

A Call for Exploration: Introduction to Special Issue on Frontier Research on Information Systems and Economics

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The most significant technological development confronting managers today is the improvement in the capabilities of information technology. For three decades, the power of computer microprocessors and memory chips has doubled approximately every 18 months, driving down computer prices exponentially. Interestingly, the demand for computer power has proven quite elastic, so businesses have responded by increasing their investments in these technologies, instead of simply pocketing the potential savings from cheaper computer power.

Technological achievements alone, however, do not ensure economic progress. Advances in information technologies can create new options and relax old constraints, but they often require commensurate changes in management practices before they create any value. Hardware represents only a small part of a larger collection of complementary investments, including software, networks and support but also, most importantly, managerial energy aimed at discovering new ways of putting the technology to work.

New managerial insights are emerging not just in the particulars of implementation but also in the rethinking of business processes, firm structure, and, in some cases, even industry boundaries. As a result, computers and communications technologies have gained a central role in shaping the emerging information-based economy. Nonetheless, as the technology continues to advance, the gap between its potential business applications and the reality of management practice has grown. This has created a need for research and curriculum development addressing the managerial impact of information technology.

Rapid technological development is not the only unusual characteristic of information technology. The spe-

cial features of information itself also present an intellectual challenge for those who wish to understand its management. As an economic resource, information can be bought, sold, and managed, somewhat like labor, material, equipment, and structures. However, digital information, which can be processed, transmitted and stored in the form of bits, has some attributes that differentiate it from physical resources that consist of atoms. The costs of reproducing information are typically negligible compared to the initial costs of producing it: a million-dollar software program or video can be copied for a few pennies. Sharing information with a customer or colleague does not necessarily reduce what you can consume yourself—in some cases, information is valuable precisely when it is widely shared, as with standards. While the information economy has much in common with the better-understood industrial economy, working with information forces managers and researchers alike to reexamine many of the heuristics which have successfully guided past practice.

While both the *information* and the *technology* portions of the information technology revolution pose special challenges, the guidance available from traditional academic models has not kept pace. The actual bottleneck lies not in further improving computers and communications, but in our understanding of the economic effects of computers and communications. While businesses are aggressively rethinking their strategies in light of the new realities created by information technologies, academia has been slower to respond.

To help address this gap and consolidate some of the leading research of the community working at the intersection of these expanding areas, we conceived this special issue of *Management Science* devoted to "Frontier Research on Information Systems and Economics." It is

part of a rapidly growing body of research that leverages the *Management Science* approach for analyzing the normative and positive managerial aspects of information technology. This research complements studies dealing with the development of quantitative methodologies for systems analysis and design. It combines the rigor of disciplinary research with the managerial relevance of the information technology revolution.

This special issue presents nine papers that explore four of the central questions on the frontiers of the IS field: How can IT affect the organization of work? What are the productivity implications? How does electronic commerce differ from conventional commerce? How should the information systems function itself be organized? Below, we briefly summarize the papers that speak to each of these major themes.

1. Information Technology and the Coordination of Work

"Information and Organization for Horizontal Multi-market Coordination." The model developed by Krishnan Anand and Haim Mendelson evaluates the effects of three alternative coordination structures on the performance of a firm that faces uncertain demand in multiple, disjointed horizontal markets. Their paper addresses the joint impact of allocating decision rights and consolidating data collected by electronic linkages among the different markets.

"Managing a Distribution Channel under Asymmetric Information with Performance Requirements." Sridhar Moorthy and Ramarao Desiraju study the impact of information asymmetry in an important supply chain—the distribution channel. Their analysis derives conditions under which monitoring retail performance—price or service level or both—makes both the manufacturer and the retailer better off than in a system where there is no performance monitoring.

