

## **Contributions of ICTs to a Sustainable Information Society: Managerial, Macroeconomic and Environmental Impacts in Japan\***

Toshiya Jitsuzumi, Senior Researcher, ITP  
Hitoshi Mitomo, Dr., Professor, Waseda University  
Hajime Oniki, Ph.D., Professor, Osaka-Gakuin University

Telework and Telecommuting (T/T) is a new style of work that utilizes information and communication technologies (ICTs) and substitutes virtual commuting for physical commuting. As such, it has been expected to enhance workers' quality of life, to increase productivity, and to improve social welfare. All of which raises a question: Why has T/T not become as popular in Japan as in the United States? Although many explanations to this question have been offered thus far, perhaps the most important factor has yet to be taken into consideration: namely, the differing macroeconomic situations of the U.S. and Japan. In an effort to address this research gap, the authors, all of whom had conducted individual research in the T/T field, agreed to extend their research interests to address the overall relationship among ICTs, economies and environmental issues. In April 1999, we began a joint research project on information and communication technologies in Japan (PICTJ) with financing from the Institute for Posts and Telecommunications Policy (ITP).

PICTJ is based on an inter-institutional collaboration among a governmental institute (ITP), a private research firm (Mitsui Knowledge Industry Co., Ltd. [MKI]), and university professors. The project will be conducted under the following three-year schedule:

**In the first year** (fiscal 1999, i.e., April 1999 - March 2000), we carried out a questionnaire survey to collect data on the amount and types of ICT investment made by major Japanese corporations, and on how this investment had affected the efficiency of intra- and inter-corporate activities.

**In the second year** (fiscal 2000), we will conduct a statistical analysis of the questionnaire results intended to determine whether ICTs have yielded significant effects on corporate management. In parallel with this analysis, we will formulate a theoretical model to describe how ICT investment in Japan can affect macroeconomic activities.

**In the third year** (fiscal 2001), we will conduct a cross-sectional econometric analysis on a data set that combines the questionnaire data with corporate financial data (obtained from balance sheets and profit-and-loss statements). The project will conclude with an effort to define some policy implications of ICT activity.

In conducting the research, we need to deal with many difficult issues. One of the biggest challenges is to create an adequate quantitative measure to evaluate the impacts of ICTs and to construct "real" ICT price indices.

When designing our questionnaire, we assumed a certain corporate behavioral model in which a firm would react to an exogenous business environment primarily through strategic investment. Such investment would be expected to confer some competitive advantage on the firm. Competition would drive other firms to follow, so that what was once an advantageous change for a single company becomes a national macro-economic trend, thus creating a feedback effect and initiating another cycle of investment. Given this pattern, we expect that the impact of ICTs will depend on the factors listed in the following paragraph. Our hope is that

---

\* The authors would like to thank Takashi Shitomi, Kosuke Nakano and Osamu Kayasono of MKI, and Yoshiaki Kasai of ITP for their contributions.

the questionnaire data will confirm the validity of our behavioral model and enable us to define the links between ICT investment and the factors below.

- ✓ Macroeconomic context
- ✓ Firm characteristics
- ✓ How exogenous factors are perceived and evaluated by management
- ✓ How management reacts to those exogenous challenges
- ✓ Degrees of market competitiveness and reaction by competitors
- ✓ Regulatory issues

The questionnaire was sent to 3,321 firms during mid-January 2000; approximately 200 responses have been received thus far. Among these firms, 78.9% of all PCs are connected to a LAN environment; also, almost four times as many respondents plan to increase ICT investment as plan to increase non-ICT investment. In addition, the majority of respondents are currently using ICTs for sharing information and streamlining their internal processes. Some 64.8% of firms in service industries consider ICTs a tool to increase customer satisfaction vs. only 38.1% of firms in the manufacturing and construction industries. It is interesting to note that fewer than 14% of respondents thus far stated that they took environmental issues into consideration when making ICT investments; after investment, however, many companies begin to note environmental benefits of ICT investment, especially in terms of its ability to reduce both paper waste and business-related travel.

