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REPORT 1

## HUMAN CAPITAL INITIATIVE:

# The Changing Nature of Work

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# PREFACE

## Getting to the Right Questions—A First Installment

*Committee on the Changing Nature of Work*

*The social scientists have a long way to go to catch up, but they may be up to the most important scientific business of all, if and when they finally get to the right questions. Our behavior toward each other is the strangest, most unpredictable, and almost entirely unaccountable of all the phenomena with which we are obliged to live. In all of nature there is nothing so threatening to humanity as humanity itself.*

Lewis Thomas

**N**oted biologist Lewis Thomas was assessing the state of American science in the above quotation, and indeed, as one watches daily news reports, there is ample evidence to support Thomas's judgment about the unaccountable and unpredictable in human behavior.

Today we face serious problems, problems that will not get better by being ignored. There are now over a million prisoners in federal, state, and local jails, and the rate of incarceration has doubled since 1960. Violence is growing, and drugs and alcohol are undoubtedly factors in crime. Americans are concerned about health, and the AIDS epidemic is relentlessly growing. Health care costs have been climbing steadily for decades in terms of constant dollars and as a share of gross national product, and there is no end in sight. The average age of our population is higher than ever before. The news we hear about education is not good, with signs of failure everywhere: A quarter or more of students drop out of high school, only 1 in 4 can interpret a complex bus schedule, and only 30% can write a job application letter. In industry, the drop in the rate of productivity growth in America since 1950 is a well-known fact. Jobs today are complex and in the future will become even more demanding, requiring more from the humans who are part of complex systems.

Our problems are enormous and interconnected—violence and crime link to drugs and alcohol, and to health, to aging, to

education, and to jobs. Each problem seems to be so much worse than in “the good old days.”

### The Human Capital Initiative

All of these problems are—at their core—problems of human behavior. There is so much that needs to be learned. We are just scratching the surface, and we need to quadruple our efforts. Research alone won't solve these problems, but neither will they be solved without research. Given the severity of the problems we face and the tides of change sweeping the global economy, we need basic and applied research that can help strengthen our human capital.

Through a series of three summit meetings and the combined efforts of hundreds of researchers representing nearly all of the research-oriented societies of psychologists, the six major problem areas described above—worker productivity, education and literacy, the aging of society, substance abuse, health, and violence—have become the starting point for trying to get to the “right” questions regarding these problems. The report of the Steering Committee for a National Behavioral Science Research Agenda, *The Human Capital Initiative* (HCI), was published in the *APS Observer* in February of 1992. Now the first two of a series of companion documents are being released. In this issue of the *Observer*, **The Changing Nature of Work** identifies research opportunities with regard to the nation's productive capacity. In the December, 1993, *Observer* issue, **Vitality for Life** will examine how

***What has begun is an ongoing process of collaboration, one that can get us closer and closer, in Lewis Thomas's words, to the "right" questions that can immerse us more deeply in "the most important scientific business of all."***

COMMITTEE ON THE  
CHANGING NATURE OF WORK

researchers can contribute to solving problems brought on by the most massive demographic change in our country's history, the graying of America.

### **The Changing Nature of Work and a World Market**

An emerging global economy mandates serious scientific attention to discoveries that foster enhanced human productivity in an ever-changing and technologically sophisticated work world. Worker adaptability and training will play increasingly critical roles in organizational effectiveness and efficiency as the nature of work changes at an ever-faster rate. American industry and government can no longer take for granted American dominance in technological advancement and efficiency. Historic economic, social, demographic, and political changes around the world are forcing a reassessment of our very concept of "work." And, psychological science is poised with the methodology and ability to provide answers needed by both industry and government in efforts to increase our competitive edge in the world market. The world market will prove to be the most stringent test of our competitive resolve to address these issues. Analogously, in Thomas's assessment, our attempts to understand human behavior are the toughest test of our scientific prowess. In the future, economic competitiveness will require a sophistication in our understanding of *worker* behavior that rivals our current understanding of the technology we use to achieve work. Psychological science is uniquely prepared to help provide that requisite understanding, and this document provides the initial details for beginning the task.

### **The Purpose and Scope of HCI Reports**

Both **The Changing Nature of Work** and the **Vitality for Life** documents call for basic and applied research. Neither document attempts to be the last word within its domain but rather to bring key research opportunities to the attention of our colleagues in federal agencies, the members of Congress, and the general public. Other reports in this series are now being organized by the Human Capital Initiative Coordinating Committee and prepared by inter-society drafting committees. **Combating Drug Abuse** will likely be the next report to appear, and others will be released in coming months and years.

What has begun is an ongoing process of collaboration, one that can get us closer and closer, in Lewis Thomas's words, to the "right" questions that can immerse us more deeply in "the most important scientific business of all."

### *Reference*

Thomas, Lewis, (1983), *Late Night Thoughts on Listening to Mahler's Ninth Symphony*, Bantam Books, New York, p. 23.

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Educational Psychology	Society for Research in Psychopathology
Evaluation and Measurement	Southwestern Psychological Association
Experimental Psychology	Western Psychological Association
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## ACKNOWLEDGMENTS

*The Changing Nature of Work* is the result of collaboration among representatives from 41 organizations. A workshop was held in Herndon, Virginia, on September 20-21, 1992, and a **Drafting Committee** was selected to create this set of research initiatives from the proceedings of the workshop and written information provided in response to the Call for Participation (see February, 1992, *APS Observer*). The final text was circulated for review and approval by all workshop participants and an additional group of representatives named by the sponsoring organizations.

The **Coordinating Committee for the Human Capital Initiative** gratefully acknowledges grant support from the National Institute of Mental Health to the American Psychological Society for aid in elaborating the Human Capital Initiative, and also from Bowling Green State University. Additional support for travel was provided by many of the sponsoring organizations. We thank Alan Kraut, Sarah Brookhart, Lauren Butler, and Lee Herring, all from the American Psychological Society, for their assistance in this work.

*The Changing Nature of Work* is published by the **Coordinating Committee for the Human Capital Initiative** on behalf of the sponsoring organizations. All sponsoring organizations have unlimited rights to reproduce and disseminate this document. Address inquiries to Milton D. Hakel, Chair, Human Capital Initiative Coordinating Committee, Department of Psychology, Bowling Green State University, Bowling Green, OH 43403-0228 (BITNET: MHAKE@TRAPPER, tel. 419-372-8144, fax 419-372-6013).

# Background

In January 1990, the American Psychological Society convened a Behavioral Science Summit in Tucson, Arizona. The Summit conferees, representing almost 70 psychological organizations, unanimously endorsed the development of a *national research agenda* that would help policy makers in federal and other agencies set funding priorities for psychological and related sciences.

The conferees asked Frances D. Horowitz, the Science Advisor of the American Psychological Association; R. Duncan Luce, President of the Federation of Behavioral, Psychological and Cognitive Sciences; and James L. McGaugh, President of the American Psychological Society, to appoint an Interim Steering Committee to draft a document based on the deliberations of the two-day summit. The Interim Steering Committee consisted of Janet T. Spence and Donald J. Foss, University of Texas-Austin, Co-chairs; David Berliner, Arizona State University; James Blascovich, State University of New

York-Buffalo; Milton D. Hakel, Bowling Green State University; J. Bruce Overmier, University of Minnesota; Sandra Scarr, University of Virginia; and Larry R. Squire, University of California-San Diego.

