The Impact of Computers on Management

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August 1966

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CHARLES A. MYERS

Introduction

THE COMPUTER revolution in management is not far off, if it is not already here. According to a recent report, in 1955 there were only 10 or 15 computers installed, worth about $30 million. By 1965, the total had reached nearly 31,000, worth $7.8 billion. Projections to 1970 indicate that there will be 60,000 computers in use by that time, to be valued at $18 billion.[1] Therefore, within a few years no business firm will be unaffected by computers, especially with the spread of computer utilities selling services and programs to smaller firms.

The papers in this volume discuss the present and future impact of computers on management organization and the nature of managerial work. With the exception of Dr. Charles R. DeCarlo of IBM, all of the authors are academic scholars who have devoted their research efforts for a number of years

[1] Data from "State of the Information Processing Industry," prepared by C-E-I-R for the American Federation of Information Processing Societies and presented during the Spring Joint Computer Conference in Boston early in May 1966.

to studies of the effects of computers in business organizations. These papers were prepared for a research conference convened by the Industrial Relations Section of the Alfred P. Sloan School of Management at the Massachusetts Institute of Technology on April 29 and 30, 1966. There were a number of other invited participants, and the discussions following each author's oral summary of his paper were tape recorded. These discussions, edited and condensed, follow the respective papers in this book.

Some summary comments by Jay W. Forrester conclude the papers and discussion. Professor Forrester holds the basic patent on the magnetic core memory for information storage and retrieval in the digital computer, and he has pioneered in the development of industrial dynamics, an approach to managerial problems which utilizes computers. Finally, there is an appendix containing a case study by Professor Edgar F. Huse of Boston College on some of the human problems associated with the introduction of a computerized information system in a large integrated manufacturing company. Since the papers deal very little with these human aspects, the case study adds to our knowledge of the problems of implementation of computerized systems. It was completed after the conference but supplements the papers and discussion.

AN INTERDISCIPLINARY CONFERENCE

Although the main research papers were written around the central theme of the conference, they do not cover the same ground or reach similar conclusions about the present and future impact of computers. The authors write from different perspectives and come from different disciplines: industrial relations, economics, psychology, operations research, and accounting and control. In opening the conference, I called attention to the perceptive comments of Herbert A. Simon, who, in discussing which expert to choose, said that the "easiest and commonest way is to accept an expert who

confirms one's present beliefs and prior prejudices." He then added:

> We choose among experts by forcing the experts to disclose how they have reached their conclusions, what reasoning they have employed, what evidence they have relied upon. Having made this disclosure, they have exposed their assumptions and their reasoning to the scrutiny and challenge of other experts. We do not have to be championship boxers to referee a fight. But disclosure serves a second purpose. The expert is seldom an expert about consequences and policy implications . . . When the expert explains how he has reached his conclusions, we generally find that much of his reasoning derives from the same common sense and common knowledge of the world that all of us believe ourselves to possess . . . (so) We are quite prepared to examine and judge for ourselves those tenuous paths of common-sense dialectic that commonly connect a specialized fact with a general consequence in the real world. We can do this if the paths are revealed.[2]

The reader can thus choose his own "expert" from these papers, for they provide him with the authors' assumptions and findings. These assumptions are, in turn, supplemented or challenged by the other experts at the conference in the discussion following each paper. Finally, policy implications are advanced and reviewed both in the discussion and in Jay W. Forrester's concluding comments on the conference discussion.

The first paper by Thomas L. Whisler builds on his long interest in the impact of information technology on management, initially set forth in conjunction with Harold J. Leavitt in an early and widely quoted article[3] and later with George P. Shultz in one of the early conferences on this topic in 1959. His paper begins with some conceptual problems of

[2] Herbert A. Simon, in his introduction to *The Shape of Automation for Men and Management*, New York: Harper & Row, 1965, p. xiii.

[3] Harold J. Leavitt and Thomas L. Whisler, "Management in the 1980's," *Harvard Business Review*, 1958, *36*, No. 6, 41–48.

definition and research and then reports the conclusions of his more recent studies, some of which were made in the insurance industry. George E. Delehanty's paper supplements the Whisler research with a more detailed report of research on the effect of computerization on the organization structure of five life insurance firms. He writes from the perspective of an economist concerned with both the external and internal environmental pressures.

David Klahr and Harold J. Leavitt draw parallels between computer programs, managerial tasks, and organization structures. While they bring in some of their own research and that of others at the Carnegie Institute of Technology, they also speculate on the future possibilities. In a different way, Donald C. Carroll's paper looks ahead to the implications of newer computer developments: on-line, real-time, and time-sharing systems. His research has been conducted at M.I.T.'s Project MAC (an acronym for machine-aided cognition and multiple-access computer).

