Chapter 10

Policy Issues and Options

Contents

Table

Chapter 10

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Introduction

The central policy question that emerges from OTA'S computerized manufacturing automation assessment is, "Should there be a national strategy for the development and use of programmable automation (PA)?" Although such a strategy could take many forms, the fact that the opportunities and problems posed by programmable automation are interconnected makes it appropriate to consider a policy strategy combining actions in several areas. PA may well become an important factor in national productivity growth and improvement in economic performance, but the spread of this technology can aggravate existing social and economic problems as well as create new ones for individual regions and for the Nation as a whole. While the potential for PA to benefit industry and the economy counteracts arguments for slowing its spread, the risks inherent in rapid diffusion raise questions about whether, and how, the spread of PA should be accelerated. Among the principal motivations for policy are:

- The immaturity of PA technology and limited experience with its application. Although current technology is applicable in many situations, further development and applications experience are needed before its potential for improving productivity, work environment, and product quality can be fully realized.
- The competitive environment in which PA development and use are taking place. Governments in countries that are or may become U.S. trading partners are encouraging the development and use of PA abroad, while markets for many goods and services, including PA equipment and systems, are becoming increasingly international. Both situations militate against complacency.
- The risk of growth in unemployment. In the absence of growth in production levels, PA maybe associated with unemployment, especially in the East North Central, Middle Atlantic, and other areas where PA use is expected to be heavy, and where local economies are vulnerable to import competition and other economic factors.
- The risk of adverse effects on the psychological aspects of the work environment. These effects, arising from the combined influences of new technology and job design, may not only diminish productivity gains from PA, but may constitute new health problems. Collective bargaining will allow only a fraction of the labor force to resolve these problems on their own. Because PA and structural changes in the economy will limit the number and range of manufacturing jobs available, many workers will become less able to move out of disagreeable situations.
- The ramifications for education, training, and retraining at all levels. The appropriateness of the mix of skills within the labor force governs both the rate at which PA can be developed and used, and the extent of adjustment (through retraining or relocation) that maybe necessary given changing skill requirements. The challenges posed by PA and other new technologies come at a time when the capacities and resources of the instructional system are particularly strained.

As the above list indicates, there are factors that motivate policy promoting PA (technological immaturity and international competition) and factors that militate against accelerating PA adoption or that support complementary policy in other areas (the risks of

worsening unemployment and work environments and the need to assure appropriate instructional capacities). Furthermore, concerns raised by PA are also aspects of larger policy problems. Competitiveness and unemployment, for example, reflect many circumstances, not just use of new technology. Assuaging these concerns, in particular, requires a healthy economy—something that PA can influence but not guarantee.

The remaining portions of this chapter will identify key groups of people with an interest in the use and impacts of PA and define existing and potential Federal roles. The chapter next adresses overall strategy for policy regarding PA. Then, current programs in the areas of technology development and use, work environment, employment, and education and training are outlined, and options for new policy are presented. The final four sections illustrate the types of policy that have emerged from more or less independent policymaking in each area, and they relate to existing legislation those options that could be combined into integrated strategies.

Stakeholders

Not surprisingly, the broad set of issues surrounding the spread of PA has aroused concern among a diverse group of stakeholders. Solving the problems associated with PA and realizing its potential benefits to the Nation will involve balancing the interests of the various players. Six principal groups are concerned about the shape of policy relating to programmable automation.

First, there are the developers and producers of **PA,** including the research community in both the public and private sectors and the manufacturers and vendors of PA equipment and systems. Engineers, computer scientists, and others in industry, academia, research institutions, and government are involved in de veloping, refining, and applying PA. As a group, they are concerned principally with the technical performance attributes of PA technologies; they tend to treat effects on the use of labor or the work environment as consequences rather than initial considerations. PA developers and producers are interested in the adequacy of funding and facilities for their work. They are also interested in the sources of funding and goals of R&D. PA manufacturers and vendors seek business climates that support the sale and effective use of PA.

Second, there are the purchasers and users of PA. Managers of manufacturing firms make decisions about research activity and the nature and type of equipment used in production. Concern with their ability to compete with other companies, especially foreign firms, translates into concerns for production efficiency, costs for labor and capital, product de sign, production processes, whether to make or buy components, and where to locate production. They consider a broad range of human resource issues, from job descriptions, hiring, promotion, and layoffs; to the scope and quality of education and training in local communities and the extent of training their firms offer; to labor-management relations and the scope of managerial control. As a group, they resist (and protest) Government intervention in production and personnel areas, while they call for better business climates.

