition reform to the heads of the military Services and defense agencies (Carter, 2010). Covering five major themes, with 23 individual initiatives, but published in just 10 pages, the memorandum called for a thorough rethinking of how the Pentagon went about acquiring goods and services—an approach aimed at developing “better buying power.” Indeed, Better Buying Power was the document’s chosen title—a term intended as a quiet rallying cry for better performance in the business of defense.

Background

Underperformance and Shrinking Budgets

As the largest buyer by far of weapons worldwide, and the monopsony buyer in the largest market, the U.S. Government ought to be a more powerful buyer, Carter believed, extracting better terms than it had historically. Why the sudden imperative? As Carter told an assemblage of industrialists in a progress report 10 months later, their generation had “grown accustomed over the post-9/11 decade to circumstances in which we could always reach for more money.” The problem, he continued, was that “those days are gone” (Marshall, 2011). Amidst a financial crisis and a nearly global recession, the military budget clearly would be decreasing. With tighter spending constraints, continued underperformance could become dangerous on the frontline.

To be fair, there had been some remarkable success stories in the wars in Afghanistan and Iraq with rapid, off-the-shelf procurements. But many developmental programs had lurched from delay to cost overrun. The plight of the Army was remarkably bad. Twenty-two of the Service’s major weapon systems programs had been cancelled since 1995, at a cost of \$32 billion for materiel never fielded (Capaccio, 2011). Perhaps this should not have been news. Carter had previous experience in the Pentagon, and was a professor of public policy at Harvard’s Kennedy School of Government. As such, he likely agreed with Asher and

Maggelet's assertion of almost three decades prior that "schedule and cost growth in DoD weapon systems acquisition have been recognized as an economic fact of life" (1984, p. iii). He simply believed in breaking that supposition.

The dilemma with which Carter and his team had grappled was "how to incentivize lower prices in the short run without ruining suppliers' incentives to commit assets, incur risk, and innovate for the long run."

Aiming to do so, Carter's planners took in more than one hundred ideas for reforms, and whittled the list down to the 23 they considered "long-ball hitters" (McFarland, 2011, p. 7). There were clear themes: the word "incentive" appears 13 times in the memorandum, and the word "competition" fully 50. In particular, as a former chief industrial strategist at the Pentagon observed, "Better Buying Power has taken aim at eradicating what it views as a sclerosis of comfortable contractor incumbency...and reads like a monopsonist's playbook for defense in the 21st century" (Grundman, 2010, p. 3). The dilemma with which Carter and his team had grappled was "how to incentivize lower prices in the short run without ruining suppliers' incentives to commit assets, incur risk, and innovate for the long run" (Grundman, 2010, pp. 1, 3). That long run would last a bit, for after Carter moved up to become the new deputy secretary of defense, incoming acting Under Secretary Frank Kendall (2011b) issued a two-page memorandum largely staying the course of Better Buying Power.

How easily the strategy would be implemented by program managers (PMs) might be another question. In the ensuing pages, I recount some of the historical difficulties with procuring technical data for fielded systems, and present a heuristic economic model outlining the problems that PMs should consider before making an offer.

The Technical Data Package Explained

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Competition amongst prospective contractors is one natural way of inducing lower prices. So, under the heading “Promote Real Competition,” and subheading “Remove Obstacles to Competition,” one of those 23 instructions called for the Services to “Require Open Systems Architectures and Set Rules for the Acquisition of Technical Data Rights.” Specifically, Dr. Carter (2010) wrote that:

At Milestone B, I will require that a business case analysis be conducted in concert with the engineering trades analysis that would outline an approach for using open systems architectures and acquiring technical data rights (TDRs) to ensure sustained consideration of competition in the acquisition of weapon systems. (p. 10)

This was not strictly a revolutionary thought. Prior to Carter’s initiative, the John Warner Weapon Systems Acquisition Reform Act (WSARA) of 2009 had mandated that the acquisition strategy for any Major Defense Acquisition Program (MDAP) provide a plan to ensure at least the competition throughout a system’s life cycle. The WSARA listed 10 possible measures to consider; buying the technical data package (TDP) was one of those (Byrd, 2010, p. 10). Carter’s memorandum moved that from *probably should* to *definitely should* consider. The Army then got its own recommendation from the Decker-Wagner Army Acquisition Review Panel, which recommended buying TDPs during development, so long as that was “consistent with the risk-reward” (Decker-Wagner, 2011, p. xvi).