In January 1991, the Steering Committee reported its progress at the next Behavioral Science Summit held in Houston, Texas. Organizations participating in both Summits are listed in the February 1992 *APS Observer* Special Issue. The Summit Organizations provided feedback to the Steering Committee and agreed to begin the second phase of the Human Capital Initiative (HCI): to propose specific research projects tied to priorities laid out in the February 1992 HCI document. That second phase is now underway, and this current document, *The Changing Nature of Work*, is the first to provide those specifics in the first of the six major areas identified as research priorities by the Steering Committee. Those six areas are:

- ◆ Productivity in the workplace
- ◆ Schooling and literacy
- ◆ The aging society
- ◆ Drug and alcohol abuse
- ◆ Health
- ◆ Violence in America

Not a day passes without one or more of these concerns grabbing the national news headlines. While these six topics are not the only challenges facing the country, each by itself seems nearly overwhelming. Each presents difficult dilemmas, and each is a problem of human behavior.

Each of these six urgent challenges is addressed in *The Human Capital Initiative* (1992). Developed by representatives from 68 behavioral, psychological, and cognitive science organizations—with a net total membership well over 100,000—*The Human Capital Initiative* describes in general terms both the nation's problems and potential contributions of research.

The pages that follow are the product of the Drafting Committee for The Changing Nature of Work initiative. This document, together with portions of the two APS Summits, was supported by grants from the National Institute of Mental Health to the American Psychological Society, and we gratefully acknowledge this support. ◆

## The Steering Committee's mission was to:

- ◆ Identify a unifying theme or themes for behavioral research from among those developed at the summit;
- ◆ Invite specialty organizations in their subsequent comments to attach more specific initiatives; and
- ◆ Provide the context of one or several strategies aimed at developing a consensus model of a common research agenda.

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**Human Capital Initiative Report of the National Behavioral Science Research Agenda Committee**  
February 1992

- ◆ **Human Capital Initiative - Report of the Committee on the Changing Nature of Work**  
October 1993
- ◆ **Human Capital Initiative - Report of the Committee on Research Initiatives in Vitality for Life (Aging)**  
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# HUMAN CAPITAL INITIATIVE

## REPORT OF THE Committee on the Changing Nature of Work

JUNE 1, 1993

### Brief Summary

The nature of work is changing dramatically, and global competition assures that the rate of change will increase and intensify for the foreseeable future. Strengthening the skills and capacities of America's "human capital" is the key to assuring the future economic security of American companies and workers. *The Changing Nature of Work* analyzes key factors in these changes, and identifies potential contributions of research.

Technology is driving immense change in the ways workers use and communicate information, and in automated production systems, to name just two examples. Patterns of worker organization and interaction are also changing, as in self-directed work teams. This leads to changes in the skills required of workers, for instance, in mathematics, leadership, or initiative. Demographic trends are also crucial—the average age of the workforce is increasing, and more women and minority group members are participating in the workforce. Finally, workplace health and safety issues continue to grow in importance, as noted in the now well-known statistic that the single largest cost in producing a new car is health care for auto workers.

Over the years psychological research has contributed greatly to the productivity of America's companies and workers (see following page), and in this time of rapid change in the nature of work, researchers in all fields of the psychological, cognitive, social, and behavioral sciences stand ready to discover the knowledge needed to create a secure future. Here we identify many specific research initiatives in which immediate investment will yield immediately usable knowledge. Research alone will not solve all the problems brought to the fore by the changing nature of work, but neither will these problems be solved without research.

#### *The Changing Nature of Work*

*The Changing Nature of Work* is one in a series of companion documents to *The Human Capital Initiative*, each addressing a specific topic in greater depth. Growing directly out of the "Productivity in the Workplace" component of *The Human*

*Capital Initiative*, the current document gives brief overviews of problems facing the American workplace and also of psychology's contributions to knowledge and practice, and then reviews five key facets of the changing nature of work:

- ◆ Changing Technology
- ◆ Social Organization of Work
- ◆ Skill Training and Work Expertise
- ◆ Adapting to Growing Workforce Diversity, and
- ◆ Productivity and Worker Health

These are the dynamic frontiers of the workplace. Each one offers enormous opportunities and challenges for behavioral science which must help the nation keep pace with the changing nature of work by developing theoretical and practical advances in these areas within the next decade.

Not one of these problems is exclusively a problem of psychology. The nation's problems do not come in neatly partitioned disciplinary packages. In proposing these research initiatives we aspire to energize researchers from other related areas of study. The need for links with related disciplines, such as economics, management science, sociology, organizational behavior, human resource management, computer science, decision science, systems engineering, political science, anthropology, demography, education, medicine, occupational health, epidemiology, and biology, will be evident throughout the following pages. *The Human Capital Initiative* came from a collaborative process involving 68 psychological organizations, and we look forward to an even broader collaboration as researchers bring their talents and tools to bear on the challenges of the changing nature of work.

# Past Contributions by Psychological Researchers

## ◆ **Psychologists Have Responded with Innovative Practices and Technologies in Times of Great National Need.**

Shortly after the emergence of psychology as an academic discipline, psychologists made their first large contribution to meeting the nation's needs by creating the Army Alpha, an objectively scored, group administered mental ability test. It was used to classify 1,700,000 recruits during World War I. After the war, civilian editions became widely used in industry for employee selection. During the Great Depression, psychologists worked on problems of employment stabilization and training, and vocational guidance practice was put on a sound footing by E.K. Strong, G.F. Kuder, and others. Vocational counseling is still one of the most important interventions devised from psychological research. In World War II, psychologists again responded with scientific selection and classification methods, and also created efficient and effective methods for training pilots. Since then, research and application in these and related topics have flourished.

## ◆ **Today, Psychological Research Results Form The Basis for Effective Practice throughout The World of Work.**

Assessment centers are used in both the public and private sectors for making promotion decisions and planning employee development activities. Behavior modeling procedures are used in managerial and supervisory training. Surveys are used in marketing and political polling. Participative management, quality circles, employee involvement programs, and the total quality management

movement all are built in part from the results of psychological research. Even pay plans (e.g., incentive systems, piecework, skill-based pay, gainsharing) are closely tied to research in the psychological, social, and behavioral sciences. Of course, tests continue to be refined through computerization and to play important roles in employee selection.

## ◆ **We Are Now in a Period of Urgent National Need.**

The nature of work is changing. Given the global flow of money, technology, equipment, and factories, the future looks especially turbulent. Our economy is undergoing fundamental changes, and the principal challenge facing America's companies and workers today is to increase the economic value of our part of the global economy. The way to do it is through enhancing the skills and capacities of America's human capital.