Third, there are the current and future members of the labor force. These individuals care about whether they can get and keep jobs, and what kinds of jobs are open to them—by occupation and industry, by compensation level, and by degree of job security. They also care about the work environment implications of PA utilization, the type and location of PA applications, and trends in job design. And, they care about the amount, cost, quality, and sources of education and training available. Some labor force concerns are articulated by labor organizations (including unions), which are concerned in part with the potential for new technology to diminish their membership by reducing job opportunities in manufacturing or shifting them away from unionized industries. Unions have already begun to address various workplace concerns through collective bargaining and other activities. However, only about a fifth of the labor force currently can influence job design, job secu-

rity, and training through collective bargaining. Hence, much of the current and future labor force lacks focused representation of their concerns, and this group may be the least well represented in private or public debates over PA and relevant policy.

Fourth, there are communities and state and local governments. These groups are particularly concerned about economic development and maintaining their employment bases. Because some communities depend on manufacturing for employment, and because they administer and fund education and training activities at least at lower levels, communities care about the rate and extent of PA production and use, along with associated changes in skill requirements, job mix, and instruction~ needs. Even though individual companies may adjust their work forces without layoffs (through attrition), decreases in company hiring may cause or aggravate employment and business problems for the local economy. Declines in employment and business levels may in turn give rise to a variety of problems for communities that range from increased health disorders to diminished tax revenues.

Fifth, there are educators and trainers. People who teach children and adolescents base curricula in part on expectations about employment opportunities and job design. People who teach adults also care about changes in skill requirements and industry hiring patterns; their planning and activities are especially sensitive to the rate of change, because the number of adult students is more subject to change than the number of younger students. Educators and trainers of all types are concerned about the funding, equipment, and facilities available to them. Currently, their concerns are likely to be heightened by the barrage of potentially confecting demands and criticisms from numerous sources.

Sixth and finally, there is the Federal Government. Existing Federal programs suggest that the Government has broad interests in the development and use of PA. On the military side, the Government is concerned with the implications of PA development and use for national security and for reducing costs for defense products. On the civilian side, the Government has several concerns: It is concerned about levels of productivity, industrial well-being, and economic growth, which influence the standard of living of U.S. citizens; it is concerned about employment levels, which influence the income distribution, tax revenues, and expenditures for aid to individuals and regions; and it is concerned about equity issues, from occupational safety and health to the balance of power between labor and management. The Federal Government thus represents the interests of the Nation as a whole.

The Reasons for a Federal Role

Existing Federal programs reveal ample precedent for Federal involvement in the development and *use* of PA. In particular (and as described in more detail below), the U.S. Government already has a major role in funding PA research and development, and it offers tax incentives for capital investment that may motivate adoption of PA and other equipment. Moreover, it is involved in study and regulation of occupational safety and health impacts generally; it measures employment trends and relates them in limited degree to technological and economic developments; and it funds and shapes education, training, and retraining activities.

Both the nature of existing programs, and the fact that some of the benefits and costs of PA will accrue to the Nation as a whole, also suggest that the Federal Government has a stake in the diffusion of PA. The level of activity in PA production, for example, is a national issue. There is a limit to the amount of PA production the U.S. economy will support (even with low levels of imports and substantial exports). While policy at the State level fostering "high-tech" industrial activity may involve competition for a limited number of facilities, only Federal policy can affect the level of PA production nationwide. Also, international technological leadership, and its implications for national security, is a Federal

concern; at issue are goals and conditions that transcend the interests and resources of individual companies, researchers, employees, and States.

Furthermore, there are equity issues which the Federal Government is best suited to address. First, adjustment assistance-whether in the form of extended unemployment compensation payments and other types of income maintenance, retraining, or relocation assistance-has long been a Federal responsibilit y. If PA or other influences, such as rising import levels, have adverse employment effects, the Federal Government will eventually pay to take care of individuals unable on their own to adjust to changing job opportunities. Second, work environment impacts seem to be social costs, like pollution, which market activity on its own not control.* The labor market may be particularly ill-suited to handle both employment and work environment problems arising from PA in coming years for several reasons. In particular, the relatively slow rates of net job growth that economists expect will reduce the numbers of choices available to jobseekers. Also, fear of displacement and limited union representation will diminish opportunities for workers to negotiate with management about working conditions or to seek other employment if dissatisfied. If industry does not move to alleviate adverse effects on the work environment, the Federal Government is in the best position to do SO.

Finally, only the Federal Government is in a position to coordinate policy initiatives across a broad range of areas. The problem of coordination is not-trivial. Current-programs, which lack formal coordination, implicitly favor some interests over others by virtue of the allocation of funds and the breadth of participation in developing program objectives. Specifically, present programs (described in detail below) appear to favor the interests of PA developers-fid producers, and to a lesser extent, the users and their employees. For example, one Federal official involved with new-technology programs remarked to an OTA staff member, "I'm putting people out of work. Am I supposed to worry-about that?" While present policy allows programs to remain separate and parochial, only the Federal Government is empowered to 'assure that programs designed to address one area of national interest do not conflict with other national interests.

*According to Ruth Ruttenberg, former OSHA ecnomist, "Occupational safety and health has become a public policy issue precisely because the economic system has failed to achieve an adequate solution the problem of workplace hazards." "Regulation and the Economist,"The New *York 'Times,* NOV. 20, 1983.

