
Editor's Comments

Probing the Productivity Paradox

While providing some amusement to our detractors, the information technology (IT) productivity paradox has, or should have, generated considerable hand-wringing among information systems (IS) professionals and some erosion of IS credibility in the boardroom. Productivity paradox proponents claim that investments in IT, though massive, have not produced significant improvements in industrial productivity. Or, as one economist quipped, "We see the computers everywhere but in the economic statistics."¹ Among the *MIS Quarterly's* subscribers are many of the world's great prescribers, purveyors, and providers of IT-based business solutions. If the productivity paradox is true, these executives, consultants, vendors, and educators may face a complete overhaul of current approaches to managing IT.

Given the professional standing of our critics² and the momentous implications if they are correct, it is the obligation of every information systems professional to understand the issues that surround the paradox. So armed, each of us must then be prepared and willing to participate knowledgeably in the debate. Fortunately, over the past year, several studies have shined some powerful light into the dark corners of this alleged paradox. These studies permit the kinds of high-visibility charges we have seen in the past to be intelligently confronted. Much of this new evidence has come from the work of Erik Brynjolfsson and colleagues at the Massachusetts Institute of Technology and a study³ commissioned by the U.S. National Research Council, chaired by J. Brian Quinn of Dartmouth College. This blue-ribbon committee's 17 participants included several members of the Society for Information Management, co-sponsor of the *MIS Quarterly*. Among those interviewed were 80 senior executives drawn from 46 top-performing corporations drawn from 10 service industries.

Described below are some of the counter-arguments regarding the productivity paradox. Much of this discussion draws heavily on the Research Council's report as well as the research conducted at MIT—though neither group necessarily subscribes to all the arguments.

It's Only a Problem in Services

Much of the hoopla surrounding the productivity paradox has centered on the high growth services industry. The services sector spent over \$750 billion on information technology hardware in the 1980s and \$862 billion in the past 10 years (representing about 85 percent of total U.S. IT hardware investments). The service industry's investment in information technology in the 1980s was accompanied by an average productivity growth of 0.7 percent, a rate significantly lower than in the 1970s and much below that of the manufacturing sector during the decade of the eighties. That the productivity paradox may only apply to the services sector is further confirmed by productivity data gathered on 380 firms during the 1987 to 1991 timeframe.⁴ This study found returns on investment for both computer capital and for information systems labor spending for this sample of firms to be greater than the return on investment received for other types of capital spending. Based on their data, the authors claim that "the 'productivity paradox' disappeared by 1991, at least in our sample of firms."

¹ Attributed to Robert Solow in "Computer and Dynamo: The Modern Productivity Paradox in a Not-Too-Distant Mirror," by Paul A. David, Center for Economic Policy Research, Stanford University, 100 Encina Commons, Stanford, CA 94305, 415-725-1874.

² Two of the more prominent have been Stephen Roach, an analyst with Morgan Stanley and Company, and Lester Thurow, former Dean of the Sloan School at the Massachusetts Institute of Technology.

³ National Research Council (NRC) Committee to Study the Impact of Information Technology on the Performance of Service Activities, "Information Technology in the Service Sector," National Academy Press, 1994, 2101 Constitution Avenue, N.W., Washington, DC, 20418.

⁴ Brynjolfsson, E. and Hitt, L. "Information Systems Spending Productive? New Evidence and New Results," Proceedings of the International Conference on Information Systems, Orlando, Florida, December 5-8, 1993, p. 47-64.

Since the bulk of these firms were in manufacturing, the study did not eliminate the possibility of a productivity paradox for the services sector. Steven Roach, a long-time believer in the paradox, claims that the service sector in the 1980s, unlike the manufacturing sector, was shielded both by regulation and lack of foreign competition. According to Roach, service sector managers in such an environment became complacent and unwise in their investments in information technology. Furthermore, Roach believes that the development of a high-cost IT infrastructure transformed the service sector's cost structure from one dominated by variable labor costs to one that is increasingly made less flexible by an increase in IT-related fixed costs.⁵

Manufacturing versus Services Is a Misleading Dichotomy

In fact, however, the line dividing the manufacturing and service sectors is a fuzzy one. Manufacturers increasingly elect to outsource many of their services, thus pushing less productive activities outside of their own organizations. Service industries, on the other hand, provide products that can significantly improve the productivity of their customers, while not necessarily generating internal productivity improvements. A consulting firm, for instance, may operate relatively inefficiently but produce very strong positive outcomes for thankful customers. Similarly, "designing for manufacturability" can produce impressive productivity gains among blue-collar workers that should easily make up for less impressive gains among the white-collar workers who collaborate, perhaps inefficiently, in producing those new designs.