## ◆ **Researchers Can Address Five Major Facets of This National Need.**

This document describes our current knowledge of the changing nature of the workplace and the workforce, and identifies needed basic and applied research and development. We cover in turn five major facets of change: (a) the technology, (b) social organization, and (c) skill needs of the changing workplace, and then (d) demographic changes in the workforce, and (e) issues of worker health. Along the way we identify potential contributions the research community can make to America's people and organizations.

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# The Critical Questions

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## *I. How Can We Make People and Technology Work Well Together?*

The future workplace will be more technologically sophisticated, demanding higher levels of skill to operate complex systems. Designers of systems need to know about human skills, problem-solving abilities, and limitations so that new technologies can assist people rather than frustrate them. Well designed intelligent systems can expand the limits of our technology.

## *II. How Can We Build Organizations in Which People Will Produce Their Best Work?*

There are now many more ways for people to communicate in the workplace. Many workers now communicate via computer stations rather than face-to-face or by telephone. Matrix organizations, flexible scheduling and staffing, temporary task forces, self-directed work teams, and other collaborative efforts will add to the complexity of the social organization of work. Whether and how they add to productivity needs to be addressed.

## *III. How Can We Train and Retrain Productive Workers?*

Changing technology and social organization requires changes in skills and expertise in a well-educated workforce that is able to adapt and learn continuously. Retraining displaced workers and training new workers are big challenges now and for the years ahead.

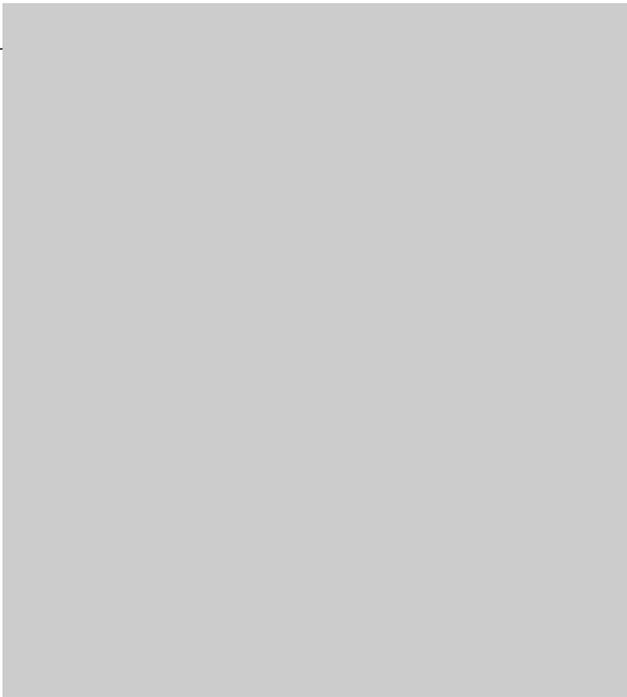
## *IV. How Must the Workplace Change to Adapt to the Growing Diversity of the Workforce?*

The composition of the workforce is changing dramatically. The average age of workers is increasing steadily, and we know far too little about age-related changes in productive capacity. Ethnic minority group members and women are entering the workforce in increasing numbers. By the year 2000 women will make up two-thirds of all new entrants into the labor market, and 29% of the new entrants will be ethnic minorities. Social changes also affect the workforce. Currently, more than half of all women with young children work outside the home, a figure that will likely rise given the growing need for workers. Quality child care programs and support services are needed.

## *V. How Does the Workplace Affect Worker Health?*

Health care is currently the fastest growing sector of the American economy. Employers are concerned about rapidly escalating costs. Employees, indeed all Americans, are concerned about access to high quality health care. The roles of psychological factors in health are becoming better understood. In the drive for health care reform, worker health and safety will require major attention.

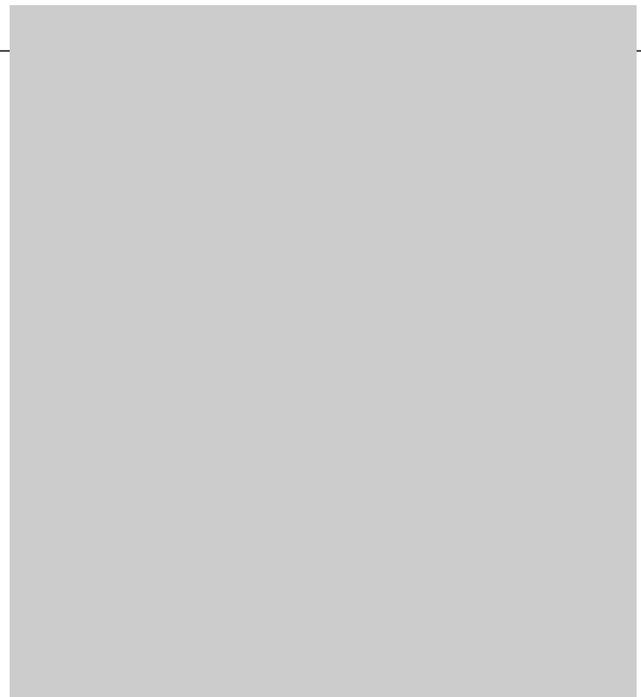
Each of these five questions is explored in greater depth in the following sections, along with the research needed to address them effectively. The report concludes with several recommendations.



Photos by David Hathcox

***New technology does not automatically yield enhanced productivity.***

THE CHANGING NATURE OF  
WORK COMMITTEE



***Retraining displaced workers and training new workers are big challenges now and for the years ahead.***

THE CHANGING NATURE OF  
WORK COMMITTEE

# CHAPTER 1

## Making People and Technology Work Well Together

### **New Technology Does Not Automatically Yield Enhanced Productivity.**

Every discussion of productivity and competitiveness notes the tremendous influence of technology on the workplace. The emergence of computerized technology, and particularly automated systems, is the 20th Century's industrial revolution. New technology creates new requirements and opportunities for workers. Depending on its design, technology can provide resources for worker productivity and satisfaction, or it can present stumbling blocks. For example, of 2,000 U.S. companies that installed high technology production equipment, 40% reported they have not achieved their intended results. Some of the causes of failure were technological; others were psychological and social. Behavioral science research has the potential to address both kinds of problems.

### **Keeping Up with Technological Change Is Challenging.**

The present pace of technological change is frantic. National and global competitive pressure is driving new product introductions to record level. For example, applications software for personal computers today has a half-life of about two years. With each change in software, users must unlearn old terminology and behaviors and learn new ones. As with any technological upgrade, productivity is interrupted and degraded as users overcome the effects of negative transfer and struggle to learn new skills and rules.

### **To Be Most Productive, Workers Will Need To Know Their Machines Better than They Know Them Today.**

To perform ably and responsibly in the changing workplace, people must be able to understand machine actions. This is a formidable task, involving not just observing outcomes, but also apprehending the process by which the machine takes actions. We foresee increasing numbers of jobs in which people will act as interpreters between machines and clients. A recent study of expert systems in the insurance industry found, for example, that claims processors were no longer able to explain unreimbursable expenses to clients because the computer-based expert system hindered access to previously available information. People in the interpreter role must be able to combine their understanding of the client with their understanding of the machine. We need to know more about how people do these things in order to make maximum use of the capacity of advanced machines.

