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ABSTRACT

The impact of computers in organizational management has been the subject of much literature. As such, one can note distinct variations as to impact on different levels of today's management. A linear relation between the future of organizational management and advanced computer technology has been detailed. Parameters such as the human factor, integrated systems or networking, future computer aided manufacturing, and fifth generation computers were the key issues on revolutionizing this same management. It is predicted that human-like robots and thinking machines slowly will eliminate management, wherein organizational structures will be redesigned to suit this revolution.

INTRODUCTION

Virtually no American business is untouched by the computer revolution. Office work is being transformed by word processing, instantaneous data retrieval, and the storage of information with correspondence on disk and tape. Robots, multi-media computer systems, computer related telecommuting, numerical control, and process control affect many workers in the factory. Even firms that formerly hand-process data now deal with automated suppliers and clients. In a most recent survey, in companies with less than 100 employees, 63 percent own computers and 29 percent plan to buy more; and the breakdown of softwares used are: 75% word processing, 70% accounting, and 67% spreadsheets (Holtzinger & Hotch, 1991). And certainly, no one escapes the "clutches" of a computerized Internal Revenue Service.

Today, the impact of computers on business management receives less notice. But, more and more, computers are infiltrating the business world and are dictating the organizational structure of companies. They are replacing humans in decision making as well as production lines.

With the change in technology and its effect, carefully planned management of change is critical to survive. If left to happen, change could destroy us. If well prepared for, change will serve us in our pursuit of success and fulfillment. Management must appreciate that impact of the change evolves over time. They must learn to be realistic in their expectations (Herzog, 1991).

The involvement of computers and the expected impact of information technology on today's management will depend on the growth and availability of affordable yet pragmatic computers. The use of computers for higher production and better service has restructured the modern corporation. Computers are now used as a new tool and competitive weapon. Also, new organizational structures are evolving in order to manage information technology. The vulnerability of management to displacement by computers, the relation of information specialists to management, and computerization problems that managers must resolve are some of the new topics organizational management must face (Hussain & Hussain, 1988).

In this report, the impact of computers on management is reviewed. The future goals of the computer industry and expected revolution of computers in organizational management is discussed in detail. A summary concludes this report. For a better analysis, an Appendix gives three case studies of the effect of computers in industry.

THE IMPACT OF THE COMPUTER IN ORGANIZATIONAL MANAGEMENT

In the mid-1970s, the use of microcomputers in small business was still a dream of the future. By the mid-1980s, thousands of small growing businesses would not know how to operate without microcomputers. After such phenomenal growth and acceptance by the business world, definitions and new theories were introduced to management. Organizations were now defined within an information and decision processing framework, whereby a manager served as nodal information processor and decision maker to achieve certain and definite goals or ideas (Federico, Brun, & McCalla, 1980). The computer has affected organizational management in several areas. Three main areas of interest are described as follows.

Multi-Level Management

The impact of computers on different levels of management has been studied by several researchers (Simon, 1965). Table 1 shows that some management functions have had relatively little impact by introduction of computers (Hussain & Hussain, 1988:565). Kanter (1982) quantified the percent of the impact of computers in different levels of management. Nevertheless, the greatest impact of computer technology on business has been the new opportunities created for managers. Information technology is changing the fundamental nature of industry. It is altering the structure of markets, transforming daily operations from product design responsibility to capitalize on information resources. Hence, it uses the same competitive weapon in order to improve competitive and financial positions.

Table 1. Impact of Computers on Functions of Management

Function	Top Management	Middle Management	Operational Management
Identify areas of improvement	Scant	Scant	Some
Analyze these areas	None	Scant	Some
Develop alternate solutions	Scant	Moderate	Moderate
Evaluate alternate solutions	Scant	Moderate	Moderate
Implement decision	Some	Moderate	Heavy
Job content	Some	Moderate	Major
Job numbers	None	Scant	Moderate

Management Information System

Management Information Systems (MIS) performs as a complex integration of the hardware and software system tool for the managers. The objective of MIS is to supply relevant information in a timely manner to decision making managers. With the rapid changes of the technology and computers, this management tool changes its definition and its direction (Bush & Robbins, 1991).

