WELCOME TO *INNOVATIONS*— a column designed to help you navigate this time of vibrant change by bringing you inspiring ideas, approaches, and methods you can apply.

If software is eating the world and thereby government, then government contracting professionals need to know how best to buy it and government contractors need to know how to sell it. Where they come together is at the price and contract. But how should we price software?

This is becoming a key point of debate within the acquisition community, and this month's *Innovations features* a leading thinker and keen observer of that debate—Eric Lofgren. Eric is an economist and government contracting research fellow at George Mason University's Center for Government Contracting. He spent seven years consulting with the Defense Cost Assessment and Program Evaluation office. His "Acquisition Talk" blog has quickly become a must-read for everyone watching the convergence of budget, government contracting, and innovation.

Here, he argues that while all the most important aspects of today's economy relate to innovation and software, government really doesn't know how to effectively cost out either one. Eric does a great job of explaining the dilemma and offers an alternate path away from traditional cost-based pricing to help pave the way.

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Pricing Innovation: Century-Old Cost-Basing Doesn't Work

BY ERIC LOFGREN

If the Department of Defense (DOD) wants to harness commercial technologies, it will have to look beyond the century-old cost-based pricing model. Tracking labor and materials makes sense for assembly line work, but the 21st Century is defined by knowledge work found in software, data, and product design. Prices are not regulated by the cost of inputs, but through a continuous process of competition.

Cost Accounting's Decline

For more than 100 years, little has changed in accounting methodology. Compare the first financial report of U.S. Steel in 1902 to the company's report in 2012, and one finds minimal difference.[1] Similarly, during World War I, the U.S. government paid its sole source suppliers a price based on accounting costs for direct labor and materials with even allocations of indirect costs, adding on top of that a small profit consideration.[2] Except for minor differences, the DOD of today evaluates prices the same way it did more than 100 years ago.

At the turn of the 20th Century, industrial production became more complex. Managers demanded accurate information on costs to aid in pricing decisions, measure efficiency, and allocate resources across competing product lines. Cost accounting became an integral part of the search to improve productivity that came to be known as "scientific management."

In theory, the cost of each unit of output was measurable; in practice, this measurement turned out to be very difficult. Even the best-managed firms could not track direct costs to each type of product, let alone unit. Managers focused on time-studies and material usage rates for each activity, which, when burdened with indirect costs, became the "standard" product cost. The standard costs were compared to aggregate flows of costs and units over an accounting period to determine variances.

Standard costs formed the basis of pricing proposals, but more often

reflected average rather than marginal costs. When accountants provided estimates of marginal costs, they proved "perilously" low.[3] For example, the costing system put in place at Watertown arsenal from 1908 to 1915 routinely applied 100–300% increases to the standard cost as a basis for pricing.[4] Moreover, the same product at different firms received wildly different cost estimates. It took seven years of industry studies, for example, to determine a standard cost for as simple an item as a 2' x 4' board.[5] Robert Anthony, accounting scholar and assistant secretary of defense (comptroller) from 1965–1968, later explained:

> Suppose the president of a widget company says, "Last year our cost of manufacturing widgets was $1.80 each." The ordinary person may think he has learned a concrete piece of information from this statement. Anyone who understands the vagaries of cost accounting knows differently. He knows that "cost" in this context has no generally accepted meaning.[6]

Over time, the problems grew worse. Direct input of repetitive labor and raw materials declined in importance. Indirect costs grew substantially, making an even spread over direct costs less indicative of actual absorption rates. In other words, the allocation of indirect costs to a particular sale was arbitrary.

In 1987, scholars Robert Kaplan and H. Thomas Johnson published the seminal book, *Relevance Lost*.[7] They argued how "management accounting information is produced too late, too aggregated, and too distorted for managers' planning and control decisions."[8] A crucial point was that the cost accounting system did not accurately represent the demands made by each product on the firm's resources, which led to cross-subsidies and misguided pricing decisions. More important, the system treats investments as an operating expense even though they result in future benefits such as research and development, employee morale, enterprise systems, and preventative maintenance. These investments were neglected by managers in order to minimize cost and boost short-term earnings performance.[9]

Pricing Innovation

The kind of investments that cost accounting penalizes are ultimately those that matter most to productivity improvements. While investment in tangible capital such as machine tools and facilities allow a firm to move up or down a fixed production function, intangible capital can allow firms to do more with less. Yet intangible investment is not easily tracked by cost accounting systems. It requires upfront expenditures that cannot be assigned to the future sale of individual products.

The most important aspects of the modern economy relate to innovation. Costing problems are compounded when considering new ideas and nonreproducible production. For example, software represents a product whose marginal cost of reproduction is zero. Software companies do not own physical assets in the same way steel manufacturers do. They own intellectual property and a company culture that is embodied in lines of code, data, reputation, and the potential for great ideas.