### **Productive Technology Will Have to Be Engineered with Human Capacities in Mind.**

It's easy to say that technologies should be designed to fit the needs and abilities of people in the settings where the systems are to be used. Doing it is something else. Computers to be used in the workplace must be designed with an appreciation of the capacities, limitations, preferences, and tendencies of operators. One of the most striking psychological aspects of high tech jobs is that motor, perceptual, and even some decision-making requirements are being amended by automated devices and "intelligent" computer programs. Thus, new cognitive skills become essential as workers at every level are required to deal with machines that process information as well as materials. Computer software must be designed and implemented to enhance cognitive abilities of its users, and to facilitate communication and cooperation among groups of workers. There needs to be cooperation and fit between computer capacity and human capacity. To achieve such synergy, we need to understand better the human cognitive and social processes as well as the human-computer interface.

### **Social and Behavioral Science Research Results Can Enable People And Technology to Work Well Together.**

We know much about perception, cognition, and human performance that can aid in the design of complex information systems. At the same time more basic and applied research in cognition, perception, and human performance is needed to answer the challenges posed by placing such information systems into work settings as diverse as naval ship war-rooms, nuclear power station control centers, and the trading floors of major stock markets.

### **Researchers Can Enable the Design or Redesign of Systems for Maximum Productivity.**

Psychological research can provide methods for evaluating technological systems as they are used by people, and can show how characteristics of people affect how technology actually gets used or misused. By observing and analyzing people using information systems, researchers can identify positive and negative features of systems as resources for workers' activities, and for system designers.

### **Researchers Can Design More Effective Ways to Introduce New Technology.**

Research can lead to understanding basic ways to diminish productivity losses while new technology is introduced. This research can focus on (a) how to reduce the interfering effects of negative transfer, (b) ways to implement systems to facilitate transitions to new or enhanced technology, and (c) ways to design “expert help systems” that detect and diagnose user problems and errors and propose corrective actions by means of on-line-in-task coaching and prompts. A closely related issue concerns whether different strategies are required for introducing and using machines that take over tasks previously thought to require special human skill, such as planning or decision making.

### **Researchers Can Enable Fast, Efficient, Thorough Training of Workers.**

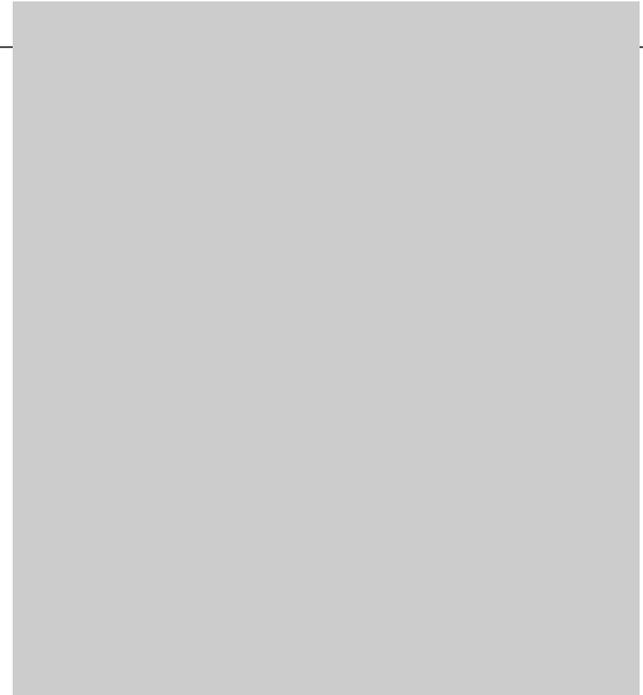
Since the new information technologies can be adapted to teaching, research can address the need for information systems to enhance learning that occurs as people do their work. The design of “intelligent tutoring systems” is being pursued both in psychology and computer science, and such work needs to come out the laboratory and into applied research and development in education and industrial training.

### **Researchers Can Enable “Smart” Technologies that Don’t Outsmart Their Users.**

The changes wrought by technology are also creating workplaces in which people are increasingly involved in team efforts with “smart machines.” Research can explore the psychological aspects of this new world of work, including issues of attributing responsibility and commitment to technological systems. Research on characteristics of distributed systems with interacting human and computer components can accelerate the development of more productive systems.

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***. . . new cognitive skills become essential as workers at every level are required to deal with machines that process information as well as materials.***

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## CHAPTER 2

# Building Organizations in Which People Will Produce Their Best Work

### How Productively People Interact Is Determined by the Social Organization Of the Workplace.

Among the many changes occurring in the nature of work is a major shift toward activities involving more communication and cooperation among people. As automation reduces human work in routine tasks, people's work becomes increasingly interactive, focusing on coordinating activities and communicating among individuals, teams, and departments. Factors such as "organizational climate" and the functioning of work teams will become more crucial in the success of organizations. Also, U.S. businesses are embracing principles of Total Quality Management and other alternative management strategies to increase productivity, change work roles, increase the ratios of subordinates to supervisors, and define new performance standards. These new practices frequently introduce the requirement that workers observe and evaluate their own work output and make work decisions in teams.

### Communication Patterns and Authority Relationships Are Changing.

The introduction of electronic mail and fax communications to workplaces has affected fundamentally the performance of individuals and work organizations. Face-to-face and telephone conversations have been replaced by less personal channels of communication. Work activities are interrupted frequently, requiring workers to attend to more tasks. Hierarchical authority structures are replaced by inter- and intra-organizational networks.

### Motivation and Satisfaction Are Changing As Well.

Changes in the nature of work and the workforce are creating significant challenges for maintaining and enhancing motivation and morale in all types of organizations. Motivation lies at the core of productive organizations. When effective motivation programs are implemented, job and organizational commitment are increased and members experience greater satisfaction and better health. Changing technologies and innovative organizational structures create complexity requiring flexible and adaptive responses by managers and workers.

### To Build Productive Organizations, the Interactions of Individuals with Organizations Need to Be Understood.

Research in organizational psychology has identified many important phenomena in work group settings. But research has not had its maximum beneficial impact on organizational development and management, because (a) this country's research structure has not facilitated transfer of basic knowledge to application, and (b) basic researchers know many of the major phenomena that regulate group behavior but they understand less about the ways in which these phenomena interrelate in applied settings. Thus, a complete research program must include basic research in applied settings and in large-scale simulations.

Programmatic research linking basic, developmental, and applied research in organizations has three advantages: (a) Knowledge is enriched by study of complex behavioral

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interactions; (b) Forming, prototyping, testing, refining, applying, and evaluating intervention theories is facilitated; (c) Knowledge from basic and developmental research can be applied efficiently, rapidly, and routinely to improve the management of organizations.