Management information systems exist to support the decision making process of managers by identifying decision needs and supplying supportive information. It must be noted that information is not information until it makes a difference in some way. Information is used in the decision-making process. Any item that does not call for a decision is not information (Bush & Robbins, 1991).

A system is a collection of component parts that include input, processes, outputs and feedback that are integrated in such a fashion as to achieve the MIS objectives. With the improvements of the MIS software and computer hardware capabilities, the possibilities are becoming endless and left for imaginations of the organizational manager (Bush & Robbins, 1991).

Office Automation

One of the earliest and fastest growing computer applications was in office automation (word processing, spreadsheets, etc.) (Anderson & Dunkelberg, 1987). There were many reasons why management decided to computerize.

1. A computer can save time and money.
2. Computers allow access to up-to-date information.
3. Computers reduce time-consuming payroll calculations.
4. Computers allow managers to ask "what-if" questions.
5. Computerization of inventories can reduce inventories relative to sales volume.
6. Computers can reduce purchases through improved purchasing histories and more accurate order statistics.
7. Computerization of receivables should reduce delinquents, pinpoint bad credit risks, and speed up payment.

As a result of automation, many activities in the office have been computerized. The voice activated computer, or easy entry word processing or management organizer softwares, has eased the pain of writing and recording for tomorrow's managers (Foegen, 1991). Table 2 gives the computer-induced changes in office work (Hussain & Hussain, 1988:564).

Factory Automation

Production/operations management has also been changed by computer technology (Wren, 1987). In Computer-Assisted Design (CAD), designs are produced and tested on a graphics video terminal controlled by a computer or microprocessor. This essentially eliminates the building of a "prototype," thus reducing the "lead" time from product concept to the introduction of the product into manufacturing. In Computer-Assisted Manufacturing (CAM), a manufacturing or materials transfer process can be controlled by a computer program. In Computer-Integrated Manufacturing (CIM), an integrated production line of operations and between machines are controlled and completed by computer programs.

Table 2. Computer-Induced Changes in Office Work

AREA	WITHOUT A COMPUTER	WITH A COMPUTER
Information handling	Typing	Word processing
Memory	Human	Auxiliary memory of computer
Record keeping	Manual filing	Computerized
Calendar	Manual	Automated, with prompts
Written communication	Postal service	Teleprocessing
Estimation	From experience	Through quantitative models
Supervision & control	Manual	Exception reporting
Information retrieval	Manual search/human recall	Computer search/retrieval
Database	Old or current data	Real-time data
Conferences	Attendance (in person)	Teleconferences
Task distribution	Specialization of tasks	Functional/integrated system
Decision making	Judgment, intuition, and experience	Testing alternatives, simulation & planning models
Graphics	Manual drawing	Graphic display; interactive displays

COMPUTER TECHNOLOGY AND ORGANIZATIONAL MANAGEMENT IN THE 1990s

The expectations of the impact of computers on organizational management solely depends on the growth, trend, and advancements of computer technology. The computer industry has several goals for technological advancements in the 1990s (Monday, Sharplin, & Flippo, 1988). Some of the same include but are not limited to:

- Total integration: networking
- Multi-user systems
- Videotext
- Data communications: modems, telecommunications
- Teleconferencing, Telecommuting
- Voice mail or voice recognition and response
- Optical character recognition technology as an input device
- Processing, replication, storage, retrieval, and distribution
- Artificial intelligence: robotics, expert systems
- Program generators, word processing, spreadsheets, database
- Computer graphics: Computer-assisted design, computer-aided manufacturing
- Maintenance of organization computer systems
- New computer architectures, improved human-machine interfaces

Business organization in the future will be a combination of functionally related computerized subsystems and skilled people who will perform work in an integrated organization (Wagoner & Ruprecht, 1984). The information (voice, text, video, etc.) flow within the organization deals with (1) input or creation, (2) processing and replication, (3) storage and retrieval, (4) output/distribution, and (5) archiving and/or destruction. Organization management will be revolutionized by the computer due to several major factors. The partial list of these factors are:

Human Factor

The human elements within future organizations will include an analysis of education, laws, human relations, and ergonomics. A critical objective is to provide a satisfactory man-machine interface with improved productivity while continuing to provide a satisfactory work environment.