But what precisely are TDRs and TDPs? While sometimes conflated, the terms are not synonymous. The Defense Acquisition University’s Glossary (2005, p. B-181) defines the TDP as “a relatively complete package of design and manufacturing information” consisting of “drawings, quality assurance provisions, standards, performance requirements, quality assurance provisions, and packaging details.” Depending on the contract terms under which a weapon system was developed, TDRs confer some degree of legal authorization “to use, duplicate, or disclose” those data, potentially to a competing contractor (p. B-78). Thus, the TDP is the actual intellectual content of the TDRs, but possession of one is not possession of the other. Frankly, neither is necessary for ensuring competition before a system enters initial production, but both figure strongly for ensuring competition afterwards. If the government lacks the data and rights thereto, the contractor that designed a weapon system will undergo a “fundamental transformation” from applicant

to incumbent (Williamson, 1988, p. 80), and stand alone as sole source for reorders, upgrades, overhauls, or possibly even spares. The government may still stand before the contractor as a monopsonist, as the only domestic buyer of heavy weapons, and the veto authority on arms exports. But even then, the buyer-seller relationship would be a bilateral monopoly—a problematic negotiating situation. One of the chief interests in acquiring TDPs and TDRs should thus be clear: with a full understanding of how to produce and maintain a system, the government can open a second source—a potential alternative to the incumbent.

A Brief History of the Government's Stance on Technical Data

With such benefits, one might presume that the government has always and everywhere wanted its data, but the policy has varied over time. Naturally, the government rarely acquires technical rights to wholly



commercial items—there is simply no reason to own the blueprints for making readily available items such as standard screws in-house. But even with noncommercial items developed at governmental expense, through the end of World War II, both the War and Navy Departments rarely acquired TDRs. Contractors were hardly willing to sign them away, having a natural interest in exclusivity, as sole possession would forestall competition. Even the government may not want to push too hard for TDRs. As noted earlier, Williamson’s “fundamental transformation” to incumbency brings stability to the business relationship. The presumption of future quasi rents from monopolistic competition may encourage long-run innovation, which the monopsonist must take care not to kill, as defense is presumably a long-run game (Grundman, 2010, p. 1).

For decades, contractors had little to fear. Armed Services Procurement Regulation No. 9 ensured that whatever technical data the government might acquire alongside its armaments, it would otherwise not possess “any right to reproduce anything else called for by this contract” (McKie, 1966, p. 5). Thus, TDPs frequently—TDRs almost never. But in 1955, the escalating cost of new aircraft led the Defense Department to assert that the aforementioned clause was not so restrictive, and that the government’s data rights could be extended to competing suppliers without royalty. Faced with such severe regime instability, quite a few contractors rebelled. Over the next 10 years, the Pentagon’s technical data regulations underwent four revisions, culminating in a state of considerable rights for contractors (Maizel, 1986, pp. 236–245). As those rights remained inadequately defined, a flurry of litigation ensued, until passage of the 1983 Defense Procurement Reform Act and the 1984 Competition in Contracting Act emphasized assertion of greater governmental rights (Maizel, 1986, pp. 270–271).

In 1993, however, the Clinton administration entered office determined to “reinvent government” with thoroughly businesslike practices. Buying suppliers’ technical data was not (and still is not) common commercial practice, so the mandate was considerably relaxed, and particularly for off-the-shelf products. Sharp reductions in the Pentagon’s procurement workforce in the 1990s simultaneously eroded in-house technical expertise, albeit with little contemporaneous worry, for contractors were deemed more than capable of maintaining their own technical data. By the late 1990s, the practice reached its apex in the Total System Product Responsibility (TSPR) concept, in which a single contractor was paid for the delivery and long-term maintenance of a

system, in a single long-term contract. The agency problems in that approach led to some spectacular failures, such as the ongoing debacle of the Space-Based Infrared System (SBIRS; see Hasik, 2004)—still unavailable for its deemed role in ballistic missile detection and tracking, some 15 years after its inception.