### **Behavioral and Social Science Research Results Can Be Used to Build Organizations in Which People Will Produce Their Best Work.**

#### **To Change Organizations Effectively, Scientists Need to Study Them from Multiple Viewpoints.**

Organizational change is a complex process that looks different from different points of view. Much of our scientific understanding of organizational change uses a selective perspective in which phenomena are viewed in global terms (e.g., the organization's culture), individual terms (e.g., the need for workers to acquire new skills), or in some intermediate terms (e.g., the need for new work teams to develop). When an organization commits to changing, however, it cannot afford to focus on one perspective to the exclusion of the others. An expanded interdisciplinary research program to study organizational change can accelerate our understanding of organizational design principles. Integrating and unifying across these perspectives our understanding of organizational learning, norms and leadership, attitudes, motivation, and skill acquisition can significantly benefit organizations' efforts to improve their effectiveness.

#### **Scientists Can Identify What Motivates Productivity for Individuals, for Work Groups, and for Organizations.**

Individuals are motivated in part by the promise of pay and security and a job which offers opportunities for autonomy, growth, and contribution to the organization's mission. Research indicates that providing knowledge of results through feedback of performance data is immensely powerful in guiding a reinforcing performance change. Reliable

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performance measurement, provision of feedback to employees, and arranging some portion of pay dependent on individual or group performance have worked well to enhance motivation and productivity in a variety of organizations. Providing employees with information and feedback also permits greater independence and self-direction. Increased authority and autonomy, coupled with knowledge of results, creates a committed, responsive, and effective worker. Most organizations' incentive systems include only regular salaries and fixed benefits, but current research shows that flexible compensation and benefit systems can improve motivation and be responsive to cultural and gender differences. Providing workers with the opportunity to design their own wage and benefit packages may enhance motivation and commitment with minimal additional costs. These strategies and others which are sensitive to worker needs must be rigorously studied and tested.

### **Behavioral Scientists Can Discover What Organizational Groupings Lead to the Best Teamwork and the Most Effective Problem Solving.**

Many state-of-the-art management systems depend on collaborative effort and teamwork. Decision task forces, quality circles, and self-directed work teams have been and will be used to harness the benefits of creative problem solving. Many organizations, however, have hastily and superficially adopted such interventions without understanding the probable consequences of their haste. Effective teamwork requires outstanding leadership, and teams that are diverse in gender, ethnicity, and nationality will demand leaders with effective skills and flexible methods, leaders who are able to create workplaces that are free of sexual and ethnic harassment. Knowledge about effective leadership must be melded with information about diversity management, intergroup relations, and team-building to provide the basis for effective supervision in the 21st century.

### **Researchers Can Discover Ways to Improve Organizational Communications.**

How can the physical and social arrangements of work settings be organized to promote effective participation by the people who work there? What characteristics of technologies and social arrangements facilitate communication and productive learning by members of the work group? Studies of ways in which technologies and social arrangements facilitate learning and performance can help organizations to train new employees and to evaluate the costs and benefits of reassigning workers among work groups. Research using naturalistic and longitudinal methods can measure the comparative impact of electronic and other communications in the workplace. Particular attention should be given to performance output, job stress, worker satisfaction, perception of control and personal privacy, and product quality. Research can also help us to understand ways that computer and communications technology can change lines of authority and power.

## CHAPTER 3

# Training and Retraining Workers to Maintain And Increase Productivity

An educated, skillful workforce is the foundation of an enduring competitive national economy and the source of maximum opportunity for all workers, and therefore the priority for developing work skills is paramount. Several trends are evident:

### **Productivity in the Service Sector Has Long Been Stagnant.**

For some time the national economy has been shifting away from manufacturing to service industries. From 1953 to 1984, service jobs accounted for about 90% of all new nonfarm jobs. In 1986 they accounted for 68% of the U.S. GDP and 71% of U.S. employment. But productivity growth in the service sector has been stagnant (zero growth from 1973 to 1985), although manufacturing productivity grew 2.2%.

### **Corporate Downsizing Leaves Many Displaced Workers Who Must Be Retrained and Returned to the Workforce.**

Restructuring and reductions-in-force among the largest U.S. corporations requires retraining of displaced workers to compete for alternative jobs. Thus, while overall unemployment is not generally higher than at times in the past, reemployment depends more on reskilling now than in the past. Quite often "reskilling" means "taking a lower paying job." Many high paying jobs simply no longer exist.

### **Output Per Worker Must Rise Because the Labor Pool Is Changing.**

With slow growth in the number of new workers (about 3 million new entrants per year in the late 1970s and about 1.3 million new entrants per year in the early 1990s), the nation's goals for increasing economic growth will require an overall increase in output per worker. This requirement contrasts sharply with the prevailing belief that new workers are poorly prepared for today's and tomorrow's jobs. Decreasing math and verbal SAT scores are commonly interpreted as reflecting an overall reduction in basic, job-relevant skills (though part of the score drop is due to broader participation in testing). The increasing proportion of minorities among new workers has been used to predict lower levels of work skill because minorities frequently score lower on assessments of work-related skills and abilities. At the same time, many new jobs are generally thought to require higher skill levels. As a result of these trends, we need to understand and act on the changes now occurring regarding skill training and work expertise.

### **Legal Requirements Are Changing.**

Legislation such as the Americans with Disabilities Act and the Civil Rights Act of 1991 and case law regarding the employment rights of individuals are establishing new opportunities and responsibilities for employers, educational institutions, and employees. These legal issues raise questions of skill equivalency.

### **The SCANS Skills and Competencies May Provide a Framework for Understanding and Improving Job Performance.**

A large-scale start was made in 1991-92 by the Department of Labor's Secretary's Commission on Achieving Necessary Skills (SCANS), which identified a foundation of skills and competencies required for high performance workplaces. SCANS skills (basic, thinking, and interpersonal) and competencies (resources, information, systems, technology, and personal qualities), when fully validated, can serve as common measures to link educational objectives to occupational requirements across organizations. Schools have widely varying curricula, educational objectives, and assessment outcomes. Employers have widely varying selection criteria and training and job performance requirements. Validation research is required to build on the SCANS competencies and skills so that they can generalize across organizations and jobs. Current work by the Departments of Labor and Education to examine work-based learning and literacy could benefit from basic research of this kind.

### **Researchers Can Develop Measures of Work Skill that Bear a Consistent Relation to Job Performance across Work Settings And across Worker Types.**

Research directed at the measurement of work skills would have at least two specific objectives: (a) Development of common measures of skills and job performance calibrated at consistent levels of specification to be used across studies to accumulate data on the interrelationships among skills and performance, and (b) Determination of differences in both the importance of culturally differentiated skills and the construct validity of specific measures for specific skills. This latter objective has especially high social value in light of the persistent group differences found on many frequently used skill measures and the equally persistent claims that such differences are, to some degree, the result of irrelevant

differences between groups, or to biases.

### **A Model of Job Performance that Is Valid across Workplaces and Links Education and Training To Work Should Be a Goal of Research.**

Job performance needs to be more fully examined. Performance is defined by each organization separately, depending on its objectives and purposes and is almost always viewed as a single criterion. However, the research that has been conducted on job performance strongly suggests the need for a multiple criterion model. Research is needed to develop a conceptual model of job performance that specifies its determinants and its critical dynamic properties. Only through a comprehensive examination of the structure of work, organizational, and individual factors can we more fully understand the dynamics of performance.

