EXCHANGE

BRIGHAM YOUNG UNIVERSITY SCHOOL OF MANAGEMENT

WINTER 1984

GETTING A GRIP ON HIGH TECH

DEAN'S REPORT

This past year has been a time of remarkable development in the School of Management.

We have been holding classes in the new Tanner Building for a year now. The move has been an absolute delight to faculty and students. We clearly have one of the great academic buildings in America, and already several universities have sent teams to examine our facility as they design their buildings. But a building is only part of a school of management's facilities. We're also strengthening our educational tools—especially computers.

We have moved into the computer age in the college. Combined University, college, and departmental funds of nearly $600,000 have been used to equip labs, classrooms, administrative offices, and faculty offices with IBM personal computers and associated software. We are now teaching our own basic computer classes through the Information Management Department.

Several important changes in curriculum illustrate the School's attempts to meet current educational needs. Specifically, we have developed new programs in information management and health care administration (these are described on page 12 of this magazine), and we've created a pilot executive MBA program. The executive MBA offering serves primarily managers from Utah Power and Light in Salt Lake City. Finally, an international management concentration is also being offered by the School.

Our Management Society chapters continue to grow throughout the country. We currently have chapters in Boise, Chicago, Dallas, Denver, Detroit, Houston, Los Angeles, Minneapolis, New York, Omaha, Phoenix, Provo, Salt Lake City, San Antonio, San Jose, San Francisco, Seattle, and Washington, D.C. New chapters are being formed in the Oakland area and in St. Louis. All alumni and friends of the School of Management are invited to participate in the activities of these chapters.

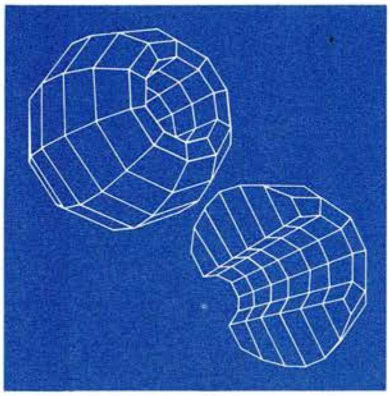
Finally, we have been blessed with several major financial gifts this year. Harold Silver, a Denver inventor and businessman, provided funding for a chair in finance and management as well as a support fund for students studying these subjects. We deeply appreciate all contributions, large and small, from our friends.

The goal of our college is to continue its growth as a school of national and international scope and recognition and to continue to train the next generation of leader/managers for the Church and society.

William G. Dyer

CONTENTS

BRIGHAM YOUNG UNIVERSITY SCHOOL OF MANAGEMENT WINTER 1984



ARTICLES

COMMENT

EDITOR'S CORNER

Many of us have a love-hate relationship with so-called high tech. We appreciate the convenience of computerized information processing, the precision of computer-aided design and manufacturing, and the thrill of the chase in a good game of Pac Man or Dig-Dug. But most of us are more than a little apprehensive of the seeming avalanche of high tech rumbling down onto our daily lives.

A recent letter in the BYU student newspaper expressed some of the anxieties well:

> So high technology has plopped down in our laps to stay awhile. We might as well get comfortable with it, or so the experts say. BYU students were told last week that those who don't keep pace with computer technology will be intellectually dead in seven years.
>
> Okay, okay. I can accept that. I've even made moderate strides to comply wih these doom-saying dictums. Yes, I have cozied up to the computer terminal. I have learned how to read a computer-generated financial report. I can enter data and print it out. I have learned to perform most word-processing functions, change a daisywheel, flip a floppy disk and even replace a circuit board on a system.
>
> Yet this only scratches the surface. The burden of technological expectations lies heavily upon the spirit, casting a pall on what is otherwise a bright future.
>
> Some of our hearts have not yet turned into silicon. We cannot fully embrace the high-tech changes in our lives without a few adjustment pains.
>
> With the proliferation of home computers, my genuine empathy lies with laymen who are forced to develop at least a working familiarity with things computorial. I feel particularly tender-hearted toward those of us over 30 who remember what the world was like B.C.—Before Computers.
>
> Even ownership of two plebian manifestations of integrated circuitry—the video game and cable television—can prove frustrating. A mire of wire puddles around the TV set. Sorting out this megalomanic mangle sets the mind musing over the bygone era when a television had but one protruding cord.
>
> Remember the Underwood? This is a little like saying, "Remember the Alamo." It is somehow disheartening to realize that incoming freshmen may have never seen this writer's workhorse. T. H. Watkins recently called it "a thing of steel and sinew, a miracle of sturdy contrivance, a paragon of the purely mechanical arts . . . the sort of machine that can be hurled bodily across the room, then be picked up and put back to work again."
>
> Yet, longing after days gone by is a romantic activity not altogether consonant with the new information age. It's just that it takes some getting used to.

Indeed, high tech does take some getting used to. We've devoted this issue of *Exchange* to examining high tech as it affects all of us. We hope you'll find the articles informative and thought-provoking. As always, we invite your comments.

Paul R. Timm, Ph.D.
Editor

Publisher: William G. Dyer
Editor: Paul R. Timm
Editorial Assistant: JoEllen Dalton
Copy Editor: Byron Bronk
Art Director: Brent D. Burch

Published by the School of Management, Brigham Young University, Provo, Utah.

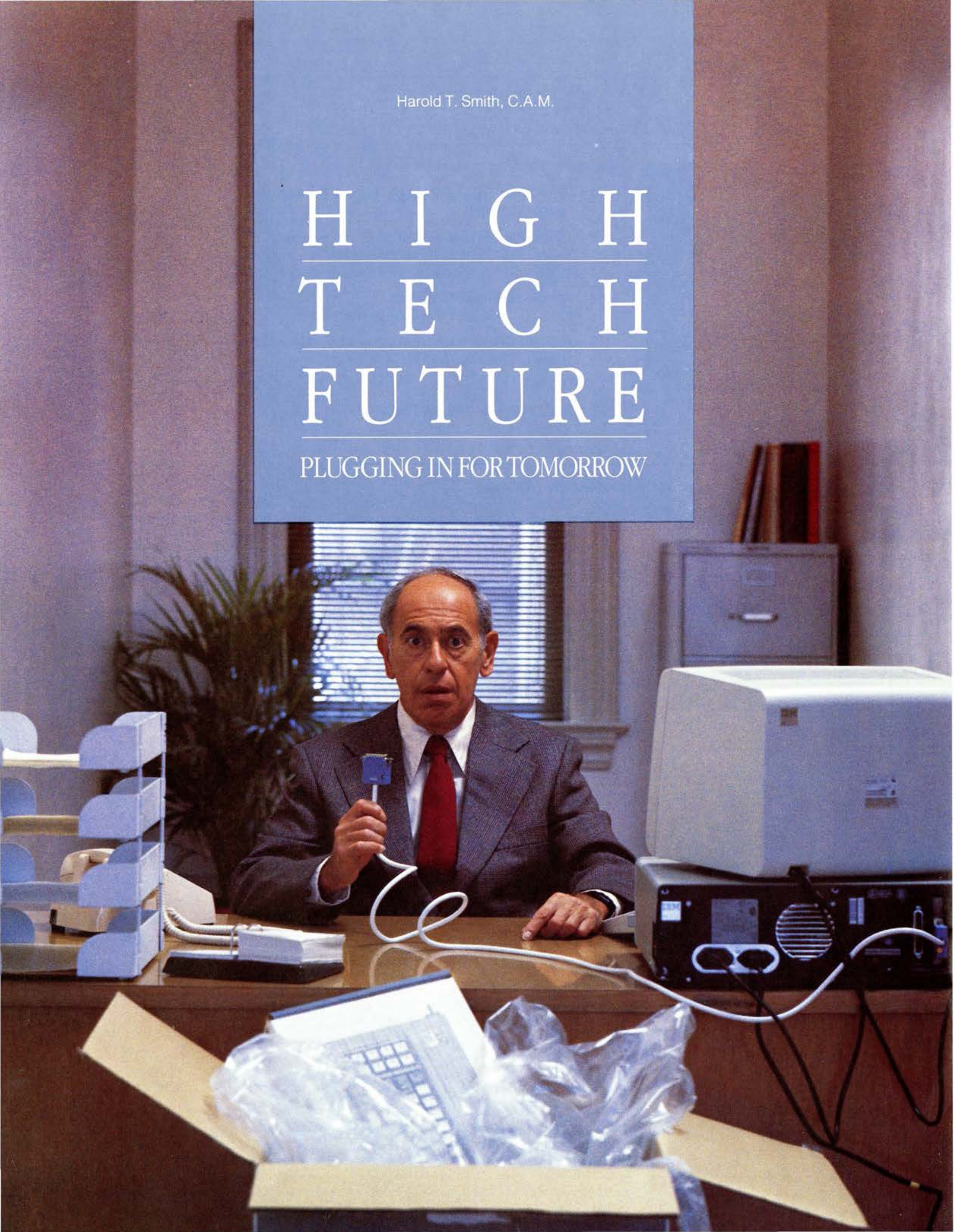
All communications should be sent to *Exchange,* 730 Tanner Building, Brigham Young University, Provo, Utah 84602. Telephone (801) 378-4121.

Cover photography by W. Mike Nielson, Thomas Pratt, and Brent Burch.

Harold T. Smith, C.A.M.

HIGH TECH FUTURE

PLUGGING IN FOR TOMORROW



The important thing to predict is not the automobile, but the parking problem; not the television, but the soap opera; not income tax, but the expense account; not the bomb, but the arms race.

—Isaac Asimov

We need to forecast not what new technology will be developed, but what will happen to people because of the technology. What changes in people's activities, values, cultural rituals, social processes, and learning patterns will spring from changes in communications? What opportunities will the Information Age offer for solving some of the grave problems that the world now faces?

—World Future Society

Two Scenarios of the Office of 1990

You are a recently appointed information manager for a major national company. You have just returned from a meeting of the company's executive committee. The chief executive officer has told you that the committee wants a forecast of what the offices of the company will be like in 1990 and beyond. The committee wants to prepare now to revamp office systems to take advantage of the new automated technologies of the Information Age.

Your assignment seems simple—all you have to do is estimate what your company's offices will be like seven to fifteen years from now. Yet you know that predicting the future that far in advance could be downright dangerous, given the accelerating rate of change taking place today. As you meditate over this problem, your eyes get heavy and you doze off.

In your dream, you wake up to a strange world. Like Rip Van Winkle, everything looks different—nothing is the same as you remember it. You are reclining in a very comfortable chair—you feel warm and cozy. As you rise to a sitting position, your chair also rises and easily molds itself to your new body position.

You notice a button on the table in front of you. You hesitate and then press the button. A visual display screen appears in front of you and lists several items: current events, world stock markets, messages, calendar, activities, and selected vital information.

"Maybe I should catch up on my current events," you say, and the last two words trigger a display of live events that are happening around the world. At the end of the display, an announcer states, "And that's the news for today, May 21, 1993." You are shocked. "1993? Where's my calendar?"

At the sound of the word *calendar,* the display turns from current events to a display of the calendar for Saturday, May 22, 1993. You see that at 1530 hours a video conference will be held with the executive committee. The CEO is in Tokyo and the director of marketing is in London. You feel relieved—at last there are some friendly names. But you say, "I still feel lost. I need more information."

Again the screen responds to the word *information* by displaying a menu of items. One is "Highlights for the Week of May 24, 1993." Another is "Alternate Scenarios for the Office of 1993–2000." You decide to look at the highlights of the week first, then view the long-range scenarios.