The Bush administration almost entirely continued the Clinton administration’s policy, though it had largely backed away from the TSPR concept by the end of its second term. Congress was busy rewriting laws as well. In 2007, the John Warner National Defense Authorization Act mandated that PMs of MDAPs assess “the merits of a priced contract option for the future delivery of technical data that were not acquired upon initial contract award, and the potential for changes in the sustainment plan over the life cycle of the system” (Government Accountability Office [GAO], 2011, p. 9); note that Senator Warner’s has been a popular name to invoke in these matters. In 2009, the WSARA had yet more fully declared a new policy, and the following year Better Buying Power had effectively declared “TSPR RIP” (Grundman, 2010, p. 4). At that point, in policy directives enacted even before Carter’s (2010) memorandum was written, PMs, according to GAO’s (2011) report, were required to:

1. assess the data required to design, manufacture, and sustain the system as well as to support re-competition for production, sustainment, or upgrade;
2. address the merits of including a priced contract option for future delivery of data not initially acquired;
3. consider the contractor’s responsibility to verify any assertion of restricted use and release of data; and
4. address the potential for changes in the sustainment plan over the life cycle of the weapon system or subsystem. (p. 11)

With Carter’s emphasis, PMs would henceforth think long and hard about the data and the data rights—if they could quite understand the difference, the advantages, and which benefits might remain elusive.

Historical, Challenging Cases in the Technical Data Approach

Buying data is not a panacea simply because intellectual capital (IC) is not synonymous with intellectual property (IP) (Gallop, 2011, p. 38). As noted earlier, possession of the data does not necessarily confer rights to the data. Conversely, the rights to produce a system may exist separate from the data needed to do so. Moreover, neither IC nor IP constitute individual skills or organizational knowledge per se, and some technologies are quite firm-specific. Consequently, technical drawings are just the start of opening a second source. As there have long been alternative methods of second-sourcing worth considering, such as directed licensing or functionally equivalent purchases, one analysis (Sellers, 1983) of nearly 30 years ago from the Defense Systems Management College took a dim view of the salience of purchasing TDPs:

Although theoretically sound, this method is perhaps the most hazardous of all the second-sourcing methodologies. It is not well-suited for use in highly complex systems or systems with unstable designs or technologies. (p. 14)

In other words, with most modern weapons.

As an example, consider the case of the Japanese F-2 fighter jet program. In the early 1990s, General Dynamics (predecessor in Fort Worth to Lockheed Martin) began working with Mitsubishi Heavy Industries to help produce a less-expensive domestic supplement to the Japanese Air Self-Defense Force's F-15 jet fighters—seemingly, a Japanese analog to the F-16. Indeed, the F-16 served as the basis for the program, with diagrams, production licenses, and technology transfer assistance forthcoming. Howls continued for some time about the “giveaway of advanced aerospace technology to America's most relentless rival” (Lorell, 1995a, p. 2), but the eventual result was unimpressive (Garretty, 2002, pp. 35–37, 42–43). Between 1995 and 2011, following the initial prototypes, only 94 combat-capable F-2s were built, in a 60/40 work-sharing agreement with Lockheed Martin, for approximately \$104 million each. In short, for all its trouble, the Japanese government got not a lot of technology transfer, and a shockingly expensive derivative of an otherwise economical airplane. The U.S. General Accounting Office concluded as early as 1992 that the technology transfer process for the F-2 had simply been “too strict” for cost-effective coproduction (Lorell, 1995b, p. 361).

