The Information Industries: Introduction to the Special Issue

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In a 1996 special issue of *ISR* on "Information Technology and Organizational Transformation," JoAnne Yates and John VanMaanen noted that Information Technology (IT) has been expected to effect major transformations at every level of organization from the workgroup through the corporation and on to the nation-state. Changes in IT have transformed not only organizations at all levels, but also entire industries. The dramatic decline in the costs of information processing and communications have resulted in the restructuring of business organizations, the nature of the interactions among them, their boundaries—and the industries that they operate in. And of all industries, those that have seen the most change are the Information Industries.

It is only appropriate that the Information Industries are leading the way to the Information Age. They were ahead of most other industries in globalization, innovation, speed, and disaggregation. The introduction of the personal computer in the eighties; the commercialization of the Internet in the nineties; and the ongoing convergence of computing, communications; and content continuously keep these industries in the spotlight and make them natural testbeds for new business models, techniques, and approaches. And while these features make the Information Industries interesting for researchers in many different disciplines, they are of special interest to the *Information Systems Research* community. Because they are subject to a fast rate of change and their products have a high knowledge content, firms in the Information Industries are "lighthouse" users of their own products, and they can provide valuable insights on ways firms in other industries may use IT in the future. Hence this special issue of *Information Systems Research*, which is focused on the Information Industries.

In this special issue, we defined the Information Industries broadly to include computers, telecommunications equipment, and information appliances; packaged software such as operating systems, browsers, and office suites; information services such as consulting, outsourcing, networking, and systems integration; and information content such as multimedia and online databases. It is especially appropriate that this special issue appear in *ISR*, because these industries give rise to the subject matter of the journal and the Information Systems field.

Moreover, the contribution of these industries to the world and U.S. economies is considerable. In 1997, 42% of U.S. capital spending was for IT capital. A 1998 report by the U.S. Department of Commerce estimates that information technology (computer hardware, communications equipment, software and services) accounted for 7.5% of the U.S. economy and 15.8% of GDP growth in 1996. Outside the United States, the Information Industries are a major source of economic output, exports, and jobs in countries like Japan, Taiwan, Singapore, Hong Kong, China, Korea, Ireland, and Israel, thanks mainly to opportunities created in the PC hardware industry beginning in the early 1980s and the Internet in the 1990s. Countries such as India, China, and the Philippines are also finding opportunities in the software industry thanks to their large supply of highly skilled programmers.

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As might be expected, the papers in this Special Issue reflect the diversity of both the Information Industries and the Information Systems community. Nevertheless, the articles share several common elements. All are empirical, theory-driven, and analytical. Some aim to develop new measures, whereas others seek to test theory. Some are highly quantitative, whereas others are more qualitative and interpretative. Together, they illustrate the rich set of opportunities for research on the Information Industries and the range of possible empirical approaches. We hope they will provide models for future research and stimulate others to conduct research on these key industries—and beyond.

One way to classify the papers in this special issue is by their scope of industry coverage. Four of the papers in the Special Issue look at broad cross-sections within the industry. Kraemer and Dedrick apply the "increasing returns" framework to explain patterns of industry evolution across countries and products. Mendelson and Pillai look at a cross-section of firms in different parts of the industry, relating the "clock-speed" (or dynamics of change) of the industry segments to their patterns of IT use and the adoption of organizational focus strategies. Talmor and Wallace examine the structure of executive compensation in the computer industry, finding that some commonly believed myths are misplaced. Poh Kam looks at the evolution of Singapore's Information Industry strategy and the country's choice of industry segments over time.

Three papers focus on issues that arise in specific segments of the industry. Gopal and Sanders perform an international comparison of software piracy rates, showing that government incentives to enact and enforce copyright laws are closely related to the size of the domestic software industry. Parthasarathy and Bhattacherjee study the "churn" phenomenon in the online services industry. Jarvenpaa and Leidner look at a company in the content segment of the Information Industries that transformed itself from a traditional newspaper publisher into an innovative information business.