**whil, the economy will experience post-recessionary job growth, strong import competition a high Federal deficit, slow population growth, and other factors are expected to constrain economic growth. See, for example: Alfred L. Malabre, Jr., "Some Economists Fear Room for Expansion is Less Than It Appears;" and Alan Murray, "Growing U.S. Trade Gap is Linked to Slowdown in Economic Growth." Both in The Wall Street Journal, Feb. 17, 1984.

The Challenge of New Policy

The diversity of issues and interested parties surrounding policy related to programmable automation suggests that Congress consider action in a variety of areas. However, in developing new policy, it is important to consider the context for actions in different arenas.

OTA'S analysis suggests that the area where PA itself may motivate the greatest departure from past Federal policy is work environment. Because PA will eventually affect the work environment of most manufacturing personnel, especially in metalworking industries, and because it poses new problems pertaining to

the psychological aspects of the work environment, the technology raises questions about the adequacy of existing mechanisms for studying, monitoring, and regulating conditions in the work environment. While this report only considers effects on the manufacturing work environment, the growing use of computer technologies across the economy may triggel similar concerns in other sectors.

By contrast, while OTA'S analysis suggests new directions for Federal policy in employment and training it it suggest that PA-motivatd initiatives be related to broader forces for change in those areas. In the area of education, training, and retraining OTA found that only some of the ramifications of PA could be isolated from the effects of increased use of new information and communication technologies generally across the economy. New technologies will affect goals for instruction at all levels, raising fundamental questions about educational objectives and the structure of the educational system. At the same time, shifts in the employment capacities of different industries (not necessarily due to new technology) may pose problems of obsolescent skills for specific occupational groups or local labor forces. These individuals, concentrated among production occupations, have special instructional needs largely unmet by the instructional system. Meanwhile, to minimize the risk of skills obsolescence in the future, it may be necessary to make fundamental changes in educational curricula and institutions, changes that better prepare individuals for labor market contingencies.

In considering employment policy, the principal problem associated with PA is how to minimize unemployment due to labor-saving technology and cope with employment adjustment without going so far as to postpone economic change and bring on problems far worse than might otherwise have occurred. Unfortunately, this cannot easily be achieved by shifting people from jobs among PA users to jobs among PA producers. PA producer jobs will continue to be fewer and much more "white collar" than typical manufacturing jobs have been. Moreover, because unemployment cannot generally be attributed to specific technologies, the "PA employment problem" is really the broader employment problem faced by the country as many factors, including growing import competition, are altering the employment potentials of different industries.

OTA'S analysis also suggests that issues pertaining to PA development and use reflect broad policy concerns for technology development and transfer. PA provides tools for improving manufacturing processes and competitive strategies, but thorough evaluation of manufacturing processes, organization, and management, as well as more attention to competitive conduct (including product designs, pricing, and responsiveness to consumers), are necessary if companies are to make the most effective choice and use of any technology. There are many aspects of PA that require further development, but OTA found little evidence of critical research areas left unexplored, or that manufacturers were hindered from adopting PA because of insufficient technological development. Of greater immediate concern is the application of the technology. Timing is an important consideration for PA adoption because productivity improvement and other benefits of more efficient equipment and systems tend to lag their installation.

Federal Policy Strategies

The orchestration of policy initiatives in different areas may be considered a policy strategy. If the Federal Government chooses to coordinate activities in the areas of technology development and use, employment, work environment, and instruction, it can pursue one of four basic strategies: 1) laissez-faire, or a continuation of current activities; 2) technology-oriented, or emphasis on PA development and application; 3) human resource-oriented, or upfront attention to education and training, work environment, and job creation; or 4)

both technology- and human resource-oriented. In each case, adjustment assistance may be required some time after the adoption of PA, though to varying degrees.*

The outcomes of Federal action can be evaluated accordirg to likely effects on industrial output, employment, work environment, and change in adjustment assistance programs. The principal uncertainties that cloud projections of change are: 1) the rate of advance of the technology, i.e., the likelihood that the state of the art will advance far beyond what is currently expected during this decade; and 2) the relative success of efforts abroad to develop or apply PA and to increase sales penetration in domestic and foreign markets. Another major uncertainty is economic growth. A stagnant economy creates numerous problems which are best addressed directly, rather than through "PA policy, " although initiatives discussed in this chapter may support a healthy economy. Federal action can influence all of these uncertainties.

The success of other countries in competing with U.S. firms (whether due to PA or not) can be a principal cause of lower industrial output and employment for the country. A strategy with at least some orientation to new technology development and use can reduce that risk, because it can contribute to improvements in productivity and competitiveness. However, a strategy that is strictly technology-oriented will probably increase the incidence of labor market problems associated with shifting employment demands, aggravating needs for retraining and other adjustment services. Even if greater use of PA were to make U.S. firms decisively more competitive, some firms may never hire to prior levels; some areas may depend primarily on such firms; and some individuals may have difficulty adapting to changing skill demands. Also, a strictly technologyaiented strategy is likely to aggravate potential work environment problems. In sum, a strictly technology-oriented strategy would entail upfront costs for technology development and use, but it would also entail other, postponed costs such as increased adjustment assistance spending.