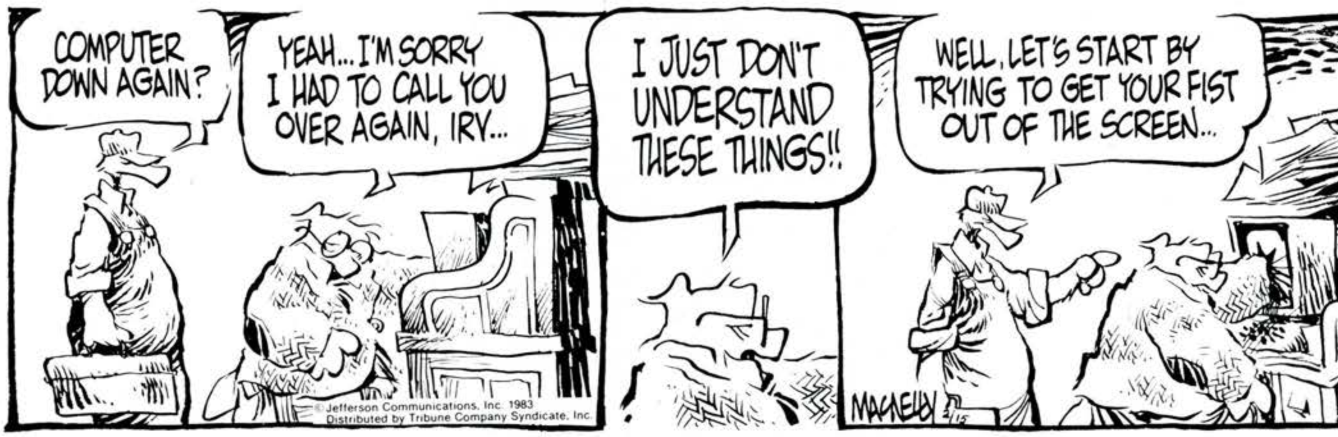
You learn that the CEO and the company's Japanese division manager will meet with the Japanese minister of technology next Monday in Tokyo. You will need to know communication requirement trends for the year 2000 and plans for employing Japanese nationals working at home. You must provide this information to the New York office. You speak to your information system in plain English and find that within a few seconds the required information is displayed in graphic and tabular form on the screen. An explanatory narrative that highlights key points of the chart is also heard. You are also surprised to see, on part of the screen, moving pictures of new communication equipment being produced in Japan.

Having the information that you need for the afternoon conference, you ask to see the alternative scenarios for 1993 to 2000. Two drastically different scenes of what the future office will be like appear.

Scene I—A worker appears, sitting at a terminal reading lists of numbers and words to the system. If he slows down, he is told by the machine to speed up or his pay will be cut. You observe that the system takes the data that the worker provides and makes some complex calculations to decide whether to grant insurance claims to a business in India. The system gives instructions on what controls to press, when to take a break, and when to change the video disk. You ask, "Why are so few people around?" You are told few others are needed. The owner of the company is at home and can be reached if necessary by pushing a button. Most of the technical people and agents are working in their homes and can be reached instantly by pressing their numbers on the directory that is available on the screen.

Scene II—As the scene changes, you immediately sense that things are different in this second office. Lots of people are around, busily engaged in their work, but they seem to have time to stop and talk with each other. You ask for further information about what you are seeing. A woman appears and explains the following.

"I am the communication specialist at corporate headquarters. Our job here is to coordinate the activities of our agents who are stationed at many locations around the globe. All of them are linked by a communications network to one another and to headquarters. A few of the key officers and staff support personnel are located here. We probably have more highly trained technical workers now than we have ever had. The rest of the workers are out doing business for the company. The new technology ties all of us together and unifies our efforts toward the



company's overall goals and objectives."

The woman adds, "We think of the technology as augmenting our work as managers and professionals. We don't need as many low-level clerical workers anymore because technology handles the routine, boring work. Most of us are managers or professionals, and the new systems provide us with tools to help get our work done. For example, we can communicate instantly with any agent around the world. We can find information with a press of a button. The terminals are easy to use—we insist that the machines be adapted to meet our needs rather than making us change to fit the requirements of the machines."

She concludes, "We are really quite happy with the new systems. We can handle more insurance claims, and our agents sell more policies. The company is making more profit. We don't really spend any less money; in fact, we probably spend more. We have just as large a staff for the whole company as we used to have, but our people are more highly trained. We still have quite a few clerical workers and secretaries, but the number isn't increasing as rapidly as it used to, and these employees are more productive than they used to be. People generally seem happier. They feel like they are making a real contribution. Sure, a lot of people still have to do routine work, but they have the technology to help them. All in all, we're better off now than we were ten years ago."

As you contemplate the two scenarios of the office of the 1990s, you wonder if office automation will take over and create more problems than it solves. Or, will office automation serve as a tool to help you and other professionals do your jobs more effectively?

Tomorrow's Office Depends upon Today's Planning

The key point of the preceding story is that the nature of the office of the 1990s depends almost entirely upon how well managers plan now to meet the many challenges facing business today. So far, managers have not, for the most part, done a good job of planning for office automation. Most change in the office has been driven by technology. Manufacturers have developed word processing, microcomputers, and other advanced office equipment, and managers have reacted by buying equipment and software and then attempting to solve problems with the systems they create. The whole process should be reversed.

To successfully adopt automated office systems, managers need to be *proactive* rather than reactive. They must determine their organization's needs and develop systems that meet these needs. If equipment and software are not available to meet the requirements of the organization, managers should influence equipment manufacturers to produce technology that will meet their needs. The marketplace can be a powerful signal to vendors that they are or are not meeting the needs of user organizations.

The time is ripe to introduce advanced office systems technology to most organizations. The technology is now widely available at prices affordable to almost any organization. Technology is advancing at such an accelerated pace that sophisticated information processing systems are being introduced on a weekly basis. Computer output has increased 10,000 times in the past 15 years. Costs are being reduced so rapidly that the per-function cost is down 100,000-fold. By 1990, it has been estimated that easily one out of every three white-collar desks will have a video display terminal.

Contrasting this, problems in the office have been multiplying. Costs have been increasing at an average rate of 10 to 15 percent per year. White-collar salaries are a huge and intractable cost of doing business. In 1980, 60 percent of the $1.3 trillion paid out in wages, salaries and benefits in the United States went to office workers. Productivity hovers around the 50 percent level, and productivity increases are minimal to nonexistent. In addition, white-collar productivity is difficult to measure. American business seems to be sinking under the burden of administrative overhead.[1]

However, cost and productivity are not the only problems. Competent secretarial and clerical personnel are becoming scarce in the labor market. Women are shying away from these positions and are entering other fields such as accounting and management. According to Theodore Barry and Associates of Santa Monica, California, an average of 1.6 million jobs of all types will be created yearly through 1990, "but far fewer job applicants will appear."[2] Business teacher and office administration programs are held in low esteem by peers and are being phased out. Senior management pays little attention to the office; consequently, the brighter, fast-track potential managers avoid office positions.

In spite of the availability of advanced office technology and the great need to use it to help solve problems in the office, the application of advanced office methods so far has had little impact on reducing office costs and has succeeded only in increasing the flood of information. The missing link is *effective managerial strategic planning.*

Clearly, the ball is in management's court. Management, through long-range, high-level planning, must act to improve administrative effectiveness and productivity. A total systems approach is needed to solve these problems. Technology should be introduced on a planned basis to meet the needs of the organization. The 1970s emphasized the technology. Now is the time to turn attention to the people who will use this technology, and not only clerks and secretaries, but professionals and managers as well. Human resources and environmental factors must be considered in a coordinated problem-solving approach to integrating automated office systems.

The Ultimate Solution to Office Problems: People Management

Ultimately, the solution to problems in the office lies in the effective management of people. This is the key to the future. As more and more technology is introduced to the office, employees must be able to accept and prepare for these changes. Some individuals will readily adapt to changes and will be willing to receive the training necessary to upgrade their knowledge and skills for the new systems. These people will find themselves with greater responsibility and new challenges. They will be able to use the new automated systems as a tool to help them do their work better.

Others, however, will not be able to adjust as readily. They will be threatened by change and will become defensive. If they are not assisted in preparing for change, they will find themselves left by the wayside and either unemployed or underutilized and unfulfilled in their job aspirations.

To successfully adopt automated office systems, managers need to be proactive rather than reactive.

The degree to which employees accept automated office systems, and therefore how satisfactorily the systems will perform, will depend mainly upon how effective management is in planning for new systems.

Management must now anticipate the problems and implement solutions that will prevent or eliminate these problems. Some office problems are ageless and recurring; other problems will be new and may be caused by office automation. Failure to foresee and solve these problems may easily render office automation efforts ineffective.

Conceivably, office workers could, in very subtle ways, "sabotage" office automation plans. Some employees now feel that the computer will make their lives worse, not better. This situation brings to mind the case of the Luddites, the British textile workers of the early 19th century who staged uprisings to protest the introduction of automatic looms, and actually began destroying the hated devices. They saw in technology not a better way of doing things, but a system that would eliminate jobs and make those that were left less creative.

While this type of aggressive resistance is unlikely, a real danger exists in either using high-level managers or professionals to do low-level clerical work, placing many office personnel in repetitive, "computer-dominated" positions, or placing unskilled workers in very specialized jobs. People in these situations will resent "working for a computer." Their office may be turned into a factory and their desk made into an assembly line. This type of office of the future could cause people to long for the office of the past.[3] Stated another way, Andrew Carnegie once said, "Take away my people and leave my factories and soon grass will grow on the factory floors. Take away my factories and leave my people and soon we will have a new and better factory."

Managing and Controlling Information: The Major Business Imperative

The office environment is entering a period of change unprecedented in history. Employing over 50 million people and costing over $1 trillion annually in salaries and support, the office has overtaken the factory as the most prevalent work place.

For the first time since the dawn of the Industrial Revolution, white-collar workers now outnumber blue-collars, comprising 53 percent of the working population, according to the U.S. Bureau of Labor Statistics. This percentage will continue to increase, reaching 65 percent by 1990 and 90 percent by the beginning of the 21st century. By the end of 1983, more than $1 trillion will be spent on white-collar salaries and benefits alone, which will represent about 70 percent of the average company's entire payroll, according to the American Productivity Center. This, also, will increase along with the increasing number of white-collar workers.

This tremendous growth in the white-collar segment of the work force has resulted from a major transition in our country's economic base from manufacturing to services. Where industry provides products, services provide information, which is multiplying exponentially. According

to one estimate, during a typical business day, American offices are now producing 600 million computer printouts, 234 million photocopies and 76 million letters, more than twice the information produced a decade ago.

Thus a major business imperative has become managing and controlling information and its related costs, emphasizing an increase in productivity, which has traditionally been lagging in the office. Business can no longer afford to ignore the staggering costs being incurred by the office, especially in the face of recent economic upheavals.

The time is ripe to introduce advanced office systems technologies to streamline the flow of information and enhance the work of white-collar personnel. Today's computer-based office systems are much more sophisticated and functional than their adolescent predecessors of the 1970s. They are also far less costly, with prices continuing on a downward trend. According to International Data Corporation, the cost of computer logic is decreasing by 25 percent per year and computer memory by 40 percent annually, while, at the same time, functions and communications capabilities are increasing at similar rates.

These growth trends in white-collar workers, information, and automated office systems will bring about substantial changes in the office work place. Indeed, some have already begun. Surpluses of middle-aged workers seeking higher-level positions contrasted with shortages of young, entry-level employees can be expected by 1990. New jobs requiring higher levels of technical ability will go unfilled due to a lack of qualified applicants. Work in the office will be restructured to take advantage of office automation opportunities and provide employees with more challenging work. Organizational levels will be reduced, and managerial spans of control increased as automation is widely implemented. Managers and professionals will be working at terminals to create and communicate information, and employees will have the opportunity to work at home on more flexible schedules.

All of these opportunities, and more, present many new issues and problems for today's manager, which together basically translate into the task of bringing people and machines, both more sophisticated and complex than ever, together in a synergistic way.

The information and research reported herein is intended to apprise managers of the major trends affecting the office environment, identify problems arising from these trends, and offer ways to avert or solve these problems. To accomplish these aims, current research has been reviewed to determine the trends affecting the office environment and to identify problem areas resulting from the trends that are expected to affect white-collar workers. Then experts in human resources and office automation, along with over 4,000 managers and employees representing a cross-section of North American business, were surveyed regarding their perceptions of the importance of the 49 problems identified by the current research. This yielded a total of 730 responses from 352 managers, 362 employees and 16 experts. Of the total respondents, approximately three-quarters indicated that they have had experience with automated office systems.

