

Beyond the productivity paradox: New views on the value of information technology



Thought Leadership

Introduction

“The productivity growth seen in recent years likely represents the benefits of the ongoing diffusion and implementation of a succession of technological advances.”

—Alan Greenspan, chairman, U.S. Federal Reserve, June 1999¹

For more than 25 years, economists, financial analysts and business leaders have debated the bottom-line impact of information technology. Initially, the focus was limited to productivity. More recently, the debate has shifted—centering around whether information technology can produce sustained competitive advantage.

In 1997, IBM launched a groundbreaking, three-year study probing the issue of information technology value. The results to date support an emerging consensus that technology is indeed driving increased productivity—even if those results aren't readily apparent in national labor statistics—and contributing significantly to corporate profits. What's more, the study is demonstrating how information technology can help companies leverage process innovations and create compelling value for customers.





The origins of the productivity paradox

The debate over the value of information technology was born when the high expectations for rapid computerization failed to materialize in national productivity statistics. From 1965 to 1995, per-worker spending for information technology steadily increased among the major industrial nations and across all developed countries. These investments accompanied continuous and dramatic price/performance improvements in information technology. At the same time, the rate of growth for labor productivity steadily declined, from an average of 4.5 percent in 1965 to 1.25 percent in 1995, reaching a low of 1.1 percent by 1997.

Hence the so-called productivity paradox: If technology promises to improve productivity, and spending in that regard is on the rise, why has labor productivity continued to decline?

A number of well-known and widely published economists concluded that there is no relationship between spending on information technology and productivity. “The productivity gains of the Information Age are just a myth,” said Stephen Roach, chief economist for Morgan Stanley.² “Is there a productivity paradox?” asked Paul Strassman, an author and former CIO of the U.S. Department of Defense and Xerox® Corporation. “The fact is, there is no correlation between computer spending and profitability.”³

On the other side of the debate is a growing number of economists, academics and business executives—including Chairman Alan Greenspan and a majority of the members of the U.S. Federal Reserve Board—who believe that productivity growth has taken a long-term leap, thanks to information technology.⁴ As for the productivity paradox, the experts offer numerous possible explanations.

- **Measurement (or “mis-measurement”) of economic output.** The economic measurements of the Industrial Age were designed to capture the production of tangible, highly quantifiable output—cars, rolled steel, even computer chips. But in the Information Age, output focuses more on intangible, intellectual assets, which existing metrics fail to capture. Workers who produce intangible goods such as information now make up nearly 70 percent of the workforce in the G-5 countries (France, Germany, Japan, United Kingdom and United States)—almost a complete reversal from 30 years ago. The validity of the mis-measurement argument was underscored in March 1999 when the U.S. Bureau of Labor Statistics confirmed that its measurement tools understate productivity growth, especially in service industries.⁵
- **Diffusion.** A new technology must reach critical mass before its effect can be fully recognized. For instance, it took approximately 50 years for the impact of electricity to be felt and measured on a national scale. Even within the U.S., the most technically advanced of the G-5 countries, information technology has yet to achieve critical mass. Until information technology is available to approximately 70 percent of a given society, the diffusion argument states, its full impact will be difficult to gauge.
- **Poor management.** This argument maintains that information technology has never been managed effectively to produce business returns. The value of information technology cannot be clearly recognized and measured until companies learn how to strategically apply technology to business processes and to assess the results in terms of defined business goals.



The search for answers: IBM investigates information technology value

The debate over the productivity paradox raises a legitimate question for IBM and our customers: How can organizations assess the return on their information technology investments? To address this question, IBM initiated a broad-based study of information technology value, working in partnership with researchers at the University of California-Irvine (UC-Irvine), the Massachusetts Institute of Technology (MIT) Sloan School of Management, and the Economist Intelligence Unit (EIU), the research arm of *The Economist* magazine. This study—the most comprehensive ever conducted on this topic—focuses on the following key questions:

Is there a correlation between information technology investments and national economic performance? Researchers at UC-Irvine have assembled a global database, the first of its kind, to evaluate the impact of information technology spending among 34 countries over a 10-year period (1985 to 1995). These countries generate approximately 80 percent of the world's gross domestic product (GDP).

Are there identifiable returns on information technology investment at the corporate level? How are they achieved? Two separate analyses addressed these questions: Eric Brynjolfsson of MIT examined information technology investments and productivity at 350 companies from 1988 to 1992. UC-Irvine researchers also developed and analyzed a database of the Fortune 1000 from 1987 to 1996.

How do senior business executives view the value and benefits of technology? The EIU surveyed more than 300 CEOs, COOs and CFOs across North America, Europe and Asia to understand how these executives view the value of information technology and how they identify where information technology has an impact in their organizations.