Consider further the case of an American purchase of a TDP, gone very wrong: that of the M119 105 mm howitzer, née the British Light Gun. In the late 1980s, the U.S. Army bought the TDP and the TDRs from Royal Ordnance (RO), the British government's arsenal for artillery and munitions, for licensed production at the Watervliet and Rock Island Arsenals. Management at RO did not fully understand what the U.S. Army meant by a TDP, as howitzer production for the rather smaller British Army was a craft-oriented, fix-it-on-the-shop-floor process. Though RO was then a crown corporation of an allied state, the U.S. Army considered suing the organization for providing a package wholly inadequate for establishing a new production line with fully trained workers (Schaller, 1996, p. 42). The TDP was also technically inaccurate: its original estimate for tooling costs was \$8 million, but actual costs eventually exceeded \$23



million. The license fee from RO for the TDRs was initially just £1.15 million, but RO's subsequent charge for fixing the deficiencies in the TDP—representing scores of engineering man-years for which it had not originally been contracted—was \$4.75 million. Accordingly, the Army's attempt at concurrent engineering at Rock Island went particularly badly, and even after that, the Army's Research, Development, and Engineering Center, Watervliet, and Rock Island spent another \$3 million fixing yet further deficiencies in the TDP.

As noted, original sources have a natural, built-in advantage of tacit knowledge about their own products, and whether omissions from TDPs are just omissions or conscious commissions of opportunism, defects therein are typically “almost always the case” (Sellers, 1983, p. 14; see also Witte, 2002). Those fighters and howitzers serve today, but as the examples show, even ultimate successes with TDPs can cost “an incredible amount of time and money” (Schaller, 1996, p. 39).

Back in the 1980s, the Army's project officer for the M119 was a junior civil servant named Kevin Fahey. Today, Fahey is the Department of the Army's program executive officer (PEO) for Ground Combat Systems, and an official pushing to procure technical data, rights and all. In 2009, pursuant to the WSARA, his staff began calling Army contractors possessing proprietary designs to inquire about buying what it could. Reports from at least one contractor reveal a remarkable lack, at least initially, of economic sense on the government's negotiating team. The Army's initial position presumed (and apparently innocently) that the contractor would only seek compensation for the engineering man-hours needed to reproduce the drawings. When apprised of the need to pay separately for the rights, in compensation for possibly lost future profits, the Army's negotiators did quickly come around (anonymous, personal communication, 2009).

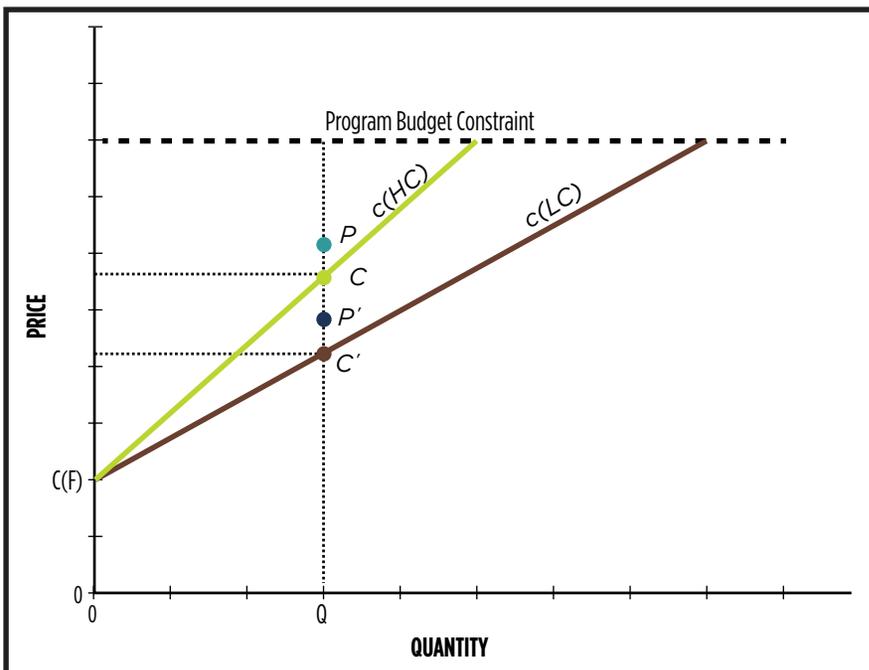
That is, if the government is investing in a competitive process, the potentially displaced contractors will assign the avoidance of that process some value. That technology transfer is costly, both in purchase price and learning costs, and so paybacks on this investment have been observed generally to take at least 3 years (Daly & Schuttinga, 1982, p. 63). Statistical estimates of learning curves tend to be highly unreliable (see Alchian, 1963), and can even turn negative with “organizational forgetting” (Benkard, 2000), so the error range on those payback estimates can be considerable. The government must also maintain that internal expertise, and continue to update the TDP as the system is upgraded