2. Information Technology and Productivity

"Information Technology Impact on Process Output and Quality." Tridas Mukhopadhyay, Surendra Rajiv, and Kannan Srinivasan use field data from 46 mail-processing centers over three fiscal years to measure

and quantify the impact of new information technologies at the application level. Their research indicates that these technologies had a positive impact on both process output and quality whenever there was a fit between the design of the application and the operational tasks.

"The Substitution of Information Technology for Other Factors of Production: A Firm-Level Analysis." Sanjeev Dewan and Chung-ki Min use five annual surveys for data on information systems spending by several hundred large U.S. corporations. Using production function analysis, they find evidence that information technology capital provides excess return relative to labor inputs and is a net substitute for both ordinary capital and labor.

3. Electronic Commerce

"Reducing Buyer Search Costs: Implications for Electronic Marketplaces." Yannis Bakos explores the role of buyer search costs in markets with differentiated product offerings. His results suggest that electronic market places will often increase price competition to the detriment of sellers and can also result in more demanding customers who are less willing to compromise on their preferred products' attributes.

"Information Technology and Screen-Based Securities Trading: Pricing the Stock and Pricing the Trade." Eric Clemons and Bruce Weber address the unanticipated impact of screen-based trading mechanism for securities. While exchanges' current electronic trading systems may improve price discovery for securities, they strip out information use to price dealing services, which may threaten market intermediaries and even the central markets themselves. The authors use a simulation of exchange operations to explore alternative trading systems that can enable more accurate pricing both for securities and for securities dealing services.

4. The Organization of Information Systems Development

"A Field Study of Scale Economies in Software Maintenance." Rajiv Banker and Sandra Slaughter investigate the influence of project size on software maintenance productivity using data collected from 129 proj-

ects in a large financial institution. They find that software managers do not take advantage of scale economies because of organizational incentives that reflect the opportunity costs of delaying projects to batch them into larger sizes.

"Contracting Structures for Custom Software Development: The Impacts of Informational Rents and Uncertainty on Internal Development and Outsourcing." Eric Wang, Terry Barron, and Abraham Seidmann analyze the unique informational attributes of custom software development projects and discuss the type of agreements that can be reached between users and developers. Their analysis indicates that in many cases uncertainty about the future system value is not a significant factor in choosing between internal and external development but increased uncertainty about development costs tends to push against outsourcing.

"An Economic Analysis of Information Systems Budgets." Vijay Gurbaxani, Kenneth Kraemer, and Nicolas Vitalari collected and analyzed detailed expenditure data from 43 large firms. They focus on how IS managers can increase the efficiency of the provision of information services by exploiting the rapidly decreasing costs of hardware. They find that the labor-capital ratio in the information systems budgets is independent of the overall budget size implying that information systems environments have ever increasing capital-intensity, and that there are no measurable economies of scale in the internal provision of information services.

This collection of papers reflects several innovative styles of research. It incorporates analytic papers, em-

pirical studies, and case-oriented analyses. The growing interest in a "multidisciplinary" research orientation is also reflected as the authors have drawn on a variety of tools from other fields. In part, the variety of research styles reflects a genuine need for multiple distinct perspectives to truly understand the complex phenomena studied. However, in some cases, it simply illustrates the fact that historical taxonomy of management disciplines was defined to fit different set of research challenges from those we face today. On occasion, the categories may need to be updated and revised, just as they sometimes are in other fields.

As researchers, our charter is to find creative ways to advance the frontiers of management. The growing role of information technology in management presents us with a major challenge when we chart the future course of research in this area: how can we producing insights that are relevant to practicing managers and yet still have a lasting value?

The rapid pace of technological innovation seems to suggest that reconciling these goals will become increasingly difficult. However, this view sets up a false dichotomy between rigor and relevance. Rapid change in business practice can also serve to test our theories and accelerate our understanding. Indeed, we believe that strong synergies exist between rigor and relevance: knowledge of how businesses are coping with the new opportunities and challenges—some of which are ingenious and some less-than-ingenious—could ultimately provide as much insight for researchers as applications of research provide for practitioners.