John Dearden and John A. Beckett bring to the subject separate backgrounds of experience in accounting and financial controls. Dearden has written widely on the impact of computers on various types of control systems, and he has been skeptical of several of the predictions about the effect of the computer on some of these systems. His paper takes sharp issue with the Leavitt–Whisler position and questions whether the profit-center type of organization will be greatly affected by computers, apart from reduced costs of data processing and the availability of more timely information. His provocative paper stimulated considerable discussion at the conference.

Beckett's paper deals with the "total-systems" concept that has become popular in the management literature on computers. He shows that the concept applies more to the operations activities of a business than to the nonoperations or "pre-doing" activities, such as policy formation, the search for alternatives, and the installation of systems. He concludes

that there are different systems for different purposes. After this analysis, he considers the impact of systems on managers working on different tasks and at different levels in the organization. Many illustrations are provided from his research.

Charles R. DeCarlo of IBM takes a more philosophical look at the impact of "technique" (of which the electronic computer is a prime example) on management values. He questions the wisdom of those proponents who seek total and tight controls through computers, because of the adverse effects on the initiative and motivation of people in the organization. He predicts that more tightly centralized or pyramidal organizations will not attract the best people in the future.

In his summary comments on the conference discussion, Jay W. Forrester picks up and develops this same theme. He does not believe that the new computers will dominate organizational structures, and he sees a long-term trend toward organizational forms that will provide more satisfactions to individuals rather than constraints to them. He sees computers being used to make men more effective and more satisfied, rather than being designed to replace them.

POINTS OF AGREEMENT AND DISAGREEMENT

This brief review of the central themes of each of the papers indicates that the conferees generally agreed that computers have affected certain management operations more than others, and that the dividing line is shifting as computer technology and — even more — experience with programming and systems design improve. The more specific questions considered in the papers and in the discussion revealed some further points of agreement and disagreement among the participants. Among these were the following:

1. Are organization structures becoming more centralized as a result of computers?
2. Are these organizational changes a necessary result of

computer technology, or are other factors more important?

3. What is the significance of the centralization of the data-processing, or information-technology, function?
4. How has the nature of managerial work changed? Will it change further as certain types or levels of management work are subject to computer systems?
5. How will higher levels of management be affected?

A discussion of each of these follows.

1. Centralization of organization structures

Whisler's recent research showed that information technology had centralized control in organizations, as measured by the increasing percentage of compensation paid to top echelons of management. Functional areas such as accounting, production, and supply management, where routine tasks are performed under great time pressure, have also been centralized. There was general agreement that management organizational structures dealing with the routine or repetitive tasks have become more centralized under computers. Klahr and Leavitt drew an analogy between computer programs and organization structures: closed-routine programs and organizations are centralized; open-routine or executive programs and organizations tend to be decentralized.

This latter distinction was developed further by other papers and discussants. Delehanty pointed out that in the life-insurance companies he had studied, he found operational centralization as a result of computers, yet the relationship between the home office and the field is still unresolved. It may be that new computer technology will permit more decentralization to the field, with remote access to the central data base. Some operational centralization within the home office may also look like decentralization when viewed from above, if top management has given upper middle-management more responsibility.

Dearden expressed strong doubts that the movement to decentralize into profit centers that has taken place in many large complex businesses has been much affected by computers — or will be. This is because it was the lack of time by top management to make detailed decisions, rather than the lack of information, which was the real reason for decentralization in the first place. He also doubted whether information technology was significantly changing the management-control systems of profit centers. This view generated some opposition in the discussion, principally from those who cited other research evidence or experience. Whisler probably summarized the dissenting view with the statement, "Every time *I* look into a company that has installed computers, I see a change . . . and it's always in the direction of centralization."

2. Is centralization a necessary result of computerization?

While most of the participants agreed that computers have led to more centralized organizations, a number also contended that this was not a necessary result. In his summary comments, Forrester expressed the view, shared by others, that the future pattern of organization structures will be set by social pressures, human values, and long-term trends. He agreed with DeCarlo, who asserted that organizations which use the computer to centralize decisions and to control individuals will fail to attract creative people. As Forrester said, "Organizations that choose the path of centralization at the expense of individual initiative and creativity may not be able to reverse themselves and will probably lose out competitively to more enlightened forms of organization."

In other words, managerial philosophy in the structuring of organizations to use computers may be more important than the technology itself. Indeed, in the area of management controls, the technology may be neutral; top manage-