Rather than cost-based pricing, technology firms use a bevy of pricing strategies for recouping fixed costs first articulated by Hal Varian and Carl Shapiro in *Information Rules*.[10] The rules – including bundling, tying, licensing, discounting, and other forms of price discrimination – are not limited to information technology firms. Many manufacturers doing business with DOD are not doing long runs of assembly line work. Lean manufacturing depends on intangibles, and so does 3D printing. Nearly the whole cost of spare and repair parts could soon be in the upfront cost of the capital, the business processes, and the knowledge work associated with data and product design. The incremental costs of producing an additional item are rather small compared to the fixed investment in capital and nonroutine development, leaving the price of any given purchase order undefined.

Investment in intangible assets that is not amenable to costing methodologies includes computerized information (software and databases); innovative property (R&D, patents, copyrights, product designs, trademarks); and economic competences (training, branding, business processes, supply chains, company culture). Intangible investments require real dollar outlays, but their precise contributions to sources of revenue are unclear. As innovation has taken preeminence over repetitive production, the importance of intangibles has only increased.[11]

Accounting scholars Baruch Lev and Feng Gu found that the value of tangible assets and earnings explained more than 80% of companies' value when entering the stock

market from 1950 to 1959, whereas the figure over the period 2000 to 2013 plummeted to just over 20%.[12] More recently, EverEdge Investments estimated that 87% of companies' value is found in intangibles.[13] The shift to intangibles explains how WhatsApp, a company with a few dozen employees and $10 million in revenues, could be bought for $22 billion,[14] or why the most important aspects of financial reporting for pharmaceutical companies aren't their income statement or balance sheet, but movement of their product pipeline through regulations.[15]

DOD pricing and reimbursement policies disincentivize firms from investing in intangible capital and instead focus on direct charging of labor hours and materials. As a result, the price of goods and services bought by the government increases relative to average prices in the economy where firms are able to make the investments. For example, between 1994 and 1999, aviation spare parts prices managed by the U.S. Navy grew at an annual rate of 12%.[16] Over the same period, producer prices for civilian aircraft parts and equipment grew at just 2%.[17] Similarly, the Congressional Budget Office estimated that the cost per flying hour for defense aircraft has grown between 5% and 9% each year.[18] By comparison, airline fares paid by civilians have grown at just 1.5% over the same period between 1999 and 2016.[19]

"An Uncomfortable Place to Work"

In DOD, the prevailing view is that a product's price is ultimately equal to the input costs plus a fair profit up to 15%. Clearly, input costs should be irrelevant to the buyer. Most people wouldn't pay $100,000 for a Toyota sedan even if they had detailed cost accounting data to support it. Yet they can only make the decision if a comparable Honda exists at a quarter the price. A buyer arrives at a product's value through his or her own valuation of foregone alternatives, or the opportunity cost. As the Defense Contract Management Agency's Commercial Item Group wrote in a white paper: "When deciding what a fair price is, it is important to think about the alternatives."[20]

One problem is that today's commercial items are less likely to be commodities of standard attributes. Alternative products are differentiated, such as Apple and Dell laptops or Azure and AWS for cloud services. Product differences must be valued and weighed alongside the prices. The problem is compounded for R&D efforts. As Ben McMartin, partner at the Public Spend Forum and a former U.S. Army contracting official, argued on the *Acquisition Talk* podcast[21]:

> You're going to get different solutions with different pricing models. You have to be able to draw analogy and correlation to commercial technologies in order to do pricing.... These things are subjective. Sorry. It's an uncomfortable place to work, but at the end of the day you're making value judgments on whether a technology will prove out, what impact that technology will have, where it will fit into the system, and whether it will transition into the field.[22]

The availability of alternatives provides important context for decision makers, helping align profit with value creation. Recognition of this fact led to the Competition in Contracting Act of 1984 (CICA). Cost-based pricing is not required when there is adequate competition. Yet CICA failed to increase competition because it relied on rigid advertisement and sealed-bid procedures, which presume the purchase of a well-defined commodity. Industry continued consolidating, prices kept rising, and DOD fell back on cost-based pricing.

Even for competitive proposals, the expectation is often that price gets broken down into classes of labor, material, and indirect rates traceable to bases of estimates. The result is a noncompetitive process.

Leveling the Field for Innovation

DOD can shift away from cost-based pricing to help level the playing field for new innovative companies in a number of ways:

- ***Commercial Solutions Openings (CSOs)*** – As Victor Deal explained in July 2020 issue of this magazine, "[a] CSO-type general solicitation advances two core concepts: modular contracting and merit-based decision-making."[23] First, modular contracting lets officials partition program tasks and take advantage of optionality. Second, merit-based decisions allow defense officials to select proposals based on differentiated product and pricing strategies. CSOs promote competition by keeping open an array of sole-source options rather than using advertisement and sealed bid procedures.
- ***Consumption-Based Solutions*** – The Section 809 Panel recommended a new contract pricing

approach for "any combination of hardware/equipment, software, and labor/services that together provide a seamless capability that is metered and billed based on actual usage and predetermined pricing per resource unit."[24] The classic use case is cloud computing billed at a price per hour. Importantly, new features and services can be added to the contract without competing the requirements. Section 884 of the National Defense Authorization Act for Fiscal Year 2021 would create a pilot program for consumption-based solutions.