Another way to classify the papers in the special issue is by their geographical coverage. Gopal and Sanders examine software piracy from a global perspective. Similarly, Kraemer and Dedrick's study of the increasing-decreasing return phenomenon and Mendelson and Pillai's study of the effects of clock-speed are global in scope. Talmor and Wallace study executive compensation in the United States and Parthasarathy and Bhattacherjee use data from a U.S.-based online service. Jarvenpaa and Leidner study a Mexican information services company, and Poh Kam gives a Singaporean perspective on a global phenomenon.

The papers are organized in the special issue based on the research approach they employ, moving from a group of more qualitative articles to the more quantitative ones. The qualitative articles can be placed within the increasing-returns, theoretical framework of Brian Arthur and Paul Romer, and provide richly detailed analyses at the firm, industry, and country levels. Increasing-returns theory indicates that some companies—by virtue of their early-mover status, control over standards, and customer lock-in—come to dominate market segments and enjoy increasing returns whereas others are locked into highly competitive, low-margin segments. Kraemer and Dedrick use this framework to explain how computer production shifted from U.S. companies to East Asian companies and countries, to characterize the results of this shift in terms of increasing- and decreasing-returns market segments and to assess the implications of the shift for the United States and the computer industry. Poh Kam looks at one country in the Asian production network—Singapore—and shows how it achieved remarkable success in a decreasing-returns segment of the industry. Jarvenpaa and Leidner look at information content, an increasing returns market, and show how one company in Mexico overcame limitations of technical infrastructure and culture not only to achieve success generally, but also to achieve dominance in the online information segment of its industry in Mexico.

The first paper, "Globalization and Increasing Returns: Implications for the U.S. Computer Industry," by Kenneth Kraemer and Jason Dedrick is based on historical case studies spanning fifteen years of the computer industry in Japan, Korea, Taiwan, Hong Kong, and Singapore in the context of the forty-year history of the industry in the United States and globally. They introduce the increasing-returns framework, and then use it to explain the development of the Asian

production network, its primary focus on decreasing-returns market segments, and why some Asian companies and countries have been successful in these markets where others have not. The analysis sharply contrasts the computer industries of Korea and Taiwan, Hong Kong and Singapore, and draws a comparison between those industries and those of Japan. The analysis demonstrates how the industry developments in each country have been path-dependent. Kraemer and Dedrick show that Asian computer vendors focus on bulk processing businesses with decreasing returns that supply to—and therefore complement—U.S. companies whose focus is on knowledge-based activities (R&D, design, and marketing and distribution) and market segments with increasing returns (microprocessors, software, outsourcing). They show that, contrary to the views in government policymaking circles, this international division of labor in the computer industry is generally positive for both the United States and its Asian partners.

Wong Poh Kam's "Leveraging the Global Information Revolution for Economic Development: Singapore's Evolving Information Industry Strategy" looks at the twenty-year history of Singapore's IT industry. It shows how a small city-state of only three million people used its resources and capabilities to achieve success in a decreasing-returns market—the disk drive industry—and has leveraged that experience into other market segments. At the dawn of the PC revolution, the Singapore government adopted a strong industrial policy focused on the IT industry, utilized its human capabilities in precision manufacturing, and brought foreign multinationals to manufacture in Singapore. It provided attractive infrastructure, skilled workers, and a stable labor environment that caused even more IT firms to locate there and broadened beyond IT to create a business hub for East Asia. Singapore has continually developed these capabilities to the point where it has not only become the leader in the disk drive industry with over 80 percent of world production, but it is also improving its competitive position well into the next century by building dynamic capabilities. It is moving into increasing-return market segments—both upstream into semiconductors, and downstream into the content industry. Poh Kam's analysis also shows the critical importance of path dependency in technology-based development and how it both limits and enables what countries can achieve.