A human resource-oriented strategy would involve investments in evaluating skill require ments; tailoring education, training. and retraining activities; and assisting in the matching of people with jobs. Ideally, it should avoid growth in adjustment assistance spending due to extended unemployment that might occur in the wake of PA, and it may even diminish such spending. Human resource development does not preclude and may well facilitate the use of PA and otherwise improve productivity. However, its effects on industrial output levels may not be as measurable as the effects of technology-oriented policy. Although human resource and technology initiatives may complement each other in influencing output and employment, explicit human resource efforts may be needed to address work environment concerns, regardless of whether initiatives are taken to accelerate PA application.

A combined technology- and human resource-oriented strategy could draw on the complementarily of equipment and humans in production, assuring technology development without compromising work environment concerns. Also, it lends itself to long-term job creation initiatives. Thus, a combined technology- and human resource-oriented strategy could assure that human impacts are explicitly considered in the processes of PA development and use. While this type of strategy is the most comprehensive and balanced, it may be the most difficult to design and implement because it explicitly affects the broadest range of interests.

*The need for adjustment assistance is Ongoing it will never disappear totally in a dynamic economy, where economic and technological change continually create dislocations. That need normally varies in level, by geographic region, and over time.

Existing Federal Policy and Options for New Initiatives

The remaining portions of this chapter outline existing Federal policy in the areas of technology development and use, employment, work environment, and education and training. Each discussion of existing programs is followed by a set of options for possible policymaking in each area. These options could be combined to develop one of the strategies outlined above.

Existing Federal Policy for Technology Development and Use

Federal policy toward manufacturing technology for new products or production processes is piecemeal at best. Relevant programs principally address research and development, although both macroeconomic policies and more specific programs, such as tax credits, may indirectly stimulate technology change in manufacturing by encouraging capital investment. Only in the area of defense procure ment does the Federal Government actively coordinate product and process technology development and application.*

As described in detail in chapter 8, Federal involvement in PA research and development comprises the efforts of four primary government agencies with distinctly different mandates. The work of the Department of Defense (DOD) and the National Aeronautics and Space Administration is heavily mission-oriented, although it may have significant spinoffs for the commercial sector. However, by and large the commercial markets for new manufacturing technologies tend to trail the Government (principally military) markets. The National Science Foundation (NSF) funds work of a more generic nature, and the National Bureau of Standards (NBS) performs significant generic work in its own laboratories. NBS performs research in many areas relevant to PA, including standardization in languages and in interfaces between computerized tools. In addition, NBS' Automated Manufacturing Research Facility, being constructed with DOD funding assistance, is one of the few full-scale test beds for computer-integrated manufacturing concepts.

The Federal Government is also involved in standard-setting. Standards in the United States are generally developed on a voluntary basis by vendors and consumers of specific products. The U.S. system of voluntary compliance with these standards contrasts with the government-enforced standards of many other countries. The role of the Federal Government, through NBS, is largely to follow and facilitate standards efforts, and in some cases perform supporting research.

Recent Legislative Proposals

Legislation has been proposed during the first session of the 98th Congress to provide direct support to the manufacturing sector in the United States. Many of these proposals include mechanisms for promoting greater cooperation between business, labor, and government for achieving national economic goals; a common theme is creation of a new institution. Such proposals include:

- The establishment of some type of National Technology Foundation or Board that would be charged with determining priorities for industrial development in the United States. It would assess the competitive capabilities of U.S. industries in order to direct national resources into those areas which would improve U.S. industrial performance.
- Some type of National Development Bank to finance the long-term development of targeted industries.
- The formation of a National Robot and Automated Manufacturing Leasing Corporation, which would facilitate the leasing of PA equipment.

*Note that defense procurement technology programs described in ch. 8 are also complemented by the provisions of the Buy America Act of 1933, which stimulates domestic production by promoting procurement of domestically made goods by the Government.

. A National Center for Industrial Technology, promoting dissemination of manufacturing technology information.
- Special tax incentives for purchases of automated equipment.

Options for Technology Development and Diffusion Policy

Research and Development

Drawing on the existing set of institutions, Congress could act to increase PA R&D by influencing both the overall level of funding and the distribution of funding to various agencies and research topics. R&D contributes to the scope and level of technology available to the private and public sectors, and it contributes to the position of the country as a technological leader.