- ***Mission- or Capability-Based Requirements*** – Commercial contracting procedures will not perform well if contracts are attached to a multiyear process that results in tightly specified requirements. Instead, requirements should define general missions or outcomes. This provides working-level officials the ability to respond to new opportunities and shape requirements through iterative feedback with industry.
- ***Budget Line Item Consolidation*** – Defense officials cannot always predict the best solution two or more years into the future when the program of record is being lined up. Budget line items should be consolidated into portfolios of programs, where tradeoffs and new starts can more easily happen within the year of execution. A logical consolidation pattern is along program executive offices and lab directorates, providing mission-driven organizations the ability to exercise portfolio management.[25]

For DOD to shift away from cost based pricing, it must foster a competitive environment. Competition is not defined by advertisement and sealed-bid procedures alone, but through continuous evaluation and support of sole-source alternatives. Contracting, requirements, and funding all play a part in making DOD an attractive buyer. If the Department cannot shift its practices from tracking cost to fostering competition, it will be left on its current path toward industrial consolidation and ever-higher prices. **CM**

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https://acquisitiontalk.comhttps://acquisitiontalk.com

ENDNOTES

1 Baruch Lev and Feng Gu, *The End of Accounting* (Hoboken, NJ: Wiley, 2016).
2 James F. Nagle, *A History of Government Contracting: Second Edition* (CCH, 2005).
3 J.R. Edwards and W.P. Stephen, *The Routledge Companion to Accounting History* (New York, NY: Routledge, 2009).
4 Hugh Aitkens, *Scientific Management in Action: Taylorism at Watertown Arsenal, 1908-1915* (Princeton, NJ: Princeton University Press, 1960): 196.
5 Robert Anthony, "What should 'cost' mean?" *Harvard Business Review* (May-June 1970).
6 *Ibid.*
7 Robert Kaplan and H. Thomas Johnson, *Relevance Lost: The Rise and Fall of Management Accounting* (Boston, MA: Harvard Business School Press, 1987).
8 *Ibid.*
9 *Ibid.*
10 Hal Varian and Carl Shapiro, *Information Rules: A Strategic Guide to the Network Economy* (Boston, MA: Harvard Business School Press, 1998).
11 Jonathan Haskel and Stian Westlake, *Capitalism Without Capital* (United Kingdom: Princeton University Press, 2017).
12 Lev and Gu, note 1.
13 EverEdge, "The Price Isn't Right: Valuing Intellectual Property and Intangible Assets" (July 12, 2017).
14 Sarah Frier, "Facebook $22 billion WhatsApp Deal Buys $10 million in Sales," *Bloomberg* (October 28, 2014).
15 Lev and Gu, note 1.
16 Government Accountability Office (GAO), "Defense Acquisitions: Prices of Navy Aviation Spare Parts Have Increased," GAO/GAO-01-23 (November 6, 2000).
17 U.S. Bureau of Labor Statistics, Producer Price Index by Industry: Other Aircraft Parts and Equipment Manufacturing [PCU336413336413], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PCU336413336413 (September 29, 2020).
18 Congressional Budget Office, "Operating Costs of Aging Air Force Aircraft" (September 2018).
19 U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: Airline Fares in U.S. City Average [CUSR0000SETG01], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CUSR0000SETG01 (September 28, 2020).
20 DCMA Commercial Item Group, "Evaluating Price; Other Transactions (OTs)," *available at* https://media-exp1.licdn.com/dms/document/C4D1FAQElJc-B3yR6qg/feedshare-document-pdf-analyzed/0?e=1598403600&v=beta&t=CJ-Dl75hoCn9WrcFGC6uTa4dvLq7HYrbS18hMs-FU3s6g.
21 The *Acquisition Talk* podcast is hosted by Eric Lofgren, where he interviews leading experts in the management, technology, and political economy of government acquisition. For more information, visit https://acquisitiontalk.com/podcast/.
22 Ben McMartin, "OTAs and Everything Else with Ben McMartin," *Acquisition Talk* podcast (August 11, 2020), *available at* https://acquisitiontalk.com/2020/08/podcast-otas-and-everything-else-with-ben-mcmartin/.
23 Victor Deal, "What Commercial Solutions Openings Can Be... If We Dare," *Contract Management* Magazine (July 2020). Processes similar to CSOs can be found in broad agency announcements (limited to S&T funding) and other transactions (which are outside the *Federal Acquisition Regulation*).
24 Section 809 Panel, "Report of the Advisory Panel on Streamlining and Codifying Acquisition Regulations, Volume 3 of 3" (January 2019): Recommendation 43.
25 Eric Lofgren, "The DOD Budget Process: The Next Frontier of Acquisition Reform," George Mason University Centre for Government Contracting White Paper #5 (July 29, 2020), *available at* https://business.gmu.edu/images/GovCon/ White_Papers/The_DoD_Budget_Process.pdf.