In "An Information Company in Mexico: Extending the Resource-Based View of the Firm to a Developing Country Context," Sirkka Jarvenpaa and Dorothy Leidner explain how a newspaper company successfully changed itself into an information company to deliver objective, reliable information through multiple channels, including reformed content, innovative media format, and entirely new online information services. They focus on how the company used its resources and capabilities, and further developed these capabilities over time to achieve dominance in an increasing-returns market segment—the information business. Tracing the efforts of the Junco family to develop an information business, they discuss the firm overcame limitations of technical infrastructure and information culture to achieve remarkable success in an essentially hostile environment. Illustrating once again the importance of path dependency, Jarvenpaa and Leidner show how the information company was able to leverage its experience with the technical infrastructure and positive information culture that existed in Monterrey, the home of the company, to overcome the more challenging information culture and problematic infrastructure found in Mexico City and elsewhere in Mexico. This rich case study shows how a company, which focused on an increasing-returns segment of the Information Industries, shaped its environment rather than merely reacted to it, and suggests that other companies in lesser developed countries can do likewise.

The rest of the articles in the special issue employ quantitative techniques, each examining a particular issue in depth. "Understanding Post-Adoption Behavior in the Context of Online Services" by Madhavan Parthasarathy and Anol Bhattacherjee presents one of the first analyses of users who discontinued their online subscriptions. The paper demonstrates that discontinuance is an important phenomenon in the online services industry; its patterns are consistent with the predictions of innovation diffusion theory. It further profiles the characteristics (as of the time of initial adoption) of users who discontinued their service, finding that their sources of influence (external and interpersonal), perceived service attributes (usefulness

and compatibility), their use of the online service, and their use of complementary products can predict discontinuance. The paper also distinguishes between the major sources of discontinuance and identifies differences in post-adoption behavior over time.

In "International Software Piracy: Analysis of Key Issues and Impacts," Ram Gopal and Lawrence Sanders study economic and cultural factors that affect software piracy around the globe. They develop two models to explain variations in the level of software piracy from one country to another—an economic model driven by the incentive structures for consumers, software publishers, and governments; and a behavioral model that focuses on the cultural dimensions of ethical behavior. Their empirical analysis reveals that the software piracy rates within a country are strongly influenced by the size of its domestic software industry: a larger domestic software industry induces the government to enforce piracy deterrents more actively, thus reducing the level of piracy. They find that this relationship holds, regardless of the per capita income levels in different countries. This result suggests that software publishers can reduce piracy levels by promoting the emergence of domestic software industries in other countries—a strategy that has evidently worked well for Microsoft in India. The paper also finds moderate support for a relationship between an index of ethical behavior and the level of software piracy.

"Computer Industry Executives: An Analysis of the New Barons' Compensation" by Eli Talmor and James Wallace is a study of the structure and determinants of executive compensation in the computer industry. The authors conduct an empirical investigation of the factors that influence various components of executive compensation packages, and examine the differences between the computer industry and other industries in the manufacturing and service sectors. They find that CEOs in the computer industry receive a higher level of stock-based compensation than CEOs in other industries (both in dollar terms and as a percentage of total compensation). Conversely, their cash-based compensation is lower than that of their peers in other industries. Their results question several myths about executive compensation in the computer industry: While executive cash compensation is tied to performance, stock-based compensation is not; the prevalent use of stock-based compensation in the computer industry does not appear to be driven by the lack of cash; and the use of stock-based compensation does not lead to increased executive stock ownership, as executives hedge their risk exposure by selling shares they already own.

In the last paper in the special issue, "Clockspeed and Informational Response: Evidence from the Information Technology Industry," Haim Mendelson and Ravindran Pillai explore the relationship between the "clockspeed" of the industry environment and the usage of information technology. They argue that bounded rationality forces firms in high-clockspeed environments to develop "information-focus" strategies to combat information overload. Their empirical analysis confirms that firms respond to higher industry clockspeeds in two distinct ways. First, they increase their communications capacity through the use of information technologies, both within the firm and across firm boundaries. Second, they take actions to reduce the number of information states that decision-makers have to contend with by limiting the number of suppliers, parts, etc., in a systematic manner. These results lend strong support to the information processing view of the firm, which makes the problem of organizational design parallel to the problem of designing computers or networks of processors for efficient and effective information processing. Further, these results close the loop between research on the Information Industries and the Information Systems research agenda, showing how the characteristics of the industry segment (in particular, its clockspeed) affect the demand for IT for firms or business units that operate in it.