### **Researchers Can Determine the Relative Contributions to Job Performance of Skill, Expertise, Work Setting, and Personal Characteristics.**

The primary social value motivating research on skills is the understanding and optimization of human work performance. Thus, we need to learn much more about the causal linkages and moderating conditions among skill levels, skill acquisition, and all important aspects of work performance. While considerable research has established the performance relevance of cognitive abilities, biographical information, and personality attributes, the relative contributions of these and other personal characteristics to all aspects of work performance have not been fully established. For example, we need to study the extent to which skills differentially relate to productivity, helping behavior, team leadership, performance reliability, dependability, and other aspects of work performance.

Also, the manner in which combinations of different skills can compensate to cause performance is not known. This includes studying the dynamics of skills shown in the progression from inferior to typical to maximal performance by people ranging from novices to experts. These research issues are captured, in part, by investigation into the creation and maintenance of expertise. The increasing diversity of the workforce requires a consideration of the ways in which different combinations of skills result in comparable job performance. This research is particularly important in light of the "reasonable accommodation" provisions of the Americans with Disabilities Act. This Act greatly enlarges the opportunities for persons with disabilities to be placed in the workforce.

### **Researchers Can Increase Productivity by Increasing the Education, Skill, and Expertise Levels of the Workforce.**

The most compelling motive to support research on work skills is that national economic competitiveness would grow and individual opportunity would be maximized to the extent that knowledge about skills and performance is effectively

transferred to education, training, business organizations, and individuals in ways that efficiently and effectively increase workers' skills and performance. Research needs to address the most fundamental skill development question "What is to be learned?" at three key learning points—education prior to entry into the workforce, structured job-specific training, and individual spontaneous skill acquisition.

To address skill development effectively at these learning points, five major thrusts need to be pursued:

(a) Linking the SCANS or other skills taxonomy to development methods and techniques is particularly critical for pre-entry educational programs that are necessarily more generic and foundational than job-specific training. The likelihood of pre-entry education affecting work performance depends on the relationships among program objectives, skills, and work performance.

(b) Applying existing instructional technologies of demonstrated effectiveness for enhancing work performance offers perhaps the best promise for short-term benefits in both pre-entry educational programs and job-specific training programs.

(c) The basis for developing and assessing new instructional methods and technologies is the clearer understanding of component skills and abilities for participation in work settings. This mapping of skills onto work performance will be the basis for developing instructional methods and techniques that are grounded in an understanding of work performance. Research should address the most effective approaches to both systematic and spontaneous learning, including environmental factors, readiness factors, cultural differences, and retention.

(d) Because of the applications orientation of much of the research serving the skill development goal, it is important that researchers include analyses of the economic consequences of skill development programs. Particularly significant are the utility issues associated with reskilling programs directed at older workers with shorter payback periods and basic skill development programs directed at the hard-core unemployed with lower payback probabilities. Since business spends approximately the same (more than \$200 billion per year) on training and education as U.S. governments do for public education, the investigation of utility is critical. Research on utility will need to focus not only on organizational utility but also on individual and societal utility.

(e) Additional basic research on the general psychology of learning and cognition can yield knowledge that will be enormously useful in pursuing the other four thrusts.

## CHAPTER 4

# Adapting the Workplace to a Diverse Workforce

To build a productive workforce, we need answers to critical questions:

### Where, How, and How Long Should Older Workers Work?

The average age of the population of the United States is steadily increasing. Due to increased longevity and decreased birth rates, the proportion of people who are over the age of 60 is at an all-time high. Moreover, people born during the post-war baby boom are poised to enter late adulthood, increasing the proportion of older adults in the society to an unprec-

edented level. Many of these people will stay in the work force into late adulthood—both necessity and desire contributing to their continuing participation. Lack of younger workers will reduce the financial base for the social security needs of retirees from the baby boom era and generate openings in the labor market for older workers. At the same time, older adults may take advantage of continuing good health to stay in productive and rewarding jobs. Others in retirement may make volunteer contributions through community and educational organizations, or by providing child-care or other services.

At present, little is known about the potential for adults to continue working into late life. It is known that cognitive functioning is a strong predictor of work behavior for extended periods of time, and that older adults show measurable declines in cognitive function including decrements in reasoning, long-term memory, short-term memory, and spatial abilities. Additionally, aging is accompanied by psychomotor slowing on the performance of virtually any cognitive task. Older adults take approximately twice as long to acquire new computer software skills compared to younger adults, but given sufficient training time they can achieve the same levels of performance as the young.

There is also evidence that older workers have the most trouble with tasks that require speed and short-term memory, such as tasks required in the job of air traffic controller. In other professions it has been demonstrated, however, that the relationship between age and job performance is positive. Despite the documented declines, it is paradoxical that numerous studies have shown there are no systematic relationships between age and work performance. The underlying mechanisms accounting for negative vs. positive relationships between age and work have yet to be discovered. Further research can help to find ways to maintain and enhance worker productivity into old age.

### How Do the Needs of Workers and the Nature of Their Contributions Change During Their Careers?

We need to have an understanding of the process by which individuals make major life transitions from training programs and educational institutions into jobs and career paths. We also need to understand how job and career changes affect both the individual and the work environments that he or she enters or exits and how work motivation changes as the individual moves from young adulthood through mid-life to retirement.

***A stable, well trained and productive workforce depends upon our ability to understand and anticipate adjustments needed in the work roles, family roles and organizational structures . . . .***

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Concerning the teenage years we need to learn about the links among part-time employment, school grades, skill acquisition, and other behavior. Some believe that working teenagers acquire skills and experiences that are useful later in life, but the time they spend at work is time not spent on school. This helps to explain why employed teens have lower average grades and are more apt to drop out of school. As noted in the previous section, we need to find effective ways to help adolescents combine work and schooling, and to ease the transition between the two “worlds.”

In addition, we also need to learn about how individual members of diverse subpopulations make major life transitions from education and training to jobs, career paths, and career changes. We also must learn how work motivation and performance changes across the life span. We need to study the relationships between occupational choices, lifestyles, and cultural identity.

### **How Can We Better Use the Talents of Members Of Ethnic and Racial Minority Groups?**

As noted at the outset, a growing proportion of the workforce will be made up of members of ethnic and racial minority groups in the coming decades. Historically, members of these groups have had limited access to the educational opportunity that would prepare them well for productive roles in the workforce, and there have been problems with fair hiring and promotion practices in the workplace itself. The stigmatizing effects of racial labels are well known. Now the nation finds that it can no longer afford to waste the talents of any of its people. As recently stated by one of the nation’s governors, employment of members of ethnic and racial minority groups is no longer just an issue of fairness or justice—it is a matter of economic necessity. The growing diversity of the workforce presents unique opportunities and unique problems to business and industry. The rapid growth of consulting firms dedicated to diversity training attests to the widespread belief that future corporate effectiveness requires doing things differently. The empirical research base to support improved practices is currently negligible, and needs rapid and vigorous expansion.