Integrated Computer Systems

The technological future includes integrated systems. These systems permit simultaneous functions as well as data (text, data, voice and image) to occur. Office automation systems such as electronic mail and message distribution will be the main organization functions. In businesses of the future, information will be freely accessible to any employee within the necessary security restrictions, thus generating a new issue for organizational management, namely, computer security.

Multi-user systems are expected to be popular in many growing firms (Anderson & Dunkelberg, 1987:305). A multi-user system consists of a powerful microcomputer with a hard disk drive that is connected to one or more terminals. A local area network (LAN) is similar to a multi-user system, but a LAN is a communication system which allows computers and peripherals to share information and equipment with each other. The advantage of sharing is simple—it saves money by requiring less equipment. The airline industry and national retail stores will be the most affected by such systems.

Microcomputers

Growing businesses will rely on the microcomputer, as a multi-user terminal and a personal computer, to improve both personal productivity and overall performance (Anderson & Dunkelberg, 1987:311). Many businesses will either adopt computer technology or be forced out of the marketplace. The use of communication via computer networking will be fairly commonplace, and computers will ease many routine chores to increase productivity. The computer will be used to model various production techniques, thereby leading to fewer expensive and time consuming pilot projects and a faster start-up of projects with a higher probability of success. Microcomputers, therefore, will greatly reduce the time required between the generation of an idea for a product and the introduction of the product in the marketplace. As seen in the Appendix, utilization of personal computers in a mid-sized hospital greatly enhanced the quality of performance in productivity and in public relations (Hsieh, Jan, Hsieh, & Lin, 1987).

In parallel to the above, Frank Werner (1985) predicts that there will be a microcomputer on almost every manager's desk, and foresees three activities in the 1990s: (1) New forms of marketing and selling, whereby entire new industries will emerge to service the growing demand; (2) Written communications will be most applicable for computers; and (3) LANs will be the key intra- and inter-organization communicating via shared resource facilities. The growing business will utilize computers to communicate both with its employees and with the customers.

Future Factory Automation

In future factories, product changeover, the time for making one product to another, will be easier due to computer-assisted design (CAD) and computer assisted manufacturing (CAM) (Wren, 1987:408). Factories will be smaller because machines will be more compact, less space will be needed for inventories, and a larger amount of work can be done by fewer production resources. There will be less people in production operations, but they will be more skilled and better paid. Information will be the key to future production systems. Hence, production function must be more closely connected to the overall goals and strategy of a firm.

Computer embedded products or "smart products" are also being introduced to organizational management (Hussain & Hussain, 1988:571). These products with their embedded microprocessor "sense the environment," compute, make choices, and control specific activities. For example, mass mailing by a "smart postal scale" can determine the exact postage required for weighted package once destination is keyed by an operator or read by an optical scanner.

Fifth Generation of Computers

The first four generations of computers have all shared a single basic design which executes simple instructions in sequence. The Japanese announced an ambitious plan to develop a new fifth-generation computer for the 1990s (Hussain & Hussain, 1988: 549). These computers will run at faster speeds and have increased processing capability, machine intelligence, and enhanced input/output capabilities.

Fifth-generation computers will use intelligent software (software that incorporates artificial intelligence features) to solve complex problems. The building blocks of such software will include the following (Hussain & Hussain, 1988:550):

1. A knowledge base - a body of expert knowledge on a particular subject.
2. Context data - information the system builds up about the situation in which the problem arises.
3. An inference engine - a computer program that provides strategies to draw inferences about and produce solutions to the problem under analysis.
4. A knowledge-based management system - a system to automatically organize, control, update, and retrieve knowledge (both data and rules) stored in memory.