Laying the productivity paradox to rest

The IBM-sponsored study, now two-thirds complete, has uncovered a strong, positive correlation among technology investment, productivity and economic performance. What's more, growing numbers of senior executives—not just information technology executives—are coming to recognize the bottom-line impact of information technology and the strategic value it can contribute. Our key findings indicate that:

Information technology contributes significantly to national economic performance.

In stark contrast to the statistics that gave rise to the productivity paradox, our analysis shows that information technology investments in developed countries contribute on average *35 percent* to GDP growth and *50 percent* to labor productivity growth.

In the U.S., for example, 1997 labor productivity growth was a scant 1.1 percent. Yet our analysis attributes 55 percent of that growth to contributions from information technology. This indicates that the stagnation in labor productivity over the past few decades has been caused not by information technology, but by other economic factors.

A second and more important finding at the national level confirms what many economists have long suspected: that information technology investments have an increasing, and possibly accelerating, impact over time. Between 1985 and 1993 (the latest year for which data are available), the contribution of information technology capital investments to GDP steadily increased. During the same period, contributions from other capital (not technology) steadily declined, while labor's contribution to GDP remained relatively flat. It is expected that this trend will continue into the near future.

These findings suggest policy directions for both developed and developing countries. For example, countries that reduce import tariffs can make it easier and cheaper for people to acquire and use information technology. Similarly, nations can employ investment tax credits and other mechanisms to encourage the use of information technology. National programs promoting information technology in Singapore, Ireland and Malaysia are producing positive economic returns.

Some companies achieve greater returns from information technology than others.

Overall, our research demonstrated a positive relationship between an organization's information technology stock and the productivity of its workforce. But there is wide variance among individual firms, both in their levels of information technology investment and in employee productivity.

In examining the reasons for the variance, we learned that simply deploying information technologies is not the sole determining factor. A number of other factors influence a company's return on its information technology investment, including:

How the organization manages its technology investments. Companies that effectively managed their information technology investments realized a 1-percent increase in value-add for every 10-percent increase in their information technology installed base. Value-add is defined as sales minus cost of material—in other words, the true contribution that information technology

is making to the company's products. Furthermore, our study associated these economic returns with specific management practices that other companies can emulate. For example, companies that focused information technology on external customers, business process transformation or organizational learning realized higher levels of productivity and profitability.

Focusing technology on gaining competitive advantage. The more successful companies strategically deployed information technology to enable new business opportunities and create additional revenue streams. At the same time, they concentrated on adjusting worker skills and allowing employees to fully exploit the technologies. On average, these companies achieved a 68-percent rate of return on investment—that is, \$1.68 for every U.S. dollar invested in information technology. This number is surprisingly high, far exceeding the impact of non-technology capital or labor.

A base infrastructure that supports future growth. An infrastructure that provides flexibility for future business needs is necessary for companies to fully exploit their technology investments. The standardization of technology platforms and applications across the enterprise provides a base that companies can leverage as new applications and advanced technologies become available.

Recognition by senior executives of the potential contribution of information technology. More business leaders recognize the strategic value that information technology can deliver. Consequently, they invest in technology with the expectation of return—a radical departure from the days when technology was viewed solely as a cost of doing business. According to the EIU's global survey, eight of 10 chief executive officers

and non-technical senior managers believe that information technology does a satisfactory to excellent job of increasing productivity. The survey also indicated a growing appreciation of technology's strategic possibilities. As recently as 1995, just 28 percent of CEOs and CFOs considered information technology to be a potential source of competitive advantage for their companies.⁶ Today, upwards of 61 percent of senior executives in the EIU survey said that information technology can improve competitiveness by expanding market reach, enhancing customer segmentation strategies, and creating a point of difference for their products and services.



Evaluating information technology investments

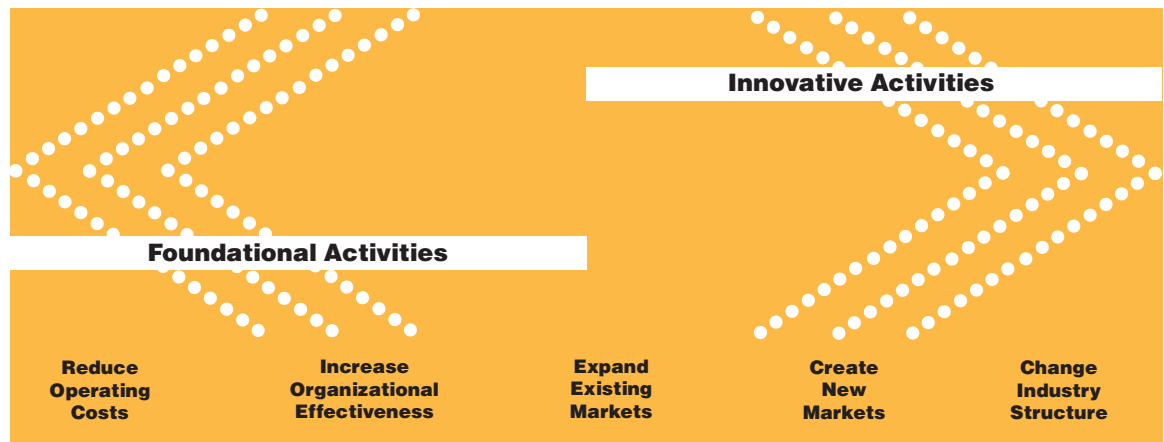
How can business leaders target their technology investments to get the maximum payoff? The answer depends on how information technology is deployed within the organization and the corporate strategy it supports. The findings of the global EIU survey suggest that the contributions of information technology can range across a broad spectrum of value—from foundational to innovative activities.