over time (Sellers, 1983, p. 14). With problems like these, unsurprisingly, second sourcing has historically been used less to reduce price than to deal with primary suppliers' quality problems (Lyon, 2006).

A Simple Economic Model for Pricing Technical Data

Price, though, is the emphasis of Better Buying Power, so purchasing data have become, whether at Fahey or Carter's direction, a proactive and presumptive option. Buying data early in a program (as Carter's [2010] memorandum directs) is very appealing (House Armed Services Committee, 2010, p. 8), but pricing is problematic for equipment already in production. Much of the volume of procurement in defense, after all, is not for wholly new systems, but for new units of systems already fielded, or for modifications to those systems. With its monopsony power, the government can apply implicit, even unwitting pressure on contractors who sell largely to military customers. Loss of goodwill from outright refusal of a sale at any price may be unpalatable. Facing that double bind,

FIGURE 1. TWO CONTRACTORS, FIXED MARGIN, KNOWN COSTS



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a contractor may seek a defensible position by marketing its irreproducible tacit knowledge, inextricably proprietary processes, and efficient embeddedness with the customer (Uzzi, 1996).

How the PM will respond is more problematic. Buying data only makes sense if the second run can amortize the costs of the production shift plus the purchase of that data. The quantities and prices to which contractors would respond optimally are likely less clear. Dixit (2002, pp. 707–708) provides the beginnings of a model, stipulating a competition involving two contractors, with higher and lower internal costs. The government may have buying power, but it does not know which contractor is which, and so the lower cost contractor can represent itself as higher cost, and conceivably earn fat margins. Auditing under profit regulations can drive down this margin somewhat, but only imperfectly: management can pad its accounts with featherbedding, and slack off from the pursuit of factor efficiencies, buying a comfortable life at public expense. Dixit's assumptions here are quite plausible in studying military procurement, where the government often has quite imperfect information of any contractor's cost or quality. However, his prescribed solution, a menu of two price-and-quantity combinations by which the contractors will efficiently self-identify as either high- or low-cost, is essentially unknown in our realm.

And yet, if we used his model, we would still not have considered pricing the data, for the government must pay in advance simply to hold the competition at all. To accommodate this complication, and to conform to a recognizable military procurement mechanism, I offer an alternative model, shown in Figure 1. Here, the PM attempts to procure a certain quantity of weapons, specified by budget planners, minimizing cost, in a single round of procurement. Arriving at Milestone B, the PM has an offer of Q units at total cost P from the incumbent contractor, which has designed and prototyped the weapon. The PM, however, suspects the incumbent to be high-cost. A competent second source, thought by the PM to be low-cost, markets its capabilities as a production alternative, notionally at price P' . (We assume invariant quality between contractors.) The respective firm-specific cost curves for the weapon are shown with marginal costs (slopes) c_{HC} and c_{LC} . For simplicity, we assume the same fixed start-up cost C_F , and a constant margin, fixed and audited by the government, of $P - C = P' - C'$. The lower cost firm is thus not incentivized to pad its costs for a greater prize.

Purchasing data rights could activate the second source, which would then presumably win the competition. By inspection, we see that the PM's reservation price for the data is $C - C'$ (equivalent to $P - P'$ with the fixed margin). We imagine that the incumbent might sell, even if selling means exit: the profit margin $P - C$ can be taken as the incumbent's reservation price. If the incumbent determines in advance that this margin will not exceed the government's reservation price (if $C - C' > P - C$), then negotiations are possible. Because we have stipulated a fixed margin of $P - C = P' - C'$, by substitution the preceding condition reduces to $P' < C$. That is, if the challenger's price is less than the incumbent's cost, and profit is the contractor's primary motivation, the incumbent and the government may make a deal. It is important to note, though, that if the cost curves are close, buying out the incumbent's margin will save the customer little.