When these building blocks are combined, the result will be a computer able to select an appropriate line of reasoning so as to solve a complex problem. The computer will then search for data relevant to the problem and arrive at a solution. Mrs. Fields Bakery chain is implementing an "expert" computer so that it can guide store managers to plan for daily

cooking activities based on the massive database given to a centralized computer station (Dressler, 1989); and General Motors has introduced "Charlie" (software), an "expert" mechanic to help diagnose the cars at every GM repair center.

Telecommuting and Telecommunications

Due to increase of travel cost, urban traffic congestion, faster level of transactions, higher efficiency, and other major factors such as global marketing and sales, the managers of the 1990s shall rely on the computer industry for new innovative ideas and strategies in the area of telecommunications and multi-media facilities.

With the advancement of the past decade in fiber optics, modems and personal computers, the concept of commuting has been widely accepted by managers. Telecommuting eliminates the time and cost of traveling to the worksite and thus increasing the efficiency and productivity of the workers (Young, 1991).

The increase of the telecommunication basic conversations globally in the past two decades has been increasing. Telephone traffic between U.S.A. and Europe has been 23 percent per year, and U.S.A. and Far East 27 percent per year. Now with reliance of the telecommunications on fax machines, modems, this number should increase. Within the metropolitan areas of cities, the cellular phone systems have exhausted the phone systems and have forced additional area codes within the jurisdictions.

Telecomputers will replace the TV, VCR, game machine, home video editor and all the rest of the gadgets with which the Japanese clobbered the U. S. consumer electronics industry. Compression of millions of data files into small mediums and their transfer through telecomputers shall revolutionize the management information systems (Gilder, 1991).

Apple computer, with a new multi-media computer system called QuickTime, shall integrate sound, video, graphics, and data through the high capacity fiber optics to homes or offices (Gilder, 1991). All the possibilities and variations of the uses of this technology is yet to be seen by tomorrow's managers.

SUMMARY

The impact of the computer in management has been briefly but thoroughly reviewed. Computers as tools and a competitive weapon have been introduced to organizational managers. Office automation using the word processing and manufacturing production using CAD/CAM are only two examples of such an impact. The growth of computer technology has made the selection of the computer hard. Days within the purchase of a computer, it is obsolete. Managers now can have thier computers to be mobile as possible (Holtzinger & Hotch, 1991). Notebooks or laptop computers have made it possible for managers through a telephone line to monitor the activities from any location and at any time (Murphy, 1991).

The goals of the computer industry in the 1990s will guide the direction of computerized organizational management. The expectations of computers to revolutionize organizational functions, management and human factors are noted. Future computer advancements such as integrated systems and multi-user computer systems are acknowledged as the future of automated organizations.

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The elimination of the work forces by highly accurate "smart" products is predicted. Robots are foreseen in the future assembly lines and within routine task positions. The announcement of fifth generation programming and computers as thinking humanoids or "experts" is becoming reality.

The high tech race of the research and development in the computer industries among U.S. and Japan shall have very high effects on the future of management. High Definition Television (HDTV) in conjunction with the multi-media concept can extremely change the shape of management. High Definition Television promises revolutionary change for TV since color was introduced in 1954. Multi-media communication allows the two users to communicate through audio/video facilities and simultaneously send hard copies through printers. A portion of the monitor can be used to show the sample output (McGee, 1991).

In conclusion, given the history of computers in the past decade, organizational management is expected to change in all aspects and dimensions. The highly computer-literate managers of tomorrow must be able to absorb everyday changes in management and functions. Indeed, the word "revolution" will come short of describing the changes in organizational management brought about by computerization of the workplace.