The *foundational benefits* of information technology include faster processes, lower error rates, lower costs, higher productivity and improved operating effectiveness. At the other end of the spectrum, information technology can also drive *innovative activities*, such as capitalizing on the Internet to reach new markets, using data mining and business intelligence tools to anticipate customer demand, and implementing knowledge management practices across the value chain to capitalize on intellectual assets.

Put simply, the foundational side of the spectrum represents the traditional benefits of information technology, while the innovation side represents the much greater impact that information technology can have when used to expand the reach of a business, create new sources of competitive advantage and change industry dynamics.

In the EIU survey, most senior executives reported that their expenditures were oriented largely toward foundational activities, and the executives were generally satisfied with those efforts. However, their goal over the next three years is for information technology to play a more innovative role across the enterprise. Future information technology investments will attempt to balance foundational benefits—cost controls, cycle times and operational effectiveness—with new initiatives targeted at expanding market presence, creating new channels and improving customer value.

Realizing the Value of Information Technology



(Chart 1)

Senior executives in the EIU survey also understood that different technology initiatives require different methods of evaluation. They indicated that they rely on traditional, quantitative metrics such as return on investment (ROI) and break-even analyses to evaluate the payoff from foundational activities, but that innovative activities demand more qualitative assessments.

Clearly, information technology investments must be viewed in their proper context and assessed with an appropriate set of metrics. Using the wrong metric in the wrong context could lead to incorrect conclusions about the value of information technology and skew future investment decisions. The value spectrum illustrated in Chart 1 can help both technical and non-technical executives clarify what a specific investment is intended to achieve and establish the relevant criteria to evaluate its impact.

For example, a bank may choose to invest in a global network and Java™-based home banking applications that it can deploy quickly in order to reach new customer segments. The institution should view this strategic investment in terms of its ability to expand existing markets. And it should measure returns not only with financial metrics, but also with such gauges as market share, customer satisfaction and strategic alignment with other business initiatives.

Business leaders in any industry can apply the value spectrum to focus on such critical questions as:

- How can information technology capabilities be brought to bear on my company's mission?
- How can my organization optimize information technology to seize marketplace opportunities and create advantage in the networked world?
- How can innovative uses of information technology lead to profitable growth in the new millennium?



About IBM Business Consulting

Obstacles to realizing information technology value

While individual companies may be competing at different points along the value spectrum and taking different approaches to measuring results, they encounter the same obstacles as they seek to deploy information technology for competitive gain. According to the EIU global survey, the roadblocks that most commonly prevent companies from realizing the full potential of their information technology investments include:

- Long lead times and unanticipated delays in implementing new technologies and applications
- Legacy systems that are inflexible and difficult to modify
- Inadequate training and support programs
- The company's inability to keep pace with the rapid advance of technology
- Employees and customers who are reluctant to use new technologies.

IBM consultants partner with clients to develop innovative business solutions that will enable companies to generate strong returns on their technology investments. Our consultants understand that in the e-business environment, business strategy and technology strategy go together. We combine industry-specific experience with renowned IBM technology expertise to help customers do business smarter, faster and more successfully.

Our business consulting practice is part of IBM Global Services, the world's largest business and information technology services provider. IBM Global Services deploys an unmatched breadth of knowledge, experience and capabilities in guiding companies through the transformation to e-business. Our team of 130,000 professionals helps customers around the world better manage their business processes, technologies and other resources.



Summary

Information technology is playing an ever-increasing role in supporting business strategy and transformation, with e-business lending new visibility to technology's strategic role. But information technology must be managed as a critical corporate asset for organizations to enjoy its full benefits. These benefits will be measured not just in terms of traditional financial metrics, but increasingly in terms of competitive advantage and market leadership.

To learn more about how IBM Global Services can help your company realize the maximum potential of your information technology investments and capitalize on the opportunities of e-business, contact your local sales representative, or visit our Web site at www.ibm.com/services.

For specific questions on maximizing returns from information technology, please contact Charles Rieger, Worldwide Principal, IT Value Management, with the IBM Global Services Consulting Group (crriege@us.ibm.com).



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