Respondents were asked to rate each of the 49 problems as being critical, important, insignificant, or solved/not likely to be a problem. Of the 49 problems identified, 17 have been rated as critical. The first six which received the highest average ratings, are, respectively:

- ☐ Maintaining a human perspective in an automated office setting.
- ☐ Designing meaningful and satisfying jobs.
- ☐ Ensuring that automated office systems are user oriented.
- ☐ Changing management's orientation to long-term strategic planning.
- ☐ Helping employees maintain job satisfaction.
- ☐ Ensuring that computer files of key personnel are available to others in the company.

Nine more problems are considered to be critical because at least 50 percent or more of at least one group rate them as critical:

- ☐ Ensuring office automation results in a substantial payoff.
- ☐ Working with employees to dispel their fears about layoffs and needs for retraining.
- ☐ Ensuring an adequate supply of intelligent, well-adjusted individuals.
- ☐ Ensuring that top management assumes leadership in an office automation effort.
- ☐ Helping managers deal with the process of change.
- ☐ Eliminating future shortages of skilled technical personnel.
- ☐ Considering possible long-term physical and mental effects of office automation on employees.
- ☐ Ensuring that automated managerial support systems are "friendly."
- ☐ Measuring nonrepetitive managerial and professional work.

Finally, two more problems are considered critical because each most frequently received a critical rating:

- ☐ Helping to improve graduates of public education systems.
- ☐ Resolving power struggles among potential leaders of office automation.

While the preceding identifies the 17 most critical problems as determined by the responses of all groups taken together, there were significant variances reported in certain problems by individual groups. For example, looking at the most critical problem—maintaining a human perspective—80 percent of the employees rate this as critical, while 50 to 55 percent of the managers and experts rate it critical. Similarly, regarding the overall critical problem of possible physical and mental effects of office automation, 57 percent of the employees rate this critical, compared to 13 to 19 percent of experts and managers. For two other critical problems—dispelling employee fears of layoffs and retraining, and maintaining employee job satisfaction—over half the employees rate these critical, while no experts rate them as such.

On the other hand, experts rate practical issues higher than any other group. Such overall critical-rated problems as obtaining a substantial payoff from office automation, measuring nonrepetitive managerial and professional work, and ensuring an adequate supply of competent personnel are rated as critical by more than 50 percent of the experts, as compared to approximately one-third of the managers and employees.

Finally, managers indicate high concern for the critical problems of ensuring automated office systems are user oriented, coping with the process of change, top management support of office automation, and demonstrating a payoff from office automation.

The solution to problems in the office lies in the effective management of people.

Overall, while the most critical problem remains maintaining a human perspective, employees are much more concerned about human-related issues, while managers are more concerned with the more practical issues involved in justifying and implementing office automation. Employees and managers both appear to be positive about the benefits of office automation, but each is concerned about problems specific to their roles.

The experts provided a wide variety of solutions to and methods for averting the 49 problems identified. Some of the solutions revolve around practicing tried-and-true principles of effective management for more recurring problems, while others represent new approaches to new problems. Generally, managers need to focus on the following principles, guidelines and techniques if they are to be successful in managing the office of 1990:

- ☐ Formulate and identify for employees a clear set of job responsibilities and performance expectations. Cooperatively set clear, difficult, but attainable objectives.
- ☐ Provide employees with the necessary resources, including office automation systems and training, so they may be able to perform more effectively and attain their objectives.
- ☐ Provide prompt and frequent feedback on performance, and provide rewards based on accomplishment of objectives and results.
- ☐ Redesign jobs where necessary to provide satisfying, meaningful work, and use automation to relieve employees of repetitive tasks requiring little thought.
- ☐ Solicit employee participation in all decision-making processes, and keep them informed of developments in new and existing programs.
- ☐ Develop organizational structures that integrate functions and decentralize authority.
- ☐ Develop productivity programs that support the overall organization's mission. Include human resource development, automated office systems, and environmental design in these programs.
- ☐ Take part in developing long-term strategic plans for the organization. Integrate office automation systems as a tool to facilitate these plans.
- ☐ Balance the emphasis for technology and the environment with an overriding concern for people.
- ☐ Keep current with trends and developments that have the potential of affecting the organization. Work to actively influence the course of events that determine organizational success.

In summary, the common thread running through many of the problem areas is the need for a renewed focus on the people element of an organization. New technologies must serve users, whether they are managers, professionals, or employees, enabling them to perform not only more efficiently, but more effectively in meeting the organization's overall goals and objectives. ≡

Notes

[1] "What's Detaining the Office of the Future," by Bro Uttal, *Fortune*, May 2, 1982.

[2] *Modern Office Procedures*, April 1982, p. 24.

[3] "Computers Needn't Dehumanize the Office," by Hillel Segal, *Modern Office Procedures*, May 1982.

AUTOMATED MANUFACTURING: TWO CASES WHERE IT FAILED TO MATCH ITS PROMISE

Although many people consider automation as some magic key to productivity, the sad truth is that many automation projects never reach their anticipated potential. Occasionally the result is even worse than that: productivity declines rather than improves.

The authors of this article have supervised a consulting course for MBA students for the past five years and have thus had opportunities to work intimately with six to ten companies per year. During that time we have seen a number of automation projects which have failed and have heard the reasons for failing explained in a number of ways. Often these reasons are not what one might expect. Typically, failure was not a result of technology difficulties, nor did it result from the machinery itself. The most common culprit resulting in a failed automation attempt was the interface between newly automated processes and other planning and management functions of the firm.

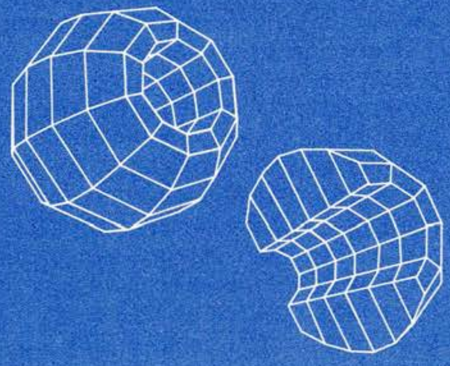
In this article we'll discuss problems identified at two of the companies we have worked with (problems which are typical of those found throughout manufacturing organizations) and then suggest some solutions to these problems. But first, we'll review some advantages and disadvantages which must be weighed before an automation decision can be intelligently made.

Advantages and Drawbacks of Automation in Manufacturing

Automated machines have a number of technical characteristics which make them attractive in manufacturing. Among the most important are:

Flexibility. Automated machines can be used to produce a wide variety of shapes with excellent accuracy. Some shapes can be readily produced which would be prohibitively difficult on conventional machines. Furthermore, these complex shapes can often be produced with only a single setup, whereas many difficult setups would be required on conventional machinery. In addition, an automated machine can be switched from one product to another relatively easily, and the range of products which can be worked is generally much larger than with conventional machinery.

Operating Characteristics. Once properly set up, an automated machine will faithfully reproduce the actions programmed into it, resulting in very little piece-to-piece variation. Unlike a human operator, who can tire or whose attention can wander, the automated machine will produce exact replicas. The operator of the automated system can be a relatively low-skilled person, since his or her job is normally limited to simple workpiece placement, removal, and general monitoring of machine performance.



Setup Characteristics. Writing and debugging a program for an automated machine can be a major task. However, once the program is written, the item being manufactured can be easily and quickly reproduced. Thus programming a part the first time is a major task, but producing batches of the part in the future involves only a minor amount of setup work, mounting the program tape, and adjusting the jigs and tooling.

Tie-in with Other Automation. Automated machines are critical links in an automated factory, where computers aid in producing designs, writing program control instructions for automated machines, and tie in with materials movement devices and robots to produce the part. Computer aided design (CAD) is currently a reality in many companies, while computer aided manufacturing (CAM) appears to be on the verge of becoming a reality.

A number of negative characteristics of the automation decision must also be weighed by management. Among these are:

Acquisition Cost. Automated machines are very expensive. Even when the acquisition cost can be justified on the grounds that the automated machine replaces many conventional machines, the large dollar outlay makes the automated machine a high visibility resource, subject to extra screening criteria and extra attention once it is in operation.

Substantial Hidden Costs. An automated machine requires a substantial investment in software programming, maintenance, and specialized personnel. It is difficult to anticipate the costs of these extra services, creating uncertainty about the financial viability of the machine.

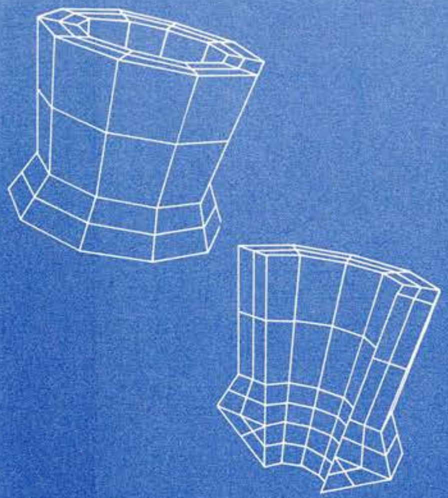
Software Compatibility. After a company has used a particular automated machine for a period of time, a substantial software library is generally developed. Since the library represents a very large cost, it may become difficult to replace the machine with newer technology. The software investment may, to some extent, lock the company into the original machine.

Because of the unique capabilities of automated machinery, their use affects virtually every part of the production/planning cycle. In order to take advantage of the full capability of this equipment and to prevent serious production problems, all phases of product planning and manufacturing—from product design to daily scheduling—should be examined. In addition, quality control and worker selection, assignment, and compensation policies are strongly affected by automation.

The reliability of automated machinery indicates that once the first part of a lot is made satisfactorily, subsequent parts would also meet

Computer generated illustrations courtesy BYU College of Engineering Sciences and Technology.

specifications. Thus, careful first-part inspection should always be performed and should be considered a critical part of the job setup. Process inspection may then be performed less frequently than is customary on manually operated machines. Such inspection is needed only occasionally to check for adjustments and tool wear on long production runs.



Finally, workers should be assigned tasks according to the knowledge that considerable skill may be needed to program and set up an automated machine, but relatively little skill is needed to operate it. Even experienced, capable machinists generally don't have the skills to program automatic equipment, while those who write programs often have limited mechanical experience on the shop floor. And, since automated machines are so expensive, they are generally used in a machine-paced rather than an operator-paced environment. As a result, job assignment rules and incentive plans which may make a good deal of sense in manually operated machine environments may lead to severe problems in an automated shop.

Implementing Automation in Two Companies

The differences summarized in the previous section indicate that a number of management practices should be modified in an automated environment, yet informal observations in a number of companies indicate that such practices change very slowly, if at all, and only in response to obvious crises. In the next section, we summarize our observations in two companies.

Company A: Equipment Manufacturer

Company A manufactures industrial equipment serving a variety of markets. Although markets are currently quite soft, growth in the past has been very rapid. Current sales are approximately $20 million per year. About two-thirds of the sales are for standard, off-the-shelf products, and about one-third for custom-engineered products. The company sells primarily to large, sophisticated customers and faces competition from a small number of competitors, most of which are larger and older than Company A.

Company A purchases castings, bar stock, and sheet stock made of various metals and plastic materials. The production process includes machining (often to very close tolerances), welding, finishing, and assembling. Exotic materials and rigid quality specifications must be handled routinely. The company generally makes subassemblies to stock, then assembles the completed units to order.

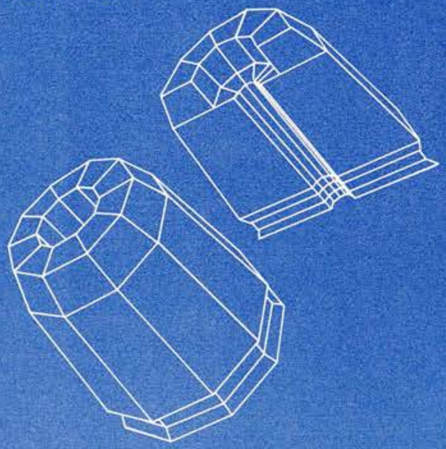
The company currently uses two large numerically controlled (NC) work centers for drilling, boring, deburring, milling, threading, and similar operations. It also uses a number of NC lathes for turning operations.