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APPENDIX

CASE STUDY 1—
Office Vision and Computer Mailbox at IBM

The use of computer technology has been assisting the IBM employees to access the company news, and many useful informations (Matthes, 1991). With the help of Office Vision (a three-hour television talk show made daily by IBM for their employees), IBM's electronic mail system and various on-line referencing applications, employees access just about anything from phone numbers of each of their coworkers to personnel policy updates to discounted travel rates and lodging.

Each morning, all IBM employees are exposed to a morning TV program produced by IBM called "IBM Today" through IBM Communication Network channel (ICN). A four-minute newscast shows the new advanced products of IBM. Electronic bulletin boards and other communications are shown on ICN which complements any other printed interdepartmental communication. ICN also transmits encrypted programs to conference sites around the country and allows the senior management to communicate confidentially over its executive network.

IBM strives to use the products that it sells internally such as Office Vision. This represents IBM's continuing commitment to its good and its employees.

CASE STUDY 2—
Mrs. Fields. Betting the Company on PCs

Now the Fieldses have placed PCs at the heart of a risky diversification into a new and potentially more stable business—full service commercial bakeries. They are "betting the company" that the business benefit of their cookie store PC systems can reach beyond chocolate chips and save the corporation.

"We are betting our future that we are going to be able to build a successful bakery chain," said Paul Quinn, Mrs. Fields' vice president of MIS. And "the only reason we got into the bakery business was because we thought our computer systems could get control of it," said Chairman Randy Fields.

The Tandy '286-based PC in each cookie store is the corporate culture at Mrs. Fields. Store managers receive daily direction not from bosses but from PC-based expert systems. The systems do production and labor scheduling and screen job candidates for required skills— "all the things Debbi Fields used to do when she ran her individual store," McFarlan said.

For example, each morning a manager tells the PC what kind of day it is, such as whether it's a rainy weekend or a sunny holiday. Based on historical data, the system then spits out an hour by hour baking schedule. If sales are slow, the system instructs the most vivacious store employee to go outside with samples to woo customers.

While expert systems pass top management's wisdom directly to store managers without middle managers, electronic mail connects executives to stores for frequent communication. Other modules facilitate submission of reports to the company's Park City, Utah, headquarters, nearly eliminating paperwork.

But can a cookie-store technology cut it in the bakery-cafe world, where inventories and consumer tastes are more complex? More importantly, can a cookie cutter culture where PCs are boss pan out in a new company that wasn't baked that way from scratch?

To supplement the cookie software, Mrs. Fields programmers are writing an expert system for bakery-cafe inventory control, and they're bolstering the production-planning rule base to handle soups and sandwiches.

CASE STUDY 3—
Hospital Computerization

The conventional approach to computerization in a large hospital was to establish an internal data processing (DP) department and DP professionals; then, begin to develop computer-based information systems (CBIS). For medium-sized hospitals, however, this approach is doubtful. The limitation of financial resources and the lack of skilled systems professionals force the medium-sized hospital to consider different approaches. A recent paper presented a conceptual framework for the computerization of a medium-sized hospital based upon the viewpoint of top management. Based on the conceptual framework presented, a PC-based application software package was developed, tested, and implemented at Cheng-Ching Hospital in Taiwan.

The hospital's experience of computerization without an internal DP department indicates that a PC-based application software package can be an adequate approach to computerization for a privately-owned medium-sized hospital. The implication and gains of this research can be summarized as follows:

1. The efficiency of information processing activities has been improved.
2. Manpower needed for data processing has been reduced.
3. The complexity of medical care activity can be adequately understood and controlled, allowing the effectiveness and efficiency of hospital management to be improved.
4. It showed that a medium-sized hospital can initiate and conduct computerization in very short time with low cost and without an internal DP department.
5. Hospital information processing can benefit from the advancement of information technology.
6. The privately-owned medium-sized hospital can initiate and conduct computerization without the establishment of an internal DP department.
7. An adequate PC-based package can provide a medium-sized hospital with an opportunity to proceed to a low cost and easily implemented computerized system.