The Measures Are Faulty

In an early productivity paradox counter-attack,⁶ Ray Panko provided *MIS Quarterly* readers with compelling evidence of the weaknesses in the economy-wide productivity data produced by the U.S. Bureau of Labor Statistics (BLS). BLS data is often relied upon by paradox supporters. U.S. government productivity data are not available for 58 percent of service industries and are highly suspect in others. For instance, in education, health care, government, and some areas of financial services the ratio of output units to input units, a traditional measure of productivity, is set arbitrarily to one.⁷ In service industries that are not characterized by severe measurement errors and where IT spending was high, Panko reports that, "significant productivity growth has been seen."⁸

They're Comparing Apples and Oranges

Another argument damaging to the productivity paradox adherents is that they are comparing incomparable services. Prior to the use of computers most transactions were very simple indeed. For instance, a call to report an emergency was handled much like any other phone call—with long delays that 911-like emergency phone service, computer-aided dispatch, and emergency vehicle location systems have thankfully reduced. Similarly, a supplier's order entry system that is able to automatically replenish a retailer's depleting shelves based on scanner data is a far different system than an order entry system of the 1970s. Such transactions, even if not handled any more productively than in the past, presumably offer a much richer service "with greater quality, convenience, reliability, timeliness, safety, flexibility, and variety."⁹

Productivity May Not Mean Profitability

Productivity data is often calculated by dividing hours worked into some standard measure of output expressed, for instance, deflated sales or profits. But, in industries such as transportation, deregulation

⁵ NRC, p. 26.

⁶ Panko, R. "Is Office Productivity Stagnant," *MIS Quarterly* (15:2), June 1991, pp. 191-204.

⁷ NRC, p. 5.

⁸ Panko, p. 200.

⁹ NRC, p. 6.

and competition have shrunk profit margins, even as technological advancements have given customers more comprehensive, reliable, and higher-quality service. Productivity may be up, but not if measured based on profitability.

It Was Too Soon to Tell

This argument has three variations. One view is that much of the evidence used to argue for the productivity paradox is old. Thus, in the 70s and 80s investments in information technology were small—perhaps averaging 1 percent of revenues for most firms—and therefore too negligible to produce a measurable productivity improvement in data that is inherently noisy. According to this argument, as information technology spending increases and as studies begin to use more recent data, an effect will be seen. Brynjolfsson and Hitt found that IT was a contributor to productivity in data from 1987-1991, while previous studies using older data had not shown such an impact on productivity.¹⁰

The second variation on this theme is that management, particularly in white-collar organizations, is reluctant to capture productivity gains by laying people off until economic circumstances make it impossible to avoid. Thus, the recent recession in the U.S. resulted in a great deal of downsizing and restructuring, much of which may have been made possible by previously uncaptured improvements in productivity produced by past investments in IT. *The Wall Street Journal* (March 1993), long a popular outlet for productivity paradox proponents, reported unsubstantiated estimates that IT-driven reengineering could “wipe out as many as 25 million jobs” in the U.S.¹¹ IT, historically a whipping boy for its alleged unimpressive impact on productivity, overnight had become a job-eating ogre.

The third variation on the “it was too soon to tell” argument is that the learning curve for a general purpose industrial tool such as IT may be much longer than we anticipated. Economist Paul David, for instance, draws a marvelous analogy between the computer industry of the last 30 years and a similar period paralleling the development and diffusion of the electric dynamo in the early 1900s.¹² He sees many parallels, including the evolution of both technologies as they proceed through several generations of false starts and refinement. However, the long-run productivity impacts of the development of the computer, like the dynamo, should be so impressive as to easily make up for the general purpose technology's failure to meet productivity expectations during the early years of its existence.