Numerically controlled tools look similar to manually controlled machinery except for an attached computer. This computer uses a simple program to direct the machine functions. NCs represent a first level of automation. While not extremely sophisticated, NCs provide some of the important advantages of automation discussed earlier.

Recently Company A also added a robot-serviced work cell utilizing a number of automatic machines. The company is planning to move further into automation in the future.

Problems experienced with the automatic equipment fell into five general areas at Company A: machine programming, dispatching and shop floor controls, machine scheduling, quality control, and work force issues. These problems are discussed in turn below.

Machine Programming Problems. Machine programmers were physically segregated from the machine operators, and people from the two groups came from different educational and vocational backgrounds. Machine operators were very critical of the programming staff. Programs were often said to not work properly, or to work inefficiently. A typical comment was that on one particular job a drill bit was withdrawn over two feet in order to rotate a work piece, while a movement of only a few inches would have been sufficient. Communications between the groups on problems and solutions were ineffective or nonexistent.



Dispatching and Control Problems. The group responsible for job dispatching was likewise physically separated from the shop floor. Job routings were often ignored by first-line supervisors, either because specific operators or work centers needed work, or because the supervisors felt that they were better acquainted with the skills and capabilities of operators than were the dispatchers. As a result, work did not flow through the work paths anticipated by the dispatchers, resulting in frequently "lost" work on the shop floor for varying periods of time. Also, data was not carefully collected on scrap rates and causes and on rework needed, resulting in poor control. These problems were not necessarily the result of having automatic equipment, but the cost and visibility of automated machines aggravated the problems. First-line supervisors were extremely conscious of the need to keep the NC machines busy and tended to plan a good deal of the shop activity around that need.

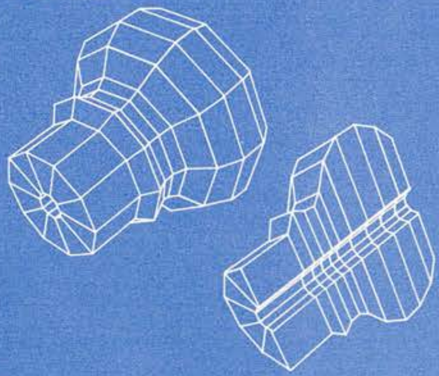
Machine Scheduling Problems. In scheduling the NC machines, both the dispatching group and the first-line supervisors gave preference to putting long production runs on the automated equipment. This was done despite the fact that many companies have found it better to do the shorter runs on NC machines, due to the short setup times required once the machine programs are written. It is unclear whether Company A's dispatch rules result from analysis or from intuition.

Quality Control Problems. Quality control strategies in Company A were not modified to take advantage of the NC machine characteristics. There was little incoming goods inspection, inconsistent first-part inspection for NC work, and generally poor scrap and rework records. Only the final goods inspection was generally acknowledged to be meaningful. In an attempt to control rework and scrap problems, the company added a rework center, but this may have made the problem worse. Workers began to rely on the rework center to fix the problems.

Work Force Problems. Finally, work force issues, primarily involving training and qualifying NC operators, proved to be counterproductive. In order to attain higher ratings, machinists were required to qualify on the NC machines. Some of the older (and more skilled) machinists resisted doing so, resulting in morale problems. In any case, it did not make sense to use a skilled machinist to do the job of an operator. It was unclear whether the company distinguished between operator skills and setup skills in analyzing personnel skills. In this particular company there were no incentive wages (although there was a profit sharing plan), so the move from man-paced to machine-paced operations has not been a problem.

Company B: Sheet Metal Job Shop

Company B is a job shop dealing primarily in sheet metal work. Processing steps are fairly standard for this type of work—layout, shearing, braking, punching, welding, hardware mounting, and a limited amount of painting and plating (more specialized work is subcontracted out). Sales are currently $750,000 per year and increasing rapidly. Company B was started as a subsidiary of a much larger company, and only within the last few months has become independent. The former manager and the shop supervisor are buying the company from their former employers, and as a result have extended their financial resources to the limits.



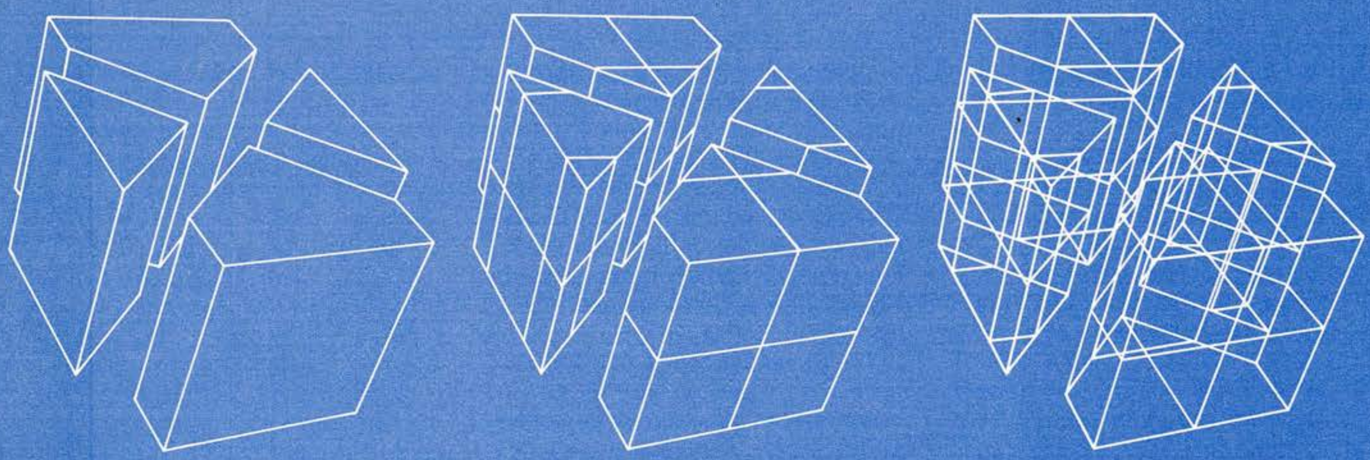
Company B has one numerically controlled punch press which is used essentially 100 percent of the time. The owner-manager has developed some ad hoc rules for determining when a given job should be scheduled through the NC press instead of the three conventional press punches available, but in practice nearly all work goes through the NC press.

Management systems are mostly intuitive rather than formal. The company does have a microcomputer system for keeping track of open jobs and accumulating cost data on work in progress. Results from previous jobs are available to the owner-manager when he prices bids for new work, but he largely depends on his intuition and experience for scheduling and pricing new work.

The major problems experienced in Company B were related to scheduling the NC press, programming the NC press, and increasing the NC press capacity.

Scheduling the NC Press Problems. The NC machine has become a significant bottleneck, since nearly all jobs require punch work, and since nearly all punch work is scheduled through the NC press. At the same time, the three conventional presses are usually idle. The scheduling rule for using the NC press instead of the conventional machines recognizes the differences in setup and run times between the two types of machines, but does not recognize the opportunity cost of having a job wait in line until the NC machine can get to it. Clearly a better method was called for, a method which would schedule the NC press for that work which has the greatest relative cost advantage while allowing the excess work to spill over to the other machines.

Programming the NC Press Problems. A related problem involved the programming for the NC machine. Only one individual was able to write the NC programs, creating another major bottleneck. Adding a second programmer was not possible, both because it is hard to find a qualified person and because of the tight cash position being experienced by the company. An improved rule for scheduling work on the NC machine vs. the conventional machines was needed. Under such a rule, preference on the NC press would be given to work for



THE MAJOR FAILINGS WERE NOT TECHNICAL, BUT MANAGERIAL.

which programs already existed or to jobs with long production runs. Unfortunately, the long-run jobs were also those which were cheaper to run on the conventional machinery, since special-purpose tooling can be justified for long runs. In any case, however, the scheduling rules in use did not consider the load on the machine programmer.

Increasing the NC Press Capacity. In order to relieve the pressures on both the NC press and the NC programmer, management considered replacing the current NC press with a newer machine which would operate twice as fast and would simplify and shorten programming. Unfortunately, the programming written for the old machine would not be usable on the new one; thus in the short run the programming bottleneck would be aggravated rather than relieved. Given the financial condition of the company, the managers would have to be concerned not only with the return on the investment in the new machine, but also with the effect on short-term cash flows. Clearly, the effect on both the machine and the programming bottlenecks would strongly affect job completions and thus cash inflows. Unfortunately, these effects are difficult to predict accurately.

Some Common Problems in Companies A and B

Although these companies are very different, there are some commonalities to the problems they have experienced. Both companies have had difficulty in allocating and scheduling work through automatic equipment. Allocation rules were inadequate in both companies, and the Company A shop management frequently ignored the allocations which were made. Machine programming was also a problem in both companies, although for somewhat different reasons. In Company A the quality control procedures were not designed with NC machine characteristics in mind. The same was true in Company B, incidentally, but the problem was not as apparent there since quality was much less of an issue in Company B. Finally, personnel problems were apparent in Company A. The small, informal nature of Company B, plus the daily involvement of Company B management in operations, worked against major personnel problems developing there.

Some Solutions

These problems do not require new management techniques. They do call for product designs which are modified to take advantage of the special capabilities of automated equipment. Quality control and personnel policies can readily be changed once management realizes that a change is required.

Rules for scheduling and dispatching work through automated machinery are obvious solutions to the problems described above. Such work rules should be particularly sensitive to bottlenecks both on machine time and on programmer time, and should also recognize the effect of prewritten programs on setup times. Thus, scheduling rules may need to be more complex than in conventional production facilities.

The major failings in both companies were not technical, but managerial. Managers undertaking automation projects must pay attention to all phases of the manufacturing operation in order to avoid having "islands of automation" in the factory—islands which are not integrated, are not efficient, and which realize only a fraction of potential benefits. ☰

WILLIAM C. GIAUQUE
WILLIAM J. SAWAYA

BRIEFLY

Gerald L. Romney Memorial Scholarship Created

The Arizona chapter of the BYU Management Society recently established a scholarship fund in memory of Gerald Lee Romney, former president of that organization.

Romney, a 1974 graduate of the School of Management, was a manager for the accounting firm Price Waterhouse and Co. in Phoenix at the time of his death. Although yet in his early thirties, Gerald Romney had accomplished much as student, businessman, and church worker. He passed away after a 20-month battle with Hodgkin's disease.

The Romney Scholarship will provide financial assistance to worthy students in the BYU School of Management. Our thanks go to the Arizona Management Society for this thoughtful and appreciated endowment.

New Master's Degree in Health Care Administration

Beginning in fall semester 1984, BYU's Graduate School of Management will admit the first class to its Master of Health Administration (MHA) program. Students will be trained for a wide variety of management positions in the health care industry. Organizations such as multihospital corporations, hospitals, long-term care facilities, clinics, health insurance companies, surgical centers, consulting firms, health maintenance organizations, and government agencies provide career placements for MHA graduates.

The new MHA program will require four semesters of course work and an eight-month residency following the course work. Persons interested in this program may contact Dr. N. Dale Wright, associate director, MHA program, 760 TNRB, Brigham Young University, Provo, Utah 84602.

$5,000 Scholarship Goes to School of Management Student

Robin Zenger Baker, a graduate student in organizational behavior at Brigham Young University, has been awarded a $5,000 scholarship to pursue her degree in human resource management.

Ms. Baker received the prestigious Olsten Scholarship in New York while attending the annual conference of the American Society for Personnel Administration. She was selected from nearly 300 students.

The California native received her bachelor's degree in psychology from Stanford University. She worked as a recruiting coordinator and office administrative assistant for Ware, Fletcher and Freidenrich in Palo Alto, California.

She also served a mission to Alberta, Canada, for The Church of Jesus Christ of Latter-day Saints.

Baker is president of the BYU student chapter of the American Society for Personnel Administration, vice president of Women in Management, and a member of Beta Gamma Sigma honor society.

Information Management Major: A Hit Program

Student demand for courses in our newly developed major in information management (IM) is resulting in standing-room-only classes.