### **How Can the Full Potential of Women in the Workforce Be Realized?**

The U.S. Department of Labor reported 6 years ago that, for the first time in history, more than 50% of adult women are in the workforce. It is estimated that by the year 2000 women’s participation rate in the workforce will reach 63%. The increase in working women, coupled with the decline in the proportion of men in the workforce, calls for a better understanding of the effects of gender on workplace dynamics.

Recent findings suggest that women are better able to compartmentalize their work and family roles than are men, who exhibit greater spillover between the two domains. This research suggests that men who are experiencing difficulties

within the family are more likely to exhibit diminished physical and mental health as well as attendant difficulties on the job. For the benefit of the workers, and for the resulting gains in productivity, individual and situational differences need to be investigated.

Review of the proportion of women in executive, managerial, and administrative positions in the United States reveals a rapid increase. Department of Labor statistics show that the percentage of women managers has increased from 16% in 1970 to a current level of about 40%. Most of the “new” women managers are in entry-level managerial positions, and they may encounter the glass ceiling without ever advancing into middle management. The height of the glass ceiling has been found to be much lower than first thought. It is estimated that between the years 1990 and 2005 the U.S. will need 600,000 new managers and top executives, so research on gender and workplace dynamics needs to contribute not only to enabling women to advance beyond the glass ceiling, but also to maximizing workgroup productivity regardless of its gender composition and leadership. There is little empirical foundation for the popular literature on women’s working relationships, and sex role stereotypes do not offer useful guidance for managing productive organizations.

### **How Can Healthy Families and Well-adjusted Children Be Fostered in a Society in Which Parents Must Work Full Time?**

Patterns of family life are changing. In 1955, 60% of American families were composed of a male breadwinner and a female homemaker. By 1985, that figure had dropped to less than 7%. The American family is in the midst of a major structural transition, and major adjustments are required. Too many employed mothers of young children are exhausted, life is hectic for their families, and many of the social supports that maintained high levels of productivity among American workers are diminishing or unavailable. In their place is a wild variety of child care arrangements, shift and flex schedules, and new family and occupational stresses with which to cope. The cost in terms of lost work output and increased health care costs is tremendous. Elder care is also becoming a family issue of major concern.

A stable, well trained and productive workforce depends upon our ability to understand and anticipate adjustments needed in the work roles, family roles and organizational structures that support workers’ abilities to adapt to the changing workplace in a constructive and competitive fashion. High quality non-parental child care is not harmful to young children, but many children do not get it. Research on the components of an affordable, quality care system in the United States is needed to ensure that the future workers of this country grow up to be emotionally, intellectually, and socially healthy adults. Recent research has clarified the relationships among employee stress, morale, participation, and investment in work organizations, but we need to know much more about the relationships between familial supports and worker performance.

## CHAPTER 5

# Creating a Healthful Work Environment that Supports Productivity

The health of the nation's workforce is one of the most significant concerns of our time. There is now widespread recognition that psychological disorders constitute many of the most important health threats to this nation and impact negatively on the productivity of individuals and the competitiveness of organizations.

### One Measure of the Worker Health Problem Is Its Present Cost

Workers compensation payments more than doubled from \$13.6 billion in 1980 to \$27.4 billion in 1987 with occupa-

tional stress claims accounting for 11% of all claims. The average cost of these claims exceeded that of all other types of claims. Social Security disability awards for mental disorders have surpassed all other types of awards with a prevalence rate of 25%. Nearly 600,000 workers are disabled by psychological disorders with annual payments of \$5.5 billion and lost wages of \$10 billion. The total direct and indirect costs for stress related and mental disorders is now about \$100 billion.

### Visible Costs Substantially Underestimate the Total Cost of Mental Disorders in the Workplace

Many disorders go untreated or do not result in claims, even while disrupting workplace performance. The true magnitude of the problem is perhaps best defined by a recent NIMH study which found that 17% to 23% of adults were afflicted with one or more major psychological disorders during a 6-month period, with lifetime prevalence rates between 29% and 38%. Creating an effective workforce from a population in which 20% to 30% of the workers are emotionally or mentally impaired is certainly one of the more complicated tasks that we face in contemporary America.

### In View of Their Cost, Surprisingly Little Is Known Scientifically about Workplace-related Psychological Disorders

Little is known about the effects of mental disorders, emotional disorders, and personality disorders in the workplace. The relationships between conditions of work and mental health must be specified if we are to create work situations in which individuals can function effectively. Even less is known about the interaction between workplace events and the family life of those who are afflicted. Such knowledge is necessary. Research is needed on the effects of pre-existing mental, emotional, or personality disorders on performance in the workplace. These disorders influence (usually inhibit) performance at work but their effects are poorly understood. Furthermore, even the knowledge already acquired is not widely available in the workplace where it could aid management decisions and facilitate interactions between personnel.

Research is also needed on the circumstances under which workplace events can create mental, emotional, or personality disorders in individuals not previously exhibiting them to a clinically significant degree, or exacerbate such disorders in individuals already prone to them. At present, little is known about the types of events in the workplace that may cause or

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exacerbate such disorders and hence there is no factual basis for either corporate or government policies designed to maintain a mentally healthy workforce. The extent to which workplace stressors represent one source of psychosomatic disorders, leading to increased health care costs or even disability, is not known. Research is required to examine both the personal and financial consequences of stress-induced disorders stemming from conditions at work. Such research should include the evaluation of the effects of substance abuse on workplace performance, and the role of workplace stressors that promote substance abuse.

### **We Need to Know More About How Psychological Disorders Affect the Work Environment and about How Work Environments Create or Exacerbate Such Disorders**

Research is needed to evaluate the effectiveness (costs, benefits, potency, and longevity of effects) of programs aimed at enhancing physical and mental health through exercise, motivation, and weight control. In the past decade, research has demonstrated that there is a direct link between behavior and most reported health problems. Psychological disorders in the workplace include not only what the worker brings to the job, but what the job brings to the worker. Increased research is needed that focuses on the prevention of psychological and medical disorders. Four cornerstones of such research would include: (a) examination of well-designed and rewarding jobs, (b) early detection systems to detect disorders and underlying risk factors, (c) prevention of health problems and occupational accidents in the workplace, and (d) how to optimize training and education of workers and managers on the signs, causes, and effects of work-related disorders. Cross-sectional studies and longitudinal studies are needed to build on the limited amount of such research undertaken by the National Institute of Mental Health and supported by National Institute of Occupational Safety and Health.

### **We Need to Know How to Schedule Shiftwork To Maximize Safety and Productivity**

About 20 million Americans are shiftworkers. Shiftwork schedules are often poorly designed to accommodate the body's biological rhythms. Poorly designed schedules cause physiological and behavioral disruptions that drastically impair the productivity, safety, and well-being of the worker. When the impaired workers are medical care personnel, nuclear power plant operators, or airline pilots, the safety of many other people is also at risk. Basic research has revealed much about the neural mechanisms that control the body's biological rhythms. Especially important is the circadian cycle underlying sleep-wakefulness, arousal, and the level of sensory-motor and cognitive performance. In 1991 an Office

of Technology Assessment report, *Biological Rhythms: Implications for the Worker*, called for a program of research to apply what is known about biological rhythms to the workplace. Such a program could provide countermeasures that would improve safety and productivity.

