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PANEL 12 INFORMATION TECHNOLOGY AND THE PRODUCTIVITY PARADOX

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Panel Chair: **Erik Brynjolfsson**, Harvard University

Panelists: **Robert J. Gordon**, Northwestern University
Gary Loveman, Harvard University
Stephen Roach, Morgan Stanley

INTRODUCTION

Information system theorists have long foreseen that information technology (IT) would have dramatic effects on the production process. Increasingly, we are in a position to measure econometrically some of these effects, for instance, the impact of IT on organizational structure. Perhaps the most fundamental question is the payback to investments in IT: how much do outputs increase as we add more IT inputs?

THE PARADOX

Economists have recently had to take note of the burgeoning IT sector and its impact on industry. IT investments now account for nearly 40 percent of all corporate investment in capital equipment. Furthermore, the computer power available per dollar has increased over a hundred-fold. These trends have enabled vast reductions in the costs of processing information, a task which currently engages over half of the American labor force. Apparently all of the ingredients are in place for a happy ending.

The paradox is that productivity, output per unit input, has fallen sharply just as significant computing power has become available. Information-intensive sectors, such as finance and insurance, have shown some of the most marked slowdowns and, perhaps more worrisome, econometric studies have specifically attributed negligible returns to investments in IT for a cross-section of companies.

AGENDA

The panel will discuss possible explanations for the apparently low performance of IT in boosting productivity. It is hoped that the panel, consisting of economists who have studied issues in information systems, will also prompt a lively discussion of the potential economic techniques have to offer the field.

Among the hypotheses discussed will be that IT is associated with a particularly steep learning curve. To exploit the eventual benefits of the technology, people have to be retrained and factories redesigned. This can lead to productivity slowdowns in the short run but suggests that future gains will be more rapid.

IT is also frequently used to redistribute output, rather than create it, as firms take away customers and profits from each other. Redistribution could also be occurring within firms as managers use the new technology to enhance their own careers or reduce their personal risks. Each of these uses of IT would result in lower productivity.

That IT could result in private gain but social loss at both the industry and firm level suggests that new organizational structures may be necessary to reap the benefits of IT. For instance, unlike tangible products, information, the output of IT, is exceedingly difficult to measure. As a result, current structures may badly misallocate IT investments and usage, dissipating potential gains.

Of course, the measurement problem also affects researchers. Improvements in quality, service, variety and convenience attributable to IT may not be adequately measured in current studies.

Each of the panelists has a unique perspective to contribute to the discussion. Stephen Roach has found that the effect of IT has been particularly disappointing in improving the productivity of "information workers" even as the economy

undergoes a transformation making them the fastest growing category of worker. Gary Loveman has analyzed 60 establishments and provides insight into where IT has lived up to its promise and where it has not. He is currently exploring how intrafirm institutions may affect IT's productivity. Robert Gordon finds that, because of IT's unique effects on both the quality of work life and on the firm's outputs, it is particularly susceptible to measurement problems. His recent intercountry comparisons support this view. Erick Brynjolfsson has found evidence of significant lags in the impacts of IT and is currently applying agency theory to the question of how organizational structures can be affected by lower information costs.

THE BOTTOM LINE

When a company or a country spends 40 percent of its investment dollars on a technology that did not exist a few decades earlier, it cannot help but have a profound effect on the way work gets done. But like the CEO, the researcher must be concerned if this investment does not ultimately lead to improvements in productivity. Only by understanding the potential causes of the apparently low productivity of IT can we know where to concentrate our efforts to improve IT's performance.

PANEL 13

INTEGRATING AI AND MIS

Panel Chair: **Stephen A. Floyd**, University of Alabama, Huntsville

Panelists: **Charles W. Bachman**, Bachman Information Systems, Inc.
John P. Birch, McCormack & Dodge
John P. Gallagher, Duke University
Eliot D. Weinman, Hanover Insurance
John S. Wurts, Symbolics, Inc.

Over the past several years, we have seen AI technologies emerge from research laboratories and universities for application to various industrial problems. Industry is now realizing that such technologies can provide significant productivity improvements and can often lead to competitive advantages. To accomplish such, however, this technology must be carefully and strategically integrated with mainstream corporate computing. As the market place experiences the first wave of AI tools, important questions are being raised. These questions relate to both technological and organizational issues and can be broadly categorized as hardware/software issues, information center issues, and overall organizational issues. Issues representative of those found in each of these categories are provided below.

Hardware/Software Issues

- The role of AI-workstations
- AI languages such as LISP and PROLOG versus procedural and other object-oriented languages
- The role of development shells

Information Center Issues

- Knowledge engineering versus systems analysis
- Centralization versus decentralization of the AI effort
- The relationship between AI and CASE technologies
- AI and end-user computing
- The role of embedded intelligence
- Training MIS personnel and/or hiring expertise
- Applying the technology and/or having an in-house AI R&D effort

Organizational Issues

- AI and strategic planning
- New technology integration strategies
- Capturing corporate knowledge

The panel session will provide attendees an opportunity to interact with those developing and implementing the first-wave of AI technologies. It is our intent to offer a panel session which will help answer the more pressing integration questions and perhaps raise some new ones. It is our hope that such discourse will help to more effectively direct future research and in turn will shape new technologies.

The distinguished group of panel members represents a broad range of experience. Charles Bachman, a Distinguished Fellow of the British Computer Society and a former Turing award recipient, has some thirty years of IS experience. He has earned international respect from industry and academia as an innovator and contributor to the IS field and continues to do pioneering work with cutting-edge technologies. John Birch has over twenty years of IS experience and currently serves as Corporate Vice President and Chief Technical Officer for McCormack & Dodge. John has extensive experience in long-range product R&D and in the application of new technologies. He is a frequent conference speaker on topics relating to the implementation of expert systems applications. John Gallagher, Director of Computing at Duke University's Fuqua School of Business, recently authored the book *Knowledge Based Systems for Business: Integrating Expert Systems and MIS*. His book articulates the issues which will determine the impact of AI