However, the degree of technological leadership to which we have become accustomed in the post-war era may not be sustainable. As one analyst notes:

> Thus, our present situation is that in many fields, America's earlier lonely eminence at numerous technological frontiers has given way to a world in which other industrial nations have attained positions close to, or at, these same frontiers. In many ways all this should be cause for rejoicing We are no longer living in the readily-identifiable aftermath of the most destructive war in history. Although we are, perhaps understandably, preoccupied with the more purely competitive aspects of the situation, we need to be reminded that companionship at the technological frontier offers some considerable benefits as well as costs. *

Congress could act to maximize technological leadership in part by influencing both the overall level of Federal R&D funding and the distribution of funding to various agencies and research topics. The current environment for automation R&D is relatively healthy. However funding for more long-term, generic research in nonmilitary application areas is relatively thin. Congress may wish to raise funding specifically for generic research, primarily through the National Science Foundation and National Bureau of Standards. Several of the measures currently under consideration in Congress which increase Federal funding for engineering research, overall or for automation in particular, could serve as a vehicle for such an increase in nonmilitary PA research. The advantage of such a measure is that it could fill a gap in generic engineering research which has usually been too applied for major NSF funding and too basic for substantial industry attention. On the other hand, some would argue that such manufacturing-related R&D is the responsibility of industry.

Congress may also wish to increase the funding of specific areas of R&D, such as standards and human factors, which could facilitate the application of PA technologies. While a de tailed assessment of funding allocations among the various topics of R&D is not within the scope of this OTA report, other studies have begun to address this issue.[1]

Standards

Standards are a means of increasing the ease of use of the technologies and encouraging their application. The principal disadvantage of standards proliferation is the risk that more rapid adoption of standards may provide short-term benefits for users but hinder future technological innovations which could be inconsistent with the standards. However, it is often the case that the products of a dominant vendor become de facto standards in the market. An increased Federal role may lead to a more reasoned choice of standard. Congress could stimulate standard-setting activities in

*N. Rosenberg, Stanford University, "U.S. *Technological* Leadership and Foreign Competition, 'De te fabula narrator'?" November 1981, mimeo, National Academy of Sciences.

[1] See, for example: *Research Agenda for Increasing the Use of Computers in Design and Manufacturing,* Panel on Computers in Design and Manufacturing, Manufacturing Studies Board, National Academy of Engineering, October, 1983; "Recommendations for CAD/CAM Research Directions in the U.S., " Richard F. Riesenfeld, Department of Computer Science, University of Utah, prepared for the National Science Foundation, July 23, 1982.

the Federal Government by increasing or restructuring the funding of NBS, the agency which administers Federal standards efforts.

Congress might also consider legislation which would clarify the legal position of standards-making groups. Currently, groups which help coordinate and oversee the intricate process of developing standards, such as professional and trade associations, can be held responsible for antitrust violations which spe cific standards may pose. A recent Supreme Court decision finding against a professional association appears to have significantly cooled private sector standards-making efforts, and it has helped make the process more tinwconsuming than usual.[2] While it is important that standards be devised so as to minimize potential anticompetitive effects, it may be possible to clarify the laws to reduce the amount of time involved in establishing standards.

In addition, Congress could consider providing a more active role for the Federal Government in standards development. Congress could direct NBS to increase its current efforts to facilitate, coordinate, and otherwise promote standard-setting efforts. A potential disadvantage of this option is that it would increase the Federal role in PA markets.

Diffusion

The appropriate rate for adoption of PA within and between industries is a subject of contention. It depends on the rates of adoption among U.S. trading partners, the extent of delay between invention and adoption of new technology, and the ability of the labor force and industries to adjust. In the past, adoption of individual PA technologies was slow, while it now appears to be accelerating. Thus, there is great danger in extrapolating from past conditions. In this context, there is probably a degree to which PA adoption can be facilitated without incurring excess costs. Beyond some indefinite point, however, encouragement of the use of PA may lead to ill-considered applications and excessive problems for employees and communities.

Congress could facilitate the adoption of PA by removing some of the barriers to application that have been cited by industry analysts and spokesmen. At the most general level, these barriers are the problems that industries traditionally cite as a hindrance to doing business, such as high interest rates and (high) taxes. Of course, such steps are not easy to take, and they may have side effects, including the creation of problems elsewhere due to the short-run loss of tax revenues. *

More specifically, Congress could consider legislation that would help to make relevant information available to businesses and communities. In particular, information about the nature of PA technologies and how their costs and benefits differ from those of other equipment would be particularly useful. Traditional modes of financial analysis are more suited to conventional equipment than to PA, and in consequence some firms have had difficulty justifying investments in PA.** Moreover, while trade and professional associations and journals do provide such information, that information tends to be incomplete. Congress could either empower a Federal agency such as the Department of Commerce to increase its efforts to collect and disseminate such information (e.g., through the National Technical Information Service (NTIS)), ardor foster cooperative arrangements between Federal agencies and relevant trade and professional associations. By complementing existing association activities with a Federal role, Congress could assure broader participation of

[2] *American Society of Mechanical Engineers, Inc. v. Hydrolevel Corp., 456* U.S. 556, *reh'g denied,* 102 S. Ct. 3502 (1982).