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Tools, Rules, and Schools on the Path Towards Technical Data

This is all simple, but again problematic, for neither the PM nor the second source can be certain of C' , and thus P' . The PM presumably understands the broad technical nature of the program, but the PM is not a production manager, with the same operational understanding of a PM's contractor counterpart. The PM's should-cost analysis (directed separately in Better Buying Power) may help understand those costs, but anecdotally, the should-cost analysis does not begin well. Commercial best practice in supplier management holds that should-cost briefings should be transparent in their assumptions and analyses, so that suppliers can correct customers' misimpressions and find common ways to remove costs from the shared value chain. According to one prominent analyst, in several cases the government's men have been dropping the should-cost figure on the table and declining to provide further insight (B. Callan, personal communication, 2012). This is no way to do business.

The soliciting second source also presumably understands its own production capabilities generically, but lacks the specific TDP and the tacit knowledge built during the development of the system. The original source might know its own production capabilities reasonably well, but not precisely, for it is only now planning to bring the weapon into actual production. The original source, therefore, will presumably know even less about the second source's costs. Even in the best of times, the original source commonly calculated breakpoints of economic order quantities, economic production rates, and minimum sustaining rates, despite their official acronyms and emphasis in the education of the PM, can be "surprisingly difficult to pin down" (Schilling, Hagewood, Snodgrass, & Czech, 2011, p. 43). If just the estimated slopes of the cost curves differ from reality, any of the players in the game may find themselves in the situation depicted in Figure 2, making decisions on faulty information, with hazardous results.

The key, to cite Decker-Wagner (2011), is hewing to that "estimated risk-reward" (p. 105). Cost-benefit analyses can get complicated if policy-makers have "highly unstable and often incomprehensible" preferences (Zaharidias, 2008, p. 517). All parties may wonder if the budget will fall, or gyrate from year to year. The PM will likely last in the job for but a few years, while the PM's counterparts may stay in their jobs for many more; if the contractor's rationality is bounded, the PM's may be more so. The problem is thus tripartite, strategic, probabilistic, asymmetric, and frankly quite challenging. Without a clear path to a solution, and slight punishments for dodging policies, PMs could just walk away from the problem. Indeed, many have. In the GAO's (2011) audit (p. 13) of compliance with the 2007 and 2009 statutes, none of the 12 program management offices sampled had fully undertaken all four of the mandated analyses of data rights acquisition.

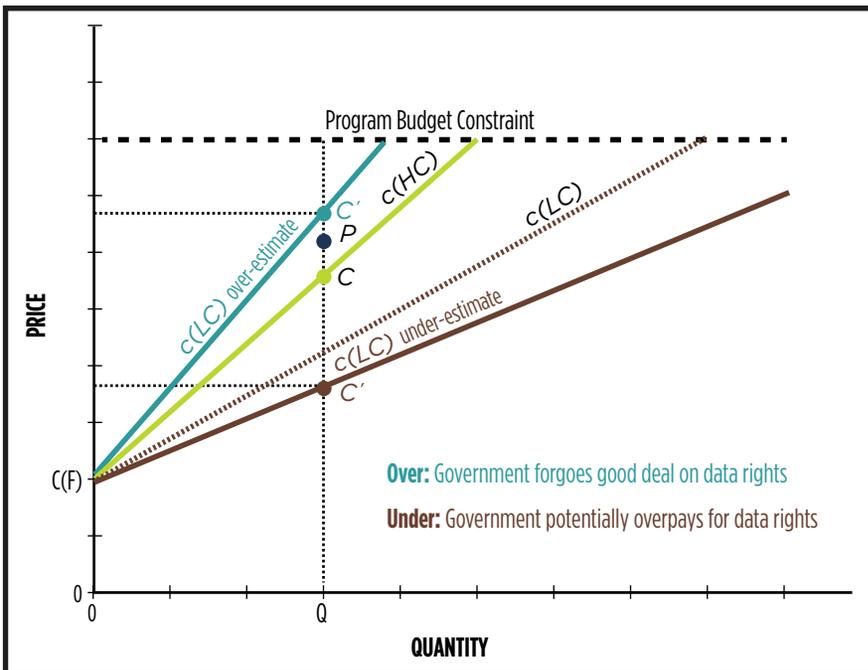
Alternatively, if pushed hard, but without the analytical tools to tackle the question, the policy of just considering buying technical data could become inefficiently self-executing. Without data rights, competition is more challenging, but competition is the clear dictum of Better Buying Power. Buying-in reduces organizational uncertainty, even if the actual business case is marginal, which can appeal more to the PM, as agent, than the PM's principal—the PEO or assistant secretary. If buying data means "sticking it to the contractors," the newly emphasized practice can become, in Selznick's famous phrase, "infused with value beyond the technical requirements of the task at hand" (1957, p. 17). PMs might then underthink and overreact, reflexively offering to buy technical data at heuristically determined prices. In a rush to do a deal, these prices