### **We Need to Know How Drugs Intended to Control Some Psychological Disorders Are Affecting Performance in the Workplace**

An increasingly wide variety of psychological and psychiatric disorders are amenable to treatment with drugs. The development of drugs with fewer deleterious side-effects represents one avenue to improving both the quality of life and the productivity of the individuals for whom these drugs are prescribed. Indeed, workplace performance might be an explicit criterion used to determine the effectiveness of such drugs in clinical trials. This is already an active area of research with pharmacologists, neuroscientists, psychologists, and psychiatrists providing the skills required for the development of improved drugs.

### **We Need to Know How Exposure to Workplace Chemicals Affects Behavior**

Some work environments involve exposure to hazardous materials. Psychopharmacologists, behavioral toxicologists, and other researchers can conduct research to document the behavioral effects of exposure to a variety of toxic chemicals in the workplace. This research would focus on the short-term and long-term effects on health and work performance of individuals exposed to such toxins in the course of their assigned duties. It would also focus on the responses of animals experimentally exposed to toxins as a means of estimating the type of damage expected in humans as well as the levels of permissible exposure.

### **Substance Abuse at Work Also Requires Additional Study**

Research on the causes, consequences, and prevention of drug and alcohol abuse is currently carried out in a variety of contexts, and should in time allow us to reduce losses in productivity and dangers to workers due to drug abuse. Health and safety in the workplace depends critically upon the willingness of employees to adhere to safety regulations and behave responsibly towards potential hazards in the work environment. Additional psychological research sponsored by the National Institute of Drug Abuse, the National Institute of Occupational Health and Safety, and the Centers for Disease Control can contribute greatly to the development of guidelines and incentives for safe behavior.

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## Conclusions

### **The Psychological Sciences Can Bring Significant Capabilities and Resources to Bear on the Challenges Posed by the Changing Nature of Work.**

#### **A Science-Based Approach to Productivity Issues Holds Major Advantages.**

First, new information collected within the context of scientific models can be combined with existing information in an orderly way. The result is development of a cumulative intelligence that can be used to further science and to provide more effective solutions to practical problems. Second, existing research findings can be refined and extended to pressing problems, thus permitting organizations to take advantage of a great deal of knowledge which has already been gained. A science-based approach could well reduce reliance on fads in management which have consumed much time and many resources with little systematic gain.

#### **Current Knowledge About Human Behavior Can Be Applied Now to Improve Workplace Efficiency.**

We have developed significant bodies of research methods and findings in our studies of organizations. These scientific resources are the basis for developing integrated knowledge and theoretical understandings of organizational change. New research would build on the considerable knowledge base that has already been established, for example, in the areas of cognitive abilities, physical and psychomotor abilities, task functions, biographical factors, and personality attributes.

#### **Both Traditional and New Research Tools Need to Be Applied to As Yet Unanswered Questions.**

Longitudinal research designs are among the traditional tools that, when used in actual organizations, can capture dynamic processes. Among new tools are the use of field observations and videotaped records of social interactions. Such tools yield reliable data while conveying the richness and variability of natural settings. For example, concepts and methods drawn from comparative, cognitive, developmental, and social psychology, animal behavior, psycholinguistics and sociolinguistics, and ethnographic anthropology and sociology are used in the analyses of videotaped materials. Both traditional and emerging research tools need to be used in actual organizations to bridge the gap between basic research and application. Worksite basic research could provide

analyses of successful and unsuccessful efforts to change organizational practice, and thereby improve our intervention theories.

#### **Mathematical and Computer-based Techniques Make It Possible to Find Answers to Workplace-relevant Questions that Otherwise Could Not Be Investigated Adequately.**

Mathematical modeling and computer-simulation are important avenues for understanding human cognitive processes, because of the increasing complexity of the problems being attacked. For example, a computer-based information retrieval system requires a model of the cognitive processes of the user. Among the considerations in such a model are the structural organization of the relevant memory domain, the nature of memory retrieval, psycholinguistic and linguistic factors, psychological similarity and association, and programming and machine-intelligence. The interactions inherent in large-scale systems make intuitive modeling and predictions unreliable. Even when more limited aspects of cognition are explored, the postulated underlying mechanisms are usually complex enough that mathematical modeling and computer simulation are needed to guide intuitions and produce predictions.

#### **Refinements in Research Methodology Make Further Progress Possible.**

The development and refinement of research methodologies (i.e., experimental design, measurement theory, data analysis algorithms, statistics, and model testing procedures) is crucial to progress in the behavioral, psychological and cognitive sciences. Methodological difficulties in psychology are particularly challenging. People differ greatly from each other, and their behavior is highly variable and can change significantly over time, even within the course of a brief experiment. Research methodology is often neglected by funding agencies. Programs for encouraging and supporting methodological research would provide valuable support for research advances in understanding work performance and skills.

#### **Americans Should React Effectively to the Many Needs and Challenges Posed by the Changing Nature of Work.**

Unprecedented collaboration between the private and public sectors will be needed to apply our current base of scientific knowledge insightfully and to expand this same knowledge

base. Basic psychological research will provide additional knowledge needed to improve our effectiveness in designing equipment and work environments, organizing work, and effecting adjustment to work.

### **New Partnerships among Government Agencies, Universities, and Industries Can Provide for the Generation, Communication, and Use of New Knowledge.**

If research is going to benefit organizational development and management, two changes in research support need to take place: (a) Government and the private sector, the traditional supporters of basic research and applied research respectively, need to form partnerships to support a full program of basic, developmental, and applied research in organizational behavior and change. In this way, the historic lack of interchange between basic research and application may be corrected. One element of this program would be support for developmental research in which goals of research and solution of practical problems are combined in integrated activities. (b) Support for basic research needs to provide many new opportunities to study complex organizational behaviors in natural settings and to develop additional research tools to carry out such studies. These studies require contributions of concepts and methods from multiple research disciplines, and interdisciplinary research teams need to be encouraged.

### **Gaining the Benefits of Research Will Require Burden-sharing Agreements Between the Public and Private Sectors.**

Research facilities agreements will be needed to provide opportunities for worksite and laboratory experimentation and

observation, along with research plans that relate basic, developmental, and applied research activities, and continuing evaluation. Professional organizations may serve as coordinators, linking academic researchers to companies and providing information on organization history and climate.

### **Special Efforts Need to Be Focused On Small Businesses.**

Major corporations and government agencies, particularly the Department of Defense, have large, ongoing programs of research and development that focus primarily on their specific needs. These efforts are generally productive, and incorporate contextual information that is crucial for conducting meaningful research and development. Equivalent efforts for small businesses would be very beneficial to our society in increasing both productivity and worker satisfaction. Both the Department of Labor and the Small Business Administration should undertake programs of research that include grants to industry-government-university partnerships and consortia for basic, developmental, and applied studies of technological and social changes in work. The National Science Foundation could be a useful partner and source of research management expertise in these programs.

### **Final Word**

Challenges to America from the changing nature of work require expanded programs of basic and applied research and development aimed toward increasing American productivity and enhancing the welfare of American workers.

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