*Overall economic policy in recent years has aimed at improving the performance of the U.S. manufacturing sector. Such policies have included increasing depreciation allowances for business investment in plant and equipment. The Economic Recovery Tax Act of 1981 (ERTA) provided generous allowances which *were* reduced somewhat in the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). Despite these tax incentives, some analysts maintain that the large Federal deficit will continue to sustain high costs for capital.

** Conventional analyses often fail to capture changes in indirect costs, which tend to be invariant for alternative forms of conventional equipment. PA equipment may not only affect direct labor costs, but indirect labor, materials, and other costs as well.

25-452 O - 84 - 25 : QL 3

interested parties, including employees and communities.

Also, Congress could consider sponsoring demonstration programs, providing examples of best practice in the areas of technology and work environment. While PA installations in several companies are already well-publicized showcases, a Federal role would increase the likelihood that work environment and employment issues are clearly addressed and linked to the technology. On the other hand, the technology in any given installation can only represent the state of the art for a limited time in the context of relatively rapid change in PA costs, applications experience, and sophistication. Further, the investment and risk associated with a typical, retrofit installation of PA is far less than that associated with, for example, a synthetic fuels plant.3 Thus, a demonstration program for these technologies may be less cost effective than for such technologies as synthetic fuels production. This gap may narrow, however, for large-scale experiments in computer-integrated manufacturing, which are far more costly and risky than "islands of automation. "

Adoption of PA is only a partial solution to problems faced by the manufacturing sector. A longer term solution involves redressing the historical inattention, both of industry and government, to manufacturing processes, organization, and management. There is some evidence that this is happening already in the private sector, where international competition appears to have generated a new awareness of U.S. weaknesses. To assure that this awareness translates into effective actions, Congress could direct funding and effort toward the development of engineering curricula in universities which combine manufacturing, design, and human resource management activities, as well as research in manufacturing engineering topics.

Another approach with nearer term benefits would be for Congress to foster the creation of some form of "manufacturing institute, " perhaps building on the research centers already at NBS or at universities to provide a focus for manufacturing technology, organization, and management issues. Such an institute could serve as an information clearinghouse. The National Academy of Sciences, for example, recently recommended establishment of at least one joint DOD-U.S. machine tool industry research center to improve flows of information supporting defense technology needs.[4] Yet, many observers believe that the need for improvement in technology transfer is greater in the civilian than in the defense sector. An institute could serve as a think tank serving all industries, with rotating fellowships bringing in people from throughout the manufacturing sector. *

The advantages of a manufacturing institute would depend on its structure and mandate. A potential disadvantage of an institute would be that it could become just another layer in a complex network of Federal and private organizations. Also, the designation of formal coordination requirements could freeze the extensive networking that already occurs informally. However, a Federal presence could assure broader participation in the networking process.

Existing Federal Employment Policy (Excluding Training)

The United States already has a variety of Federal employment programs and legislation. Most of the key pieces of legislation emerged during the Depression era. Excluding educa-

[3] See, for example, *Energy From Biological Processes* (Washington, D. C.: U.S. Congress, Office of Technology Assessment, OTA-E-124, July 1980). Synfuel plants have been estimated to cost in the $2 billion to $3 billion range, while highly automated plants in discrete-manufacturing metalworking industries tend to cost under $1 billion. Levels of both technological and financial risk are very high for synfuel plants.

[4] Manufacturing Studies Board, Committee on the Machine Tool Industry, *The U.S. Machine Tool Industry and the Defense Industrial* Base, National Academy Press, 1983-84.

*The National Science Foundation has proposed a new program for 1985 to create five to ten centers for interdisciplinary engineering research. While these centers are in some ways similar to manufacturing "institutes," the relatively modest level of funding ($10 million for all five to ten centers), and the fact that they will not necessarily address topics related to manufacturing, indicates that they will not be likely to substantially change the historical U.S. inattention to manufacturing engineering.

tion and training programs, which are described later in this chapter, existing Federal employment policy covers four broad categories: 1) the development and distribution of labor-market information, 2) income maintenance for the unemployed, 3) labor standards, and 4) job creation.

Most Federal employment programs are oriented toward unemployment of relatively short duration, generally what is referred to as cyclical unemployment. Also, over the past two decades, Federal employment policy has come to focus on aiding disadvantaged groups of people (defined as low-income, or chronically un- or under-employed). Consequently, current programs are not designed to accommodate the more enduring unemployment that may befall individuals and communities given wide spread technological change, growing import competition, and long-term shifts in consumer buying patterns-unemployment generally re ferred to as structural unemployment.

Compared to most European countries and Japan, labor market policy in the United States is reactive and uncoordinated, and it is not linked to other, industry-oriented programs for structural adjustment in the national economy. Since several recent reports by the Congressional Budget Office (CBO) and the Congressional Research Service (CRS) examine Federal employment policy in detail, this assessment will address key features and refer the reader to other analyses for more information.