Introductory IM courses provide students with an overview of personal computers and the software available for them as well as instruction in BASIC language, electronic spreadsheets, word-processing programs, and statistical packages. The intent of these classes is to make students computer literate, introduce them to the personal computer, make them comfortable with its use, and give them a solid introduction to important software packages.

Of the two core courses offered fall semester, Introduction to Information Management drew more than 200 students, while the department had originally anticipated one class section of about 50.

Introduction to Computers and Programming was also offered for the first time with the intent to service 450 School of Management majors. The seven sections offered were filled entirely by the first-priority registration deadline, and an eighth section was opened, which filled immediately. Six hundred students are presently enrolled, while several hundred more were unable to register for this course because of lack of computers and laboratory space.

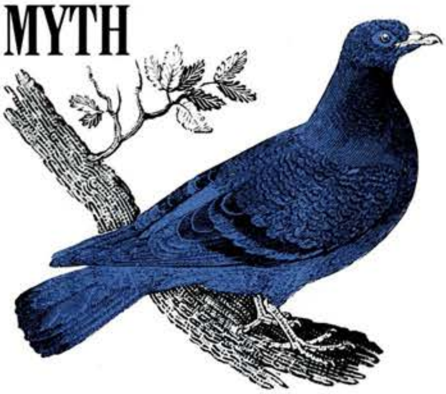
Student interest in the IM major is unexpectedly high. Four new courses in this major are scheduled for introduction fall semester, 1984. In view of the very high level of student interest, admissions requirements will likely be tightened in the future to assure high-quality candidates for this degree.

BYU Has Eight Presidential Management Internship Recipients

Each year, up to 200 Presidential Management Internships (PMIs) are awarded to outstanding advanced-degree graduates nationwide. This program places recent graduates into areas of responsibility in the federal government, providing the interns with excellent developmental opportunities. On occasion, PMIs are also placed on special assignment with state or local agencies. At the internship's completion, PMIs can convert their internship experience into career or career-conditional civil service status.

Eight BYU graduates received PMIs in 1983. Only Princeton, George Washington, and Harvard Universities were awarded more PMIs than BYU. These eight PMIs are now working for the following agencies: Bryce Baker, Office of Personnel Management—Finance, Washington, D.C.; Ginger Gardner, Department of Defense—Army, Washington, D.C.; Bill Greer, Department of Defense—Army, DARCOM, Washington, D.C.; Ann Jensen, City of Visalia—Personnel Office, Visalia, California; Michael Kelly, Department of Treasury—Commercial Banking, Washington, D.C.; Chris Miasnik, NASA—Mountain View Field Center, Mountain View, California; Zenas Moreno, NASA—Customer Affairs, Washington, D.C.; Gwen Young, NASA—Controller's Office, Washington, D.C.

PUNCTURING THE 'HOMING PIGEON' MYTH



For years now a popular myth has been perpetuated by BYU observers when discussing the pros and cons of hiring the BYU School of Management graduate. The myth, simply stated, is this: BYU graduates are "homing pigeons," intent on flocking back to "Zion" (i.e., Utah) at the first opportunity. There is one problem with this observation: It isn't true.

A major consequence of this misperception has been an ongoing image problem for BYU among potential employers who are unwilling to invest in an employee who they believe is equipped with a built-in homing device. Many of those close to BYU have heard the "horror" stories. Generally, they describe a promising young business graduate who, after accepting a position with a top firm, is "forced" back to Utah by his wife, who was not happy and missed her family and the predominantly Mormon culture of the Wasatch Front.

Undoubtedly, this has occurred. But is it typical of newly hired graduates who leave Utah or the West? A recent study of alumni job stability indicates that it is not typical. Indeed, we have found that Brigham Young University business graduates do not generally return to Utah after accepting employment elsewhere. The findings of this study could mark the beginning of the end for a well-known, and oft-accepted, objection to hiring BYU grads.

Last summer Dean William G. Dyer and Placement Coordinator Roger White decided to initiate a study to investigate the accuracy of this return-to-Utah perception of our graduates.

The researchers surveyed 1,000 former students. Approximately 500 had been BYU graduate students, while 500 had earned undergraduate degrees. The sample included alumni graduates from classes of 1972, 1974, 1976, 1978, and 1980. The sample included all MBA, accounting, and public administration students who graduated with advanced degrees during those years. The 500 undergraduates were randomly selected.

Approximately 300 alumni responded to the surveys, and it is from this sample that the researchers drew their conclusions. Major findings of the study are described below.

1. The majority of School of Management alumni live and work outside of Utah. Only 22 percent of our sample live in Utah, and *only 5 percent* of our sample indicated that they had moved back to Utah for family or Church-related reasons.
2. Twenty-nine of the respondents (10 percent) indicated that they had moved to Utah for any reason. Interestingly, 30 respondents indicated that they had originally taken jobs within Utah and later moved outside the state.
3. The respondents had a relatively high degree of job stability. Thirty-six percent of the sample had made a job change within the first four years, while *59 percent had not moved.* Another 5 percent had not been at their jobs for more than three years.

These figures compare favorably with a study done at Harvard by Lewis Ward and Anthony Athos. Ward and Athos looked at the job changes made by Harvard Business School graduates (within four years) in relation to religious preference. Results of their study indicated that 37 percent of Catholics move within four years, 46 percent of Protestants, 58 percent of agnostics, and 6 percent of Jews. Ward and Athos report the following:

> Within four years from graduation . . . there is a great difference in the turnover rate among Harvard Business School students of different religious affiliations. Agnostics lead in turnover by a noticeable margin and Jews (although our number is small) are way below the rest. Given the desired and actual descriptions for these two groups, this finding seems reasonable. Often the agnostics wanted what they did not expect to get, and they had noticeably higher expectations about salary, for example.

Our study indicates that BYU business graduates move less frequently than any of the above-mentioned religious groups, except the Jews, identified in the Harvard research.

Our findings also coincide with the results of a study conducted at Exxon Corporation during the late 1970s. At that time, the director of recruiting at Exxon in Houston became concerned by the fact that a few BYU graduates had left the organization. Consequently, he initiated a study to determine whether the attrition rate of BYU graduates was higher or lower than for employees recruited from other universities.

The study was initially started with the intention of reducing the amount of recruiting time spent at BYU if the attrition rate was, in fact, higher for BYU graduates. The results were enlightening. The BYU graduates actually showed *more* job stability than did the other groups studied.

The actions taken by Exxon as a result of this study were exactly the opposite of those originally intended. Instead of reducing the recruiting time spent at BYU, the recruiter increased the time spent at BYU by a full day, primarily because of the job stability issue.

Our conclusion is simply that BYU graduates, who are predominantly (about 95 percent) members of The Church of Jesus Christ of Latter-day Saints, do not flock back to Utah. Indeed, they are every bit as stable as employees of other religious persuasions.

—Jeffrey H. Dyer

Kevin D. West and Marshall B. Romney

Causes and Cures for Worker Resistance to Computer Information Systems

KICKING *against the* CHIPS

When the developers of the first computer (the Mark I) had assembled their electromechanical monster, which filled several large rooms, do you think they had any idea that that same computing power would one day be accomplished by microcircuits the size of a pea? What would it be like to bring history's great mathematicians back from the grave and demonstrate how their years of painstaking calculations can now be performed in billionths of a second? For instance, in the 1840s John Adams spent a laborious two years determining the galactical position of the planet Neptune—a task that could be accomplished today using less than a minute of computer time. Indeed, today's computers can solve in minutes problems that would take a lifetime to solve manually. As impressive as these mathematical feats may be, they reflect only one of numerous applications for information-processing technologies available now. Indeed, computer capabilities range from calculating with exactness the future location of heavenly bodies to providing data so that town councils can debate the educational impact of video games on children. From the "hard" sciences to the social sciences, the computer is an indispensable tool. The technological advances of the computer are close to miraculous. Internal operating speeds of some computers can now be measured in nanoseconds (billionths of a second). Yet, in our fascination with facts and figures, it's easy to forget that the developers and operators of these miracle machines are emotional human beings, who—unlike the machines—do not operate by the push of a button. Understanding how to cope with the unprogrammable nature of people is becoming increasingly important to managers as they struggle to help their employees adapt to computers and computer-based information systems. The adoption of even the most technologically advanced and economically beneficial information system may utterly fail to benefit companies if one condition is not considered—employee resistance.

Typographic illustration by Bryan Peterson.

This article specifies several common resistive reactions to computerization, examines why employees resist such change, and discusses a number of proven methods of reducing this resistance.

How Employees Resist the Move to a Computerized System

The employee view that systems change is a threat to their organizational survival, combined with a fear of the computer itself, will often lead to one or more of the resistive actions discussed below.

Sabotage

Sabotage refers to aggressive acts taken by a disgruntled employee to make the system inoperative. Although the most common type of sabotage is physical aggression (damaging the equipment, the programs, or the files), the disenchanted employee may try to make the computer malfunction by entering erroneous data into the system. For example, one office manager who felt pressured into using a personal computer was constantly complaining about operational problems with disk drives, software, and other components. Her boss suspected an attitude problem after becoming aware that her computer required significantly more repairs than the other computers. After some investigation, she was seen removing floppy disks while the drive was in operation, pushing the reset button while the machine was carrying out various program functions, and abusing the computer in other ways to vent her frustrations.[1]

Fraud

Dishonest employees, frustrated with the computer, may use their frustration to rationalize defrauding the system as payment for their disenchantment. As childish as that may sound, a little temptation and rationalization under the right circumstances can provoke crime from the dishonest at heart. In 1970, three disgruntled employees of Encyclopedia Brittanica (EB) used company equipment to copy reels of tape containing two million customer names and addresses. The names were then sold to a mailing house. EB estimated their actual loss to exceed $3 million.[2]

Misuse

A system has been misused when errors enter the system through misunderstanding or carelessness on the part of the employee. Misunderstandings can arise from inadequate training, insufficient documentation, lack of feedback and controls, job assignments exceeding the capability of the employee, and inadequate supervision. Carelessness can arise when an individual avoids learning about the computer-based system and becomes apathetic about what goes in and out of the computer. One manufacturing company, after converting to a computerized system, was pleasantly surprised—yet perplexed—at a sudden inventory increase of $1 million. Subsequent investigation disclosed, however, that the instruction manuals had been classified under the same part number as the machine they described. The computer valued the 50 manuals in inventory at $20,000 apiece.[3]

Blaming the Computer

Those individuals who will not risk their jobs through sabotage, yet still feel a sense of resentment toward the system, often vent their feelings by blaming any and all errors on the computer. Although the problem could have originated due to any number of reasons, "it's that crazy computer that caused the mistake." "Computer error" has become the catch-all excuse of the '80s.

Avoidance

Some system users either refuse to recognize a new system's existence or refuse to use it. Their reasoning seems to be that if they ignore it maybe it will go away. There have been a number of well-documented cases of all types of users who avoid a new system and continue to operate their unofficial information network. One manager even unplugged his desk-top terminal and set it in the corner of his office. When asked why he wouldn't use the costly new system, his answer was a simple "I don't like to type."

For a data-processing system to be of any value, *people* must know how to use it efficiently. However, there is a tendency on the part of system designers to design a system from a technical and economical point of view without considering the importance of the behavioral reactions to computer-based information system changes in organizations. Though the designer knows more about designing a system than the user, the system will never be successful unless the user's needs, qualifications, and fears are taken into consideration. In other words, management and systems designers must anticipate resistance and take steps to control it before it occurs.

Why Employees Resist Computerization

To understand why employees resist computerization, top management must look at a systems change from the viewpoint of those directly affected. Employee resistance to change is a direct result of the negative impacts the employee suspects will follow the restructuring of an information system. Simply put, workers harbor a fear of the unknown. Several reasons for such fear are described below.