may prove excessive, and thus sticking it to no one but the government itself. To defend the work, the program offices may simply shade their business cases to justify their preferred paths of less resistance. And thus, we would find defense fulfilling Behn’s assertion (1995, p. 321) that “constraining people from doing anything wrong often simultaneously constrains them from doing anything right.”

Fearing that the memorandum’s guidance could become ossified as such a presumed rule (Buy all TDPs!), the current Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]) Frank Kendall has “tried hard to communicate...that our guidance is just that—guidance” (Kendall, 2011a, p. 3). If Better Buying Power aims to implement 23 game-changing elements of guidance, then in the words of one reporter at the roll-out press briefing (Gates & Carter, 2010), this “might seem to require a cultural change within the Department of Defense.” The response by the former USD(AT&L) was noncommittal, with the emphasis on changing behavior versus cultural change:

FIGURE 2. TWO CONTRACTORS, FIXED MARGIN, UNKNOWN COSTS





MR. CARTER: Cultural change is—I always say I don’t do cultural change; it’s too hard. So we’re—this is directing specific actions. And the actions that we want are pretty specific, and the cause-and-effect is pretty specific, I think you’ll find as you read this, and the metrics by which we measure the effects are spelled out in the document. So culture’s too hard for me. Behavior—that’s what we’re after. (p. 3)

Conclusions and Recommendations

Although Carter’s (2010) memorandum lays out metrics for other initiatives, it does no such thing regarding data rights—one of a PM’s more challenging economic analyses. If there is direction, it is toward mere consideration. To be sure, issuing new formal rules could be counterproductive, as the PM’s managerial judgment under uncertainty is essential to the pursuit of better value. Given the complexity of the business case that the USD(AT&L) now demands at every MDAP’s Milestone B, some better tools would be important.

Better still might be actually tackling what Carter calls “too hard”—the culture. While complex weapon systems acquisition should be an eyes-open process, it simply cannot be an arms-length transaction. The Pentagon’s procurement institutions should inculcate in managers a strategic sense for mutually dependent relationships with long-term incentives for sustained innovation. The pursuit of such fuzzy objectives by PMs best relies on informal rules subject to the judgment of more senior officials (see Ingraham, Moynihan, & Andrews, 2008), and the conscious development of an organizational culture congruent with the leadership’s objectives in a commonly understood “unity of purpose” (Gulick, 1937, p. 39).

Change would require adjusting the government’s ways of thinking—its fundamental school of thought about supplier management. Carter effectively introduced a slew of new rules into the Pentagon’s bureaucracy, but he and his successor have developed few mechanisms for affecting the behavioral change beyond issuing a memorandum. Exhortations are no way to develop a sound business process (Deming, 1982, pp. 65–70), much less to develop 23 such processes. Pricing technical data in each of the Pentagon’s programs is but one of those, and a very challenging one at that.

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