Legislation

Major employment policy in general evolved from the following pieces of legislation: The Wagner Peyser Act of 1933 established a free, public U.S. Employment Service (USES). USES (now called the Job Service in some States) comprises a StateFederal network of job listing and placement services. Unlike its foreign counterparts, however, USES does not have legal monopoly on job referrals, power to regulate competing private employment agencies, or power to compel its use by employers (except for Federal contractors). Because of these limitations, during the post-World War II era, USES became an outlet for relatively low-skilled, disadvantaged individuals. This occurred through the proliferation of specialized, private employment agencies which tended to serve relatively high-skilled personnel; the combined burdens of budget cuts and labor force growth; and the effects of a policy shift in the late 1960's which emphasized disadvantaged workers and which re quired USES and Unemployment Insurance (see below) officials to assist in the administration of public assistance programs. Since the 1960's, employers and employees have associated USES with welfare programs. Private employers consequently tend not to list openings with USES, except for lower skill, high turnover jobs. Thus, despite reforms and the development of computerized job banks, the USES has continued to play a marginal role in the labor market. [b]

The Soaal Security Act of 1935 established the Unemployment Insurance (UI) system. It is a program administered by a Federal-State network of agencies which now covers most of the labor force. UI provides eligible persons with funds that replace up to 50 to 70 percent of their wages for 26 weeks. Associated extended benefits (EB) and Federal supplemental compensation (FSC) programs provide additional money over longer periods of time. Funds are generated by employer and employee contributions and disbursed through State agencies, with emergency allocations awarded on occasion by Congress. Labor-market analysts generally consider these and other payroll taxes incentives for employers to lay off personnel if business declines; the availability of unemployment compensation, together with the customary rehiring of laid-off personnel as business conditions improve, is generally considered to retard job-search efforts among the unemployed. However, the U.S. program has significantly lower wage-re-

[5]The role of the USES and contrasts with its counterparts abroad are discussed in a monograph by Mike Podgursky of the University of Massachusetts (Amherst), entitled "Labor Market Policy and Structural Adjustment," Apr. 1, 1983.

placement rates than Japan, Germany, France, and Sweden." *

Some countries provide public assistance to the long-term unemployed who have exhausted their UI benefits, and many European countries provide "short-time" (part-time or pro-rated) benefits to allow worksharing among firms and industries with reduced labor requirements. Some States, such as California, have recently begun similar worksharing programs. The Tax Equity and Fiscal Responsibility Act of 1982 called for the Department of Labor to develop model worksharing legislation for States.

The Fair Labor Standards Act of 1938 (FLSA) provides specific standards for wages (including a minimum wage and overtime rates) and hours of work. It also prohibits child labor. FLSA covers primarily non-professional and managerial personnel. While collective bargaining in unionized settings provides a means of assuring that wages and working conditions are adequate, FLSA provides protections in the form of minimum standards for wages and hours for all workers.** It was intended, in part, to prevent individual State economies from profiting in trade with other States through lower labor costs obtained by low pay a.dor long hours. According to observers, however, monitoring and enforcement of labor standards in nonunion workplaces tends to be limited. FLSA is complemented by other pieces of legislation governing wages and hours of personnel employed by companies doing business with the Federal Government. Those include the Walsh-Healy Act, the Service Contract Act, the Davis-Bacon Act, and the Federal Work Hours Act (which set the 8-day, 40-hour week as standard).

The Employment Act of 1946 established a Federal interest in the adequacy of employment opportunities. The Full Employment Act of 1978 expanded on the principles of the 1946 act, requiring that the President develop economic policy consistent with the achievement of full employment. Despite these legislative efforts to promote planning for the medium and long k-m, most employment policy and economic policy (fiscal and monetary) has focused on short-term objectives.*

Additional Programs

The legislation described above provides the framework for Federal labor market policy. Additional Federal programs aim at creating jobs, developing labor market information, and providing adjustment assistance beyond the UI income support program.

Job Creation. -Federal job creation activities fall into two categories. First, various macroeconomic policies aim to improve employment opportunities by stimulating aggregate demand (buying of various goods and services by all types of consumers) and production activity. The effect of such policies is indirect; relevant measures target interest rates, inflation, money supply, and disposable personal income, which in turn affect production and consumption activities by lowering costs and increasing budgets. While fiscal and monetary policy can aim for long-term economic growth, steps tend to be taken to improve short-term prospects as the business cycle changes. Macroeconomic policy is some times complemented by specific, short-term programs, such as the Public Service Employment Program of the late 1970's and various public works initiatives. Public works initiatives are recurrent themes in jobs legislation because of their countercyclical employment potential as well as their obvious appeal to constituents in affected areas. The Emergency Supplemental Appropriations for Jobs Act of 1983, for example, provided funds for a variety of public works projects. Public works programs can be designed to employ relatively

'ibid. Also, note that research by James Jondrow of the Cenkr for Naval Analyses suggests that nonremunerative personnel costs (about half of which are fixed, mostly federally mandated or training-related) may account for about 23 percent of manufacturing employment costs.