It's Not IT's Fault

It could be that unexpectedly small gains in service sector productivity have been caused by the adverse impact of other factors of production, factors that the relatively small percentage of revenues spent on IT could not compensate for no matter how successful those investments. For instance, the poor productivity data for the 1980s could be attributed to failures in the U.S. education system or inadequate investments in employee training or in other technologies. Others speculate that, without the stimulus of another world war, productivity was destined to taper off after the expansion accompanying the post-war recovery.

We Wouldn't Do Without It

In most industries it is difficult to imagine operating without IT. From their homes travelers can make complex travel reservations including vegetarian meals, a non-smoking room, and a mid-sized convertible rental car. Bank customers draw money from their bank accounts at any time of the day from automated teller machines located around the world. Doctors, using video conferencing facilities, supervise

¹⁰ Brynjolfsson and Hitt, p. 59.

¹¹ Ehrbar, A. “Re-Engineering Gives Firms New Efficiency, Workers on the Pink Slip,” *Wall Street Journal*, March 16, 1993.

¹² David, P.A. “Computer and Dynamo: The Modern Productivity Paradox in a Not-Too-Distant Mirror,” Center for Economic Policy Research, Stanford University, 100 Encina Commons, Stanford, CA 94305, 415-725-1874.

complex medical procedures as they are carried out in far away rural locations. Invisible electronic hands replace store merchandise that customers have pulled only hours before from store shelves. Information technology has improved the quality of all of our lives in ways that few would be willing to sacrifice.

We're Asking the Wrong Question

According to the National Research Council, the issue is not one of measuring productivity within the service sector. Instead, it is "understanding the impact of IT on the overall performance of service activities." There is surely ample room for improvement and for greater management attention to IT investments. The NRC committee recommends that management focus on IT projects offering short-term payoffs with well-defined goals that are targeted toward a long-term strategic plan. And, for their part, "top management must understand this strategy, be deeply involved in its generation, and be committed to its implementation if the strategy is to have company-wide significance and transcend divisional boundaries."¹³

The evidence suggests that it is now up to the productivity paradox adherents to refile their briefs. Perhaps they can prove their case, but it will require more valid measures. Hopefully, they will face both a more discerning jury and a more knowledgeable and proactive defense. But, the lesson of the productivity paradox debacle must not be lost on information systems professionals. An "IT is Productivity Bust" headline, like "Man Bites Dog," captures the attention of the business press far more readily than will its predictable opposite. Our profession's obsession with "what will be" leaves us vulnerable to critics who pick through the remnants of a past that we have tended to ignore.

There have been far too few studies investigating the net gains from investments in IT at the level of society or industry, perhaps partially attributable, in the U.S. at least, to inadequate labor statistics to support such research. At the level of the firm or individual computer application, management tends to focus on justifying future applications of information technology rather than attempting to confirm the financial promises made in support of past investments. A careful look backwards now and then might shed some helpful light on information technology management's credibility within the firm. Similar retrospective analysis will be essential as we continue to wrestle with another important economic issue currently confronting IT management—the outsourcing of information systems. Required are studies that provide the quality of underlying scholarship that is too often missing from the appealing reports common in the general business and information systems press. We hope to see more economic analysis in such key areas of IS management in future issues of the *Quarterly*.

* * * * *

I have two happy announcements. The first is the appointment of three new members to our editorial board. These are Cynthia Beath of Southern Methodist University, Julie Kendall of Rutgers University, and Bob Zmud of Florida State University. All three have served as reviewers for the *Quarterly* for many years and were chosen, as usual, because of the value-adding quality of their reviews as well as their many other contributions to our field. Bob Zmud has served previously on the *MISQ* board and is the research director for the Advanced Practices Council (APC) of SIM, International. The APC is actively involved in sponsoring information systems management research. Those interested in learning more about the APC can contact Bob at bzmud@cob.fsu.edu.

The second announcement is the name of the winner of our newly instituted *MIS Quarterly* best paper award. The winner for Volume 17 (1993) is Wanda J. Orlikowski for her paper, "CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development" (September, 1993, p.309). Wanda is a member of our editorial board and on the faculty at the Massachusetts Institute of Technology.

I appreciate the assistance of board members Izak Benbasat and Michael Ginzberg, who, along with former board member Margrethe Olson of the DMR Group in Australia, assisted the selection committee chair, Bob Zmud, in making the final selection from a set of papers nominated by the senior editors.

—Blake Ives

¹³ NRC, p. 19.