Due to time constraints, we have not yet completed the data analysis process. Based on our preliminary analysis, however, we would like to present the following findings and implications:

- ✓ Results obtained from the questionnaire confirm a positive attitude among Japanese firms toward the introduction of ICTs and networking technology. In the Japanese business arena, PCs are being increasingly connected to network facilities rather than used as stand-alones, and more firms are continuing to invest relatively more in ICTs than in non-ICT assets.
- ✓ If process innovation is proven to affect employment negatively, at least in the short term, then the greater emphasis on ICT investment for such purposes among manufacturing and construction firms may fail to lead to expected productivity gains, inasmuch as job security remains a central concern of Japanese management. Such behavior may provide some clues to explain why clear macroeconomic evidence for a Japanese "new economy" has yet to appear.
- ✓ The recognition lag concerning ICTs' environmental effects may imply the existence of externalities for ICT investment, which would lead to market failures. As positive externalities would imply a socially insufficient level of ICT investment and negative externalities excessive ICT investment, some degree of policy support may be required, e.g., subsidies supporting the adoption of environmentally-friendly ICTs, at least in the introductory phase of ICT investment. Such support would aid firms to recognize ICTs' external effects and would help society to efficiently attain environmental sustainability.

We must stress that the above conclusions are far from final. Indeed, PICTJ is just getting underway and this report provides one of the very first analyses of the roles of ICT investment in the Japanese economy, using individual sample data. The project will address such issues as the impact of ICT investment on corporate operations and its contribution to environmental issues. After thorough analysis of the data, we will be able to present more substantive findings intended to provide policymakers with a view of the current status of ICT activity in Japan and

of possible future directions for ICT applications. We believe that these preliminary findings, along with the accompanying policy implications, provide an initial analytical basis for understanding the dynamics of the so-called "new economy," including the directions it may evolve and the transforming effects it may have on society and the overall economy. As with any analytical report which examines a phenomenon as young and complex as ICTs, our findings generate as many questions as they answer. These questions, however, form the basis of our future research agenda, which will include a thorough survey of the literature, further data analysis, interviews with corporate managers, construction of theoretical models, and empirical verification.

## References

- Barras, R., 1986. Towards a Theory of Innovation in Services, *Research Policy*, No.15, pp. 161-173.
- Brynjolfsson, E. and Hitt, L., 1997. Computing Productivity: Are Computers Pulling Their Weight? *Working Paper*, September.
- 1998a. Beyond the Productivity Paradox: Computers are the catalyst for bigger changes, *Communications of the ACM*, August.
- 1998b. Information Technology and Organizational Design: Firm-Level Evidence, MIT, *Stanford and Wharton Working Paper*, January.
- Brynjolfsson, E. and Yang, S., 1996. Information Technology and Productivity: A Review of Literature, *Advances in Computers*, vol. 43, pp. 179-214.
- David, P.A., 1989. Computer and Dynamo: The Modern Productivity Paradox in a Not-Too-Distant Mirror, *Working Paper 172*. Center for Economic Policy Research, Stanford University.
- Economic Planning Agency, 1997. *A Study of New Economy: Has productivity really improved?* (written in Japanese), URL: <http://www.epa.go.jp/j-j/doc/1997fc-eco-j-j.html>.
- Ministry of Posts and Telecommunications, 1999. *1999 White Paper - Communications in Japan*.
- Mitomo, H. and Jitsuzumi, T., 1999. Impact of Telecommuting on Mass Transit Congestion: The Tokyo Case, *Telecommunications Policy*, 23, pp. 741-751.
- Mitomo, H. and Oniki, H., 1999. Information Technology for Sustainable Societies - Public Policy Perspectives in Japan: The Case of Telework, *The IPTS Report*, 32, March, pp. 24-31.
- Mizoguchi, T., 1996. *Development of the Information Sector and Hidden Changes in Total Information Output*. In Mizoguchi, T., Kuriyama, T., and Terasaki, Y. (eds.), *The Facts Behind the Corporate Introduction of Information Technology Revealed by Economic Statistics*, (written in Japanese), Fujitsu Books, Tokyo: Fujitsu Institute of Management, pp. 111-129.
- Mizoguchi, T., Kuriyama, T., and Terasaki, Y. (eds.), *The Facts Behind the Corporate Introduction of Information Technology Revealed by Economic Statistics*, (written in Japanese), Fujitsu Books, Tokyo: Fujitsu Institute of Management.
- The Satellite Office Association of Japan, 1997. *Report on the estimated Japanese teleworking population, 1996*, URL: <http://www.egg.or.jp/soajhome/twp96.htm>.