*FOr more information on UI, see the mdytis by cBO entitled "Unemployment Insurance: Financial Condition and Options for Change, " June 1983.

XXFLSA di~courage9, but does not pro~bit,, overtime.

*The development and aftermath of these laws are descr'~ in detail in a recent CRS analysis, "The Employment Act of 1946, as Amended, and the Opportunity for Economic Planning: The Federal Government's Response, ' Feb. 4, 1982.

high- or low-skilled personnel, although construction projects tend to employ relatively high-skilled personnel.

A more focused program is the Targeted Jobs Tax Credit program. This program, initiated in 1978,* and amended by the Economic Recovery Tax Act of 1981 and the Tax Equity and Fiscal Responsibility Act of 1982, aims at job creation for economically disadvantaged groups. It provides employers with a percent of the earnings of a new hire in the form of a tax credit. The program has two principal shortcomings: First, there is a risk that employers will be paid for jobs that they would have created anyway. Recent modifications to the program are believed to have lessened this risk. Second, the program only applies to those firms that have tax liabilities, because the credit is nonrefundable.**

Labor-Market Information. –Various programs aim to generate labor-market information (LMI), although the Federal role in this area has been decreasing. The Department of Labor aWsters the Federal-State LMI program through the Employment and Training Administration, the Bureau of Labor Statistics (BLS), and the State Employment Security Agency (SESA) LMI units. The National Occupational Information Coordinating Committee (NOICC) and the related State committee (SOICC) network provide coordination, cooperation, and communication in developing occupational information. BLS, in particular, provides information on aggregate, industry, and occupational employment and wage patterns.

Because BLS has experienced sharp budget cuts during the current administration, it has cut back on the volume and precision of the information it publishes. For example, because the sample size for the Current Population Statistics survey has been reduced, results for small areas (including the smallest States) and minority groups are less accurate;* the elimination of the labor turnover survey means the loss of a leading indicator of manufacturing expansion and contraction; the elimination of the multiple jobholder supplement survey means the loss of a measure of the income ade quacy of certain types of jobs; the elimination of the Family Budget program means the loss of a measure of economic conditions; and the cutbacks in the economic growth, productivity, and occupational outlook programs mean the loss of detailed insights into the changing deployment of labor in the economy.**

Adjustment Assistance. -Fina.Uy, in addition to the general employment programs listed above, the United States also has more focused adjustment programs. Prominent among them is the Trade Adjustment Assistance (TAA) program, launched by the Trade Expansion Act of 1962 and modified on several occasions, which has been the principal source of aid for displaced workers. The United States is unique among developed countries in distinguishing import-based displacement from other sources; European and Japanese programs encompass persons displaced by a variety of factors, such as new technology. Eligibility for TAA is limited to those who can demonstrate that they were displaced as a result of imports, although the strictness of the test has varied.

Due to strict eligibility criteria, TAA disbursements were negligible until the act was amended in 1974. During the 1970's, critics faulted the program for delays in providing assistance, for emphasizing compensation over active adjustment assistance, for funding people who eventually returned to their original employer, and for narrowly designating who was affected by imports (e.g., prime manufacturers but not firms whose principal busi-

'–*it s d~ the NeW Jobs Tax Credit enacted in May 1977.

**Th eW c r~t 9 w e discussed in a recent analysis by CRS, entitled "Jobs Legislation in the 98th Congress" (Issue Brief IB83059).

xs~p li ng ~d inf er enCe 9 for minority grOuPS have ~WaYS been suspect; the =ent cutbacka aggravate a nonoptimal situation.

XXTh e n a t we ~d r~fi ca ti on~ of th e9e Cutbackg me ~~ scribed in a detailed analysis of Federal statistical programs prepti by CRS, entitled "~cent Changes in the Statistical Activity of the Federal Government, " June 2, 1982.

ness was supplying them). For example, the General Accounting Office found that relative ly few TAA participants used the relocation assistance feature, principally because participants were either unaware of the program or uninterested in it. The 1981 amendments (through the Omnibus Budget Reconciliation Act) again revised the eligibility test, making imports a "substantial cause" of job loss, while the 1982 amendments specified that imports should have "contributed importantly" to job loss. The 1982 legislation provided very little funding, and the simple 2-year extension of the program enacted in October 1983 provided no funding. * [7]

There have been several Federal programs legislated to provide compensation and\or other assistance to select groups of people in the event of job loss resulting from Federal actions. These include the Redwoods Act of 1978 (compensating for job loss associated with the expansion of the Redwoods National Park), the Rail Passenger Services Act of 1970 and the Rational Rail Reorganization Act of 1978 (compensating for