Computer Goals Threaten People Goals

The fact that people are motivated to work suggests that work satisfies some human needs. Among the most commonly accepted theories explaining these needs are those expressed by Abraham Maslow. Maslow suggested that individuals are motivated to work in expectation of achieving some combination of extrinsic and/or intrinsic rewards. Specifically, people are motivated to work by some combination of money and status (extrinsic rewards) and/or personal job satisfaction (intrinsic rewards). These performance incentives provide a basis for occupational goals toward which employees work. People will resist changes in the organization if the new system's goals conflict with their own occupational goals. Goal conflicts could arise in several areas:

1. *Computers may be seen as a threat to job security.* While people seek steady employment in an organization that will offer them a

long-term position, computer systems should maximize efficiency. Employees may interpret efficiency to mean elimination of people from the organization.

2. *Computers may be seen as taking away interesting work.* Intrinsically motivated employees seek challenging work, tasks which are diverse and interesting so that workers do not become bored and frustrated. But when the system designer designs tasks and duties, the goal usually is simplification. Employees perceive the new system to be cold and insensitive to human creativity and ingenuity. Technology may take the fun out of work, they fear.

3. *Computers may be seen as taking away decision-making opportunities.* Job satisfaction for many is dependent upon decision-making responsibilities assigned to an employee. Many people constantly look for the opportunity to influence enough aspects of the job to feel they are making a contribution. For the systems designer, however, efficiency and simplification of tasks usually require programming the computer to make as many decisions as possible. Employees may feel they will lose control over the outcome of their assigned duties.

4. *Computers may be seen as taking away opportunities to master skills.* People gain confidence and increase productivity in an environment of skills improvement. As employees upgrade their abilities, they retain interest in their present job and prepare themselves for advancement. Yet, in time, as the system grows, the computer will increase its scope of responsibility. Middle managers especially may feel that the computer hampers their opportunities to "shine" and work upward in the corporate organization.

So, anxiety about what a computerized information system will or might do arises from the belief that employee goals will be thwarted by the computer. Another fear held by workers relates to the computer's impact on organizational climate.

Computers Reveal All

Though the corporate organizational chart specifies the lines of authority, information flows through an organization are seldom so straight-forward. Part of the socializing experience of the new employee is learning how to survive the *informal* structure of the organization. Once an employee learns the informal "ropes" to corporate survival, a computerized information system can be cause for great alarm, for two reasons:[4]

1. In the political environment of many corporations, promotions or even survival is dependent upon one's ability to manipulate information. For example, some information is withheld from others, while some information is delayed, distorted, or "sweetened." Computerized information systems can eliminate much of this manipulation. Database systems in particular allow for rapid and easy transfers of information to a storage bank, accessible to anyone designated by management.

2. Corporate politics which also tend to create a sense of interdepartmental rivalry may go by the board as computers come in. Thus, the department "barons" who seek to outperform each other using withheld information and unreferred decisions as their weapons will need to look for new techniques.

To the systems designer, the value of information is maximized if all decision makers have access to as much information as possible, even if it means breaking down the barons' protective department walls.

Finally, employees resist computer systems out of a misperception that such technology is some sort of incomprehensible enemy.

Computers Are an Incomprehensible Enemy

The introduction of a computer into any system adds an extra element of the unknown, the unusual, the unfamiliar. And it is this unfamiliarity with computer jargon, computer specifications, and technology that provokes fear. This fear is especially strong among first-time users.

When exposed to words like parity checks, asynchronous transmission, DBMS, bytes and bauds, most employees find themselves lost in a deep, dark technical jungle from which they can't escape. In some people, the fear of computers stems from being afraid that pressing the wrong key will blow up the system. Some executives feel that sitting down at a keyboard tarnishes the executive image (a feeling that is aggravated by computers that have a nasty habit of telling executives that they are wrong when the wrong keys are pressed). Finally, managers resent having to turn over much of the decision-making process previously done by intuition and gut feelings to an electronic box. That can be particularly ego-deflating to some executives.

These fears of personal inadequacy are further intensified during consultation sessions between executives and computer specialists. For example, for many managers, asking for help from a whiz-kid systems analyst half their age is a daunting prospect. After a few annoying experiences with such specialists of verbosity, the manager is filled with a terror that his or her management skills have long since become obsolete in this fast-paced world of high tech.

Employees and executives untrained and unfamiliar with the computer dislike and distrust the machine because it is perceived as a threat to their personal adequacy in fulfilling their responsibilities. However unfounded these fears are, they result in an all-too-frequent feeling that computer systems really are an incomprehensible enemy.

Dealing with Resistance

Although fairly well-defined procedures exist to correct technical problems related to a computer-based system, the techniques involved in reducing employee resistance are not as well defined. Nevertheless, experience has shown that many systems do succeed, and resistance is minimal when some, if not all, of the following procedures are used by management and systems designers.

Learn from the Past

Managers should constantly be aware that people with different biases, fears and emotions react differently to change. They should recall how the affected workers reacted to change in policies and procedures in the past. What methods were used to successfully implement previous changes? Have past performances and capabilities of system users been sufficiently evaluated as part of the design process? A system change is on the road to success when the managers learn from past experiences and are aware of how the change will, or could, affect each user in the organization.

Prepare Personnel Early

Preparing personnel for the introduction of a computer-based system by announcing the intended computerization early is another crucial step to overcoming resistance. The manager should inform his or her people in person. If employees hear rumors through the office grapevine, early resistance is bound to build as employees speculate upon what unknown effects the computer may have on them.

Another employee preparation step is to convert some data-processing procedures to computer forms as early as possible. Until the computer is actually installed, personnel can fill out the forms manually. By so doing, people will become accustomed to using these forms, easing the anxiety of changing over to the new system.

Involve Affected Persons in the System Design and Maintenance

Education and involvement of system users is the most powerful tool in overcoming resistance to change. If users can see how their jobs relate to the system as a whole, they will be more inclined to cooperate and improve performance because they appreciate their tasks and see what the system can do for them.

When should users be involved? A very important time is during the development of the system specifications—in other words, early in the planning stages. Here management and the designer can communicate to the staff the objectives which they hope the new system will achieve. These meetings should not consist of some superficial information being passed on through several short conversations. Several hours should be spent in repeated meetings to allow middle managers and clerical workers to open up and express their fears, concerns, current system problems, and the problems they anticipate with the new system. The result will be system goals and objectives that have been modified to include user concerns.

During the design phase and after the system is in operation, the users should be required to participate in extensive training classes where they will learn how to operate the terminals, read printouts, and fulfill all their old and new responsibilities under the new system. The more familiar the users become with the computer hardware and software and with computer jargon, the faster they will positively react to their specific assignments. They will learn to appreciate the computer as a powerful tool designed to relieve them of many of their repetitive and tedious tasks.

Also, system designers and top management should constantly solicit feedback and encourage suggestions for system improvement. A formalized process for reviewing suggestions should be developed so that all suggestions receive adequate review and consideration. Don't assume that any system can work over time without some revisions.

By following the steps described above, the user will develop a sense of pride, participation, and responsibility for the system. The system will become "our system" instead of "management's system," and the success of the new system will be equally shared by all members of the organization.

Set Clear and Realistic Performance Goals and Objectives

As the system designers and top management periodically meet with the staff to review the system objectives, great care should be observed to define clearly the goals and objectives of the new system. Resistance is bound to occur if users become disappointed with the capabilities and performance of the new system because they were misinformed as to what it would eventually accomplish. These meetings should not be filled with technical jargon that would increase ambiguity. Instead, computer concepts should be explained simply.

Of course, none of these recommendations will be very useful if the most important user expectation is not fulfilled: that the system accomplishes its objectives and operates efficiently. Nothing will reduce morale in the organization more than not being able to rely on the information system. If people are constantly having to check and correct data, returning to the "old way" will soon seem much easier.

Summary

Conceptually, organizations and information systems are rational and systematic. However, organizations cannot exist without people. And people are not always rational and predictable. How people react to policies, procedures, and events will vary, depending upon individual backgrounds, emotions, and attitudes. Of necessity, behavioral attitudes must be considered when designing a computer-based information system.

If employees are not properly educated and involved in the new system design, the computer can pose a very real threat to an employee's job security and satisfaction. Dissatisfaction with the new system can be manifest in several ways: sabotage, fraud, misuse, blaming the computer, and avoidance.

If management and system designers will prepare to deal with resistance effectively by learning from past experiences, preparing personnel early, training and involving personnel extensively, and being efficient in resolving new system bugs, transition to a computer-based system for employees will be smooth and well received. A technically efficient system accepted and supported by those it is supposed to serve is destined to succeed. ≡

Notes

[1] *Personal Computing*, "Some People Should Be Afraid of Computers," Charles Rubin, (August 1983), p. 57.

[2] *Computer Security Management*, Dennis Van Tassel, (Prentice-Hall), 1972, p. 68.

[3] *Computer Control and Audit*, Touche Ross & Co., (The Institute of Internal Auditors), 1976, p. xiv.

[4] Adapted from *Principles of Data-Base Management*, James Martin, 1976, p. 311–313.

A COLD, CRUEL ECONOMIC LOOK AT

Medical Costs and High Tech

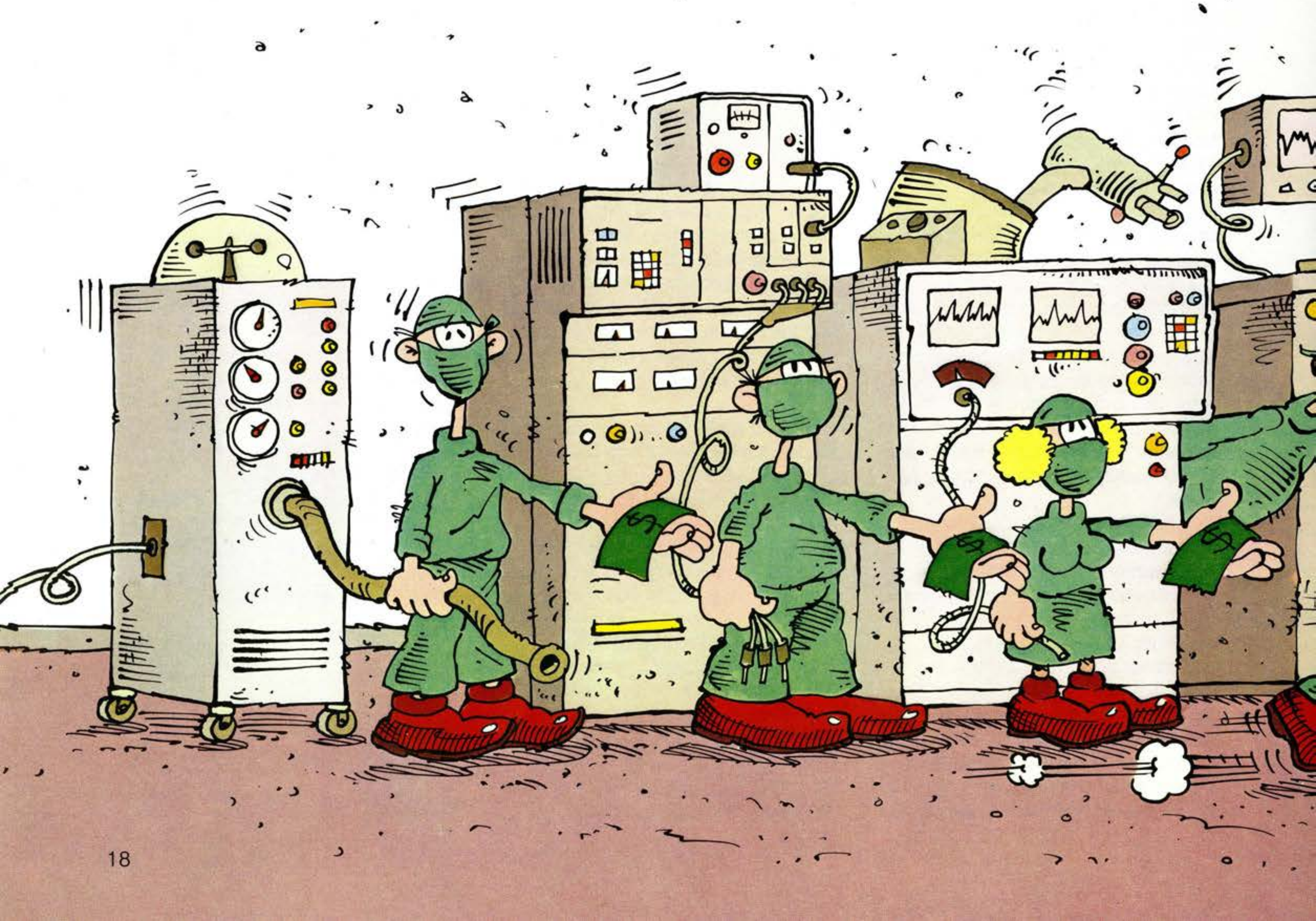
Robert J. Parsons

N. Dale Wright

The medical profession is on the horns of a dilemma—a cost versus benefit dilemma. Since 1950, we have as a nation invested a staggering amount of tax dollars as well as private capital into biomedical research resulting in technological improvements. In some instances, the research, such as that resulting in the Salk polio vaccine, brought with it major cost reductions and profound changes in health status. Other expensive technology breakthroughs such as cobalt therapy or elaborate coronary care monitoring systems have had less widespread benefits.

From a cold, economic point of view, it is clear that some medical technology is far more cost effective than others. Nevertheless, in the United States, the health care system functions so that new technology can be used whenever the physician believes that it would benefit his or

Illustration by McRay Magleby.



her patient. And in most cases, these decisions are made independent of cost implications or validation of benefits.

Herein lies the cost-benefit dilemma. While the best possible health care for the most possible people remains the goal, the diminishing marginal return of enormously increasing costs must be taken into account. Indeed, there is evidence that the American attitudes regarding technology are shifting. More attention has been given by the media to the *costliness* of new technology such as the computerized tomography (CT) scanner as well as its benefits, while professional committees have been established to objectively examine positive as well as the potentially negative influences of hi tech on the delivery of health care.

One example: A study of hospital coronary care units (CCUs) has shown that the average cost to patients treated in these units is nearly double the cost to patients treated in other areas of the hospital. From this it has been estimated that the additional cost of intensive care for patients hospitalized with acute coronary disease is nearly half a billion dollars per year. The question is whether the CCUs reflect a significant advantage over other forms of care in preventing deaths and maintaining or improving quality of life. Is $500,000,000 per year justified? Do the costs and benefits balance?

On a personal level most of us would be quick to say that money is unimportant when compared to the value of a human life. But how many human lives might be saved or enriched with that half billion dollars spent on CCUs? From a broader perspective of the health care *system,* the answers are less clear.

What Is Medical Technology?

In the delivery of health care, the term medical technology can mean anything from sterilized bandages to sophisticated laser surgical tools. From an economic viewpoint, medical technologies may be subdivided into three categories:

1. Those that require large capital expenditures to purchase—for example, the CT scanner;
2. Those that do not require large capital expenditures or high cost of attendant personnel but have potential for enormous utilization because of widespread patient use—for example, certain surgical procedures or common laboratory tests;
3. Those with high personnel costs—for example, renal disease.

The potential cost impact of new technology can depend upon its medical objectives. For example,

therapeutic technologies directed at curing a specific malady imply a limited period of resource use. Those directed at the *management* of illness, (kidney dialysis machines, for example) however, imply on-going involvement of the patient with the medical care system and thus a long-term cost impact. Benefits from these technologies depend upon the disease or disability being treated and the efficacy of the technology in reducing that illness. At the extreme, technologies that extend survival without cure place a high cost burden on the system without necessarily generating compensatory benefits. These present ethical questions about compensatory benefits—for example, high-cost open heart surgery for the very elderly.

A third medical objective of technology (in addition to curing and managing maladies) is diagnosis. For the undiagnosed disease, tests are often an open set without externally imposed limits. Indeed, the more a series of tests yields no answer, the more reason is provided to conduct more tests. Advanced diagnostic measures can, of course, reduce the need for more expensive procedures, such as exploratory surgery. But new diagnostic technology which is developed for a particular disease is often applied more widely as it becomes more available. And, in the absence of real limitations on availability, an ever-increasing expansion of diagnostic tests will be induced by hope of benefit and by concerns about malpractice claims if the tests are not pursued.

Other technologies directed at prevention, early detection, and rehabilitation offer the greatest potential to generate true cost reductions. (Advances in the 1940s and 1950s, for example, prevented diseases such as diptheria and polio and reduced the need for expensive institutionalization for patients with tuberculosis.) But such technologies often operate outside the benefit from our current reimbursement system. Thus, some important cost-saving technologies are not the objects of adequate financial investment. More on that later.

A sound policy of managing medical technology would pay far more attention to those technologies outside the medical care delivery system that emphasize prevention, detection, and rehabilitation. These however, are usually financed and supported through public health programs and are not covered by insurance—therefore they do not have the potential for extensive use because of the reimbursement issues.

Technologies that are directed toward improved management of the medical care delivery system rather than to the clinical condition of patients have significant potential for reducing the cost of care. Such managerial improvements should be included among the candidates for new technological development.[1]

It is important to distinguish between the capital costs associated with new technology and the impacts of new technology on continuing use of resources in the medical care system. Public awareness is focused on "big-ticket," high-capital-cost technologies. But many technologies that call for modest capital cost generate significant continuing costs by requiring increased personnel and supplies and by stimulating increased levels of utilization within the system.

Most medical technological advances require similar advances in personnel and do not reduce the number of personnel required. Often, in production, industrial technology can lead to a reduction in personnel required for the same unit of production. This is not the case in medical technology, which often requires more highly trained personnel.

So, there are wide differences in types of medical technology and their economic advantages. A question remains: Is technology the major cause of increasing medical costs?

Medical Technology and Rising Health Costs

In September 1975, Clifton Gaus, representing the Social Security Administration (Medicare), concluded that "adopting new health care technology is a major cause of the large yearly increases of medical care costs."[2] One year later, October 1976, Selma Mushkin and her coworkers reported that "we find at least for the period of 1930–1975 that biomedical research on balance reduces health [costs] rather than increases them."[3]

Which position is correct? Health expenditures rose from 5.9 to 9.8 percent of the GNP between 1965 and 1981. This increase is attributed to population growth, price increases, and higher per capita utilization of medical services. Over 50 percent of these increases resulted from higher prices, while one-third resulted from per capita increases in the quantity and quality of health services utilized. The increases in prices and utilization reflect significant changes in the demand and supply. Higher per capita incomes can be expected to generate greater demands for health care, but another factor seems to be more important: the extensive growth of private and public health insurance. Third-party payments covered about one-fourth of expenditures in 1950. By 1976, this figure approached 70 percent. When individuals are not paying the bill directly, their sensitivity to price diminishes. Money is no object—the insurance company will pay—and I want the best!

Even though the cost per patient day has risen, we cannot conclude that technology is the major culprit for the rise in health care costs. The most comprehensive analysis conducted thus far on the impact of technology on total health expenditures was done by Selma Mushkin and her colleagues at Georgetown University.[3] She reports that population and its changing age composition have accounted for 18 percent of the rise in health expenditures while price change or inflation contributed another 42 percent. Rising incomes account for 20 percent, the aging population 3 percent, and the impact of third-party payments for 18 percent. This leaves a residual of about 4 percent that Mushkin attributes to technology. While these studies have statistical problems, and the residual approach is a crude proxy measure for technology, the implication of her research implies that medical technology per se is not the culprit behind rising costs in health care.

The Real Problem

The real problem underlying the aggregate cost of the nation's health care system is the virtual absence in the system of incentives for containing costs. Nevertheless, what is needed is an ongoing evaluation of medical technologies regarding safety, efficacy, and cost compared to benefit.

Policy Implications

The predominant issue in the current discussions regarding medical technology is primarily cost and the balance between the cost of technology and its benefits. There are, however, a number of other issues which bear on the general topic of health care technology. Improved technologies have made a major contribution toward relieving some illnesses. Much medical technology is good, and continuing research is essential to the future development of medical care. However, health care providers, producers, and the federal government all have a responsibility to see that medical technologies employed are cost effective as well as safe. It is crucial that an ongoing analysis is conducted to provide data regarding the true costs of technology and its appropriate benefits. Specifically, where it appears that the costs of new technologies exceed the benefits—what should be the main control?

A related question needs to be addressed: "Is this a cost-benefit question or is it a biomedical ethics question? Should not the best technology be used if it is available?" In short, is the health care system as a whole paying too much for recent technology? It should also be remembered that new technology as such does not significantly boost costs. It is the behavior of individual persons and human institutions—the way they use the new technology—that leads to the cost rise. This distinction is central to a rational policy analysis.

☐ At root, new medical technologies are adopted and used because physicians, scientists, hospitals, patients, and political leaders are all predisposed to encourage their use, and virtually nothing deters them.

☐ Under present payment systems, hospitals and physicians often benefit financially from the use of new technologies. The Hippocratic Oath, the desire of the patient to obtain the best available care, pressures of the malpractice threat, the technologically oriented ethos of the twentieth century, widespread third-party payment systems, the salesmanship of the manufacturers of new technology all point in the same direction and create the same predisposition, grounded in a repugnance to setting a price on human life and insulated from cost consequences: "If a new, apparently safe and beneficial technology appears—use it." Other things being equal, new technology that is medically promising will always be promptly adopted unless active disincentives exist that slow the process of adoption.

☐ Are such disincentives in place in the present system for health care payment in the United States? Regrettably, they are not. Hospitals operate on close to a full-cost-reimbursement basis through governmental programs or private insurance plans. Doctors are paid today in largest part not by patients but by third parties—the government and private insurers—and the fees themselves are largely uncontrolled. Payment for diagnostic tests and other ancillary services in the hospital are reimbursed in the same way. The amount and kind of medical services provided are largely at the discretion of the practitioner, not of the patient or the third-party payer. The patient has little economic incentive to keep down charges for medical services and typically has even less ability to make an independent judgment as to the quality of, or need for, the service provided.

☐ If technology contributes to the aggregate cost of the medical care system of the nation, it is not because of something peculiar to technology. It is for the same reason that other factors contribute to the escalation of medical care costs—namely, that there is little at work in the system tending to keep costs down, while at the same time Congress and private purchasers of medical insurance have so far been willing to pour dollars into the system, either directly or by tax subsidy.

The conclusion that follows is that one way to influence the cost attributed to the new technologies is to build incentives for cost containment into the medical care payment system. Three approaches could be applied.

In the view of many, the best long-term solution to the problem is to introduce a fully effective *competitive environment* into the field of health care by *restructuring the entire system away from the traditional solo practitioner fee-for-service basis.* Such solutions might include health maintenance organizations, preferred physician organizations, and other familiar systems which would compete among themselves and with the rest of the system. Consumers then would have a greater opportunity for choice in selecting their provider.

A second approach would use cooperation to reduce unproductive competition. Instead of competing for the "reputation" of having all of the most sophisticated equipment, health care practitioners could arrange for *specialization of services, voluntary planning, restraint, and cooperation* between institutions.

The antithesis to competition as a means to contain health care costs requires an *increase in regulatory controls.* This could involve the imposition of a moratorium on technological advances or the use of guidelines and the potential constraint of expensive technology by planning agencies. Other regulatory controls include direct regulation of technology, or establishing a dollar limit on hospital expenditures for capital goods including high-cost technologies.

Whatever approaches are used, it is essential that health planners and policy officials look at the general problem of cost containment. It is essential that they recognize the whole range of reasons for rising costs. Medical technology is not a major reason for rising costs in health care. ≡

Notes

[1]This section based upon the proceedings of the 1977 Sun Valley Forum on National Health.

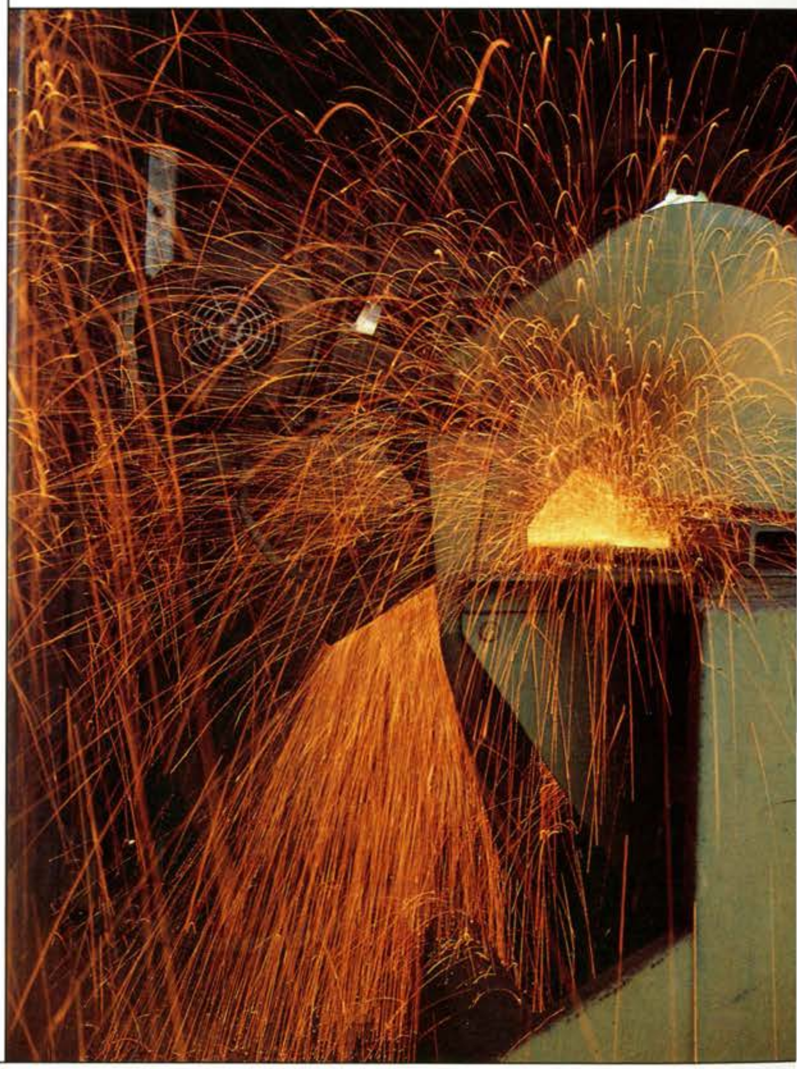
[2]Gaus, C. R. "Biomedical Research and Health Care Costs." Testimony before the President's Biomedical Research Panel, September 29, 1975.

[3]Mushkin, S. J.; Paringer, L. C.; and Chen, M. M. "Returns to Biomedical Research 1900–1975: An Initial Assessment of Impacts on Health Expenditures." Public Services Laboratory of Georgetown University, October 20, 1976.

LET'S NO

LOW

William



Americans are so bedazzled today by the glitter of high technology that our basic industrial underpinnings are threatened.

High tech's lure is seductive. High tech is nirvana—the easy, glittering path to untold riches. Ask the money merchants and traders, the market analysts and quick-profit speculators who show little concern for U.S. longer-term interests. High tech whets the public appetite for futuristic stocks and meteoric price surges.

If we attract high-tech research and industry to our aging cities, the politicians and media tell us, we will magically wipe out unemployment and other economic woes.

Not so fast. Pause for a moment and consider the flip side. Consider the virtues of low tech.

I'm a low-tech man myself. I speak as a staunch advocate for low tech, which is nothing more or less than all those oft-overlooked and taken-for-granted basic products each of us uses every day of our lives.

We should not easily forget, despite our preoccupation with megatrends and robots, Jedi and genetics, that there's profit in the prosaic, the basic, the unglamorous, the tried-and-true. And jobs—many, many jobs. There are profits and jobs in toasters and toys, glassware and greeting cards, lockers and fasteners, corn flakes and cookies, farm machinery and machine tools.

There are profits and jobs in hundreds of low-tech companies of every size and description, each more

T FORGET

TECH

Rentschler

than a little removed from the fantasyland of high tech—companies that today may be struggling and recovering slowly from such body blows as outlandish interest rates, inflation, and recession. They represent the bedrock strength of the American economy, and though I clash here with many self-styled futurists, forecasters, economists, and consultants, I believe such companies will continue to provide us with a vital and solid, if unspectacular, foundation as advanced as most of us can imagine.

Indeed, high tech is sexy and exciting. Home computers are the most visible example. Yet even this early in the heralded high-tech boom, the field is cluttered. For every Apple, there will be 10,000 worms.

The high-tech shakeout in fabled Silicon Valley, California, already is under way, and the odds of hitting it big are about as good as on the craps tables at Las Vegas. Consider the market downswing, ferocious price-cutting, and bankruptcies in such fairly recent high flyers as CB radios and pocket calculators. Consider the well-heeled, well-entrenched competition from the corporate giants.

How much of today's high tech is largely hype—a frenzy churned up by stock promoters, speculators, entrepreneurs, and others seeking short-term gain?

Newsweek reported recently on the breathless San Francisco lawyer who bought three high-tech stocks "even though he has no real idea what products they

Photography by W. Mike Nielson and Brent Burch.

I sleep well at night, confident some genius won't 'invent' us out of business before morning.

make. All he knows or cares about is that each one has some connection with high technology." This same lawyer, says *Newsweek,* also "owns shares in an outfit called Xidex, because he thinks every portfolio of high-tech stocks should include one with a name that both starts and ends with the letter X."

He's made money, of course, in the recent frenetic run-up of "futuristic stocks," but there's a downside, too, which for many will resemble the scariest ski run at Vail.

High tech almost invariably means high risk. Low tech usually means low risk—much lower risk.

For every gigantic, highly publicized payoff in genetics and home computers, there are literally hundreds of high-tech failures—good ideas that die, ideas that sag or limp and fade because of myopic planning, unrealistic expectations, inept management, and threadbare funding.

High tech has an insatiable appetite for money. The big bottom-line payoff that gets the saliva flowing often is unpredictable light years away, as distant and ephemeral as the Land of Oz.

My inclination is to forego the seductive dazzle of high tech and seek out basic low-tech products with a reasonably consistent demand-and-growth cycle. In the past two years, we have acquired just such companies. I am chief executive officer of several small to mid-sized firms that manufacture such ordinary items as steel lockers, home storage cabinets, basketball backstops, range hoods, industrial trailers, platform trucks, wheels, and casters. Even in the throes of this rugged recession, all have done no worse than hold their own by tightening the screws and outhustling the competition, while at least one has sharply increased its sales and market share. We are both excited and optimistic about our future with products that boast no kinship to high tech.

Does that make us antiprogress or ostrichlike in our approach to innovation and new technology? Not at all. We're always hungry for ways to do it better, more efficiently, more economically—ways to get a leg up on increasingly fierce domestic and foreign competition.

Few products are more basic or critical than forgings. The forging shop's ancestor was the village smithy, the blacksmith shop of yore, where that brawny craftsman shaped horseshoes and hand tools on his anvil.

In October 1982, we acquired a well-established forging company, Jackson Forge Corporation of Jackson, Michigan, whose roster of customers reads like a who's who of U.S. industry. But as we took over, these were the very companies suffering the ravages of the brutal recession. Sales were off and we struggled to stay in the black.

What was our best strategy? Increase our share of a shrunken market. But how? First and most obvious, we stepped up our marketing efforts, nearly quadrupling our commission sales force.

Even more important, we turned to technology to establish a competitive edge that would be hard to duplicate. We brought aboard a recognized expert in forging technology and developed the rare technique of making precision forgings that will reduce metal content by 15–20 percent—a critical breakthrough in any material-intensive product.

This new technology, combined with better buying of our key raw material—steel—puts us in a posture to compete with anybody, either domestic or foreign.

We are often asked why in the world we bought into what are widely perceived as slow-growth, low-tech manufacturing companies in a period of economic distress. My partner, John H. Altorfer, chairman of Jackson Forge and a former assistant secretary of commerce, has a good answer. John harks back to the legendary Bernard Baruch's explanation of how he made his money. "I buy my straw hats in the fall," Baruch used to say, exhibiting the canny good sense for which he was famous. Low tech is "out of season" right now, but to turn our backs on it would be a grievous mistake.

We still aren't at the threshold of cutting our grass with laser beams. People will continue to slice bananas over cold cereals at breakfast. My associates and I sleep well at night, confident some genius won't "invent" us out of business before morning with a substitute for lockers or casters or range hoods or whatever.

Of course, high tech is critical to our progress and survival and quality of life. We must always encourage innovation and dramatic technological breakthroughs. But it is equally critical, as we gradually emerge from the economic depths, to restore a climate conducive to low-tech resurgence.

Let it never be said that here in the 1980s the epitaph for low tech was writ. Let us understand, as National Association of Manufacturers (NAM) chairman Bernard J. O'Keefe has said, that "old ways of doing business, like old buildings, have their place." And let us give a damn about the less prestigious, less glamorous, slower-growing low-tech companies that often are ignored by government, media, and the pubic at large, but that, properly tended and cultivated, provide the solid undergirding for growth, jobs, great enterprises, and national prosperity and security. ≡

Reprinted from the August 1983 issue of *Enterprise,* a publication of the National Association of Manufacturers, Washington, D.C. Used courtesy of NAM.

William H. Rentschler is chairman and CEO of Medart, Inc., Greenwood, Miss. (an NAM member); Jakes Manufacturing Corporation, Nashville, Tenn.; FloatAway Home Products, Inc., Atlanta, Ga.; and Swanson Metal Products, Inc.; Greenwood, Miss.

ABOUT THE AUTHORS

N. Dale Wright is a professor and associate director in the Institute of Public Management and Health Administration. His primary professional interests are in the area of health administration, and he is the coordinator of the Master of Health Administration program. Professor Wright earned his BS and MS degrees at BYU, received a Ph.D. from the University of Southern California, and did postdoctoral studies under a National Science Foundation grant at the University of West Virginia.

Kevin D. West earned his BS degree in accounting and will be completing his master's degree in April of 1984. His accounting specialty is management advisory services, and he has done research in the area of computer rating and selection for small business applications. Mr. West has earned a four-year Board of Trustees scholarship for his studies at BYU.

Jeffrey H. Dyer is a graduate student in the Master of Business Administration program. He graduated summa cum laude in psychology and has been on the national dean's list. In April of 1984 he will complete his MBA in the top 10 percent of his class. Mr. Dyer is anticipating doctoral studies in management.

Harold T. Smith earned his Certified Administrative Manager designation and recently served in a national office as vice-president/ management education for the Administrative Management Society. As a BYU professor, he serves as director of the newly developed information management major. He has written three books as well as numerous articles and monographs in his area of specialization, the office of the future.

His article in this issue is adapted from research funded by the Administrative Management Society Foundation. A complete report is published by AMS entitled *The Office Revolution: Strategies for Managing Tomorrow's Workforce.*

Professor William C. Giauque is active in teaching production at the undergraduate and master's levels at BYU and has had wide experience consulting and working in production-related areas. He is certified as a production and inventory control manager at the Fellow level by the American Production and Inventory Control Society. Professor Giauque holds a BS degree in geophysics from the California Institute of Technology, and a master's and doctorate in business from Harvard University.

Marshall B. Romney is an associate professor of accounting at BYU. He earned his Ph.D. at the University of Texas and is a former auditor for Touche-Ross & Company. He is the author of over 30 professional articles and was recently awarded a grant to study management fraud. His professional specialties include auditing, systems analysis and design, and small business computers.

Robert J. Parsons serves as associate dean of the BYU School of Management. His professional interests focus on health care economics, and he has written a number of articles in this area. Dean Parsons earned his undergraduate and master's degrees at BYU and a Ph.D. from the University of California-Riverside and has done postdoctoral studies at the University of Michigan.

William J. Sawaya teaches courses in the Institute of Business Management at BYU. His academic training includes an undergraduate degree from the University of Wyoming and an MS and Ph.D. from Arizona State University. Professor Sawaya teaches, writes about, and consults in the area of production management.

School of Management
730 Tanner Building
Brigham Young University
Provo, Utah 84602

Address Correction Requested

Nonprofit
Organization
U.S. Postage
PAID
Provo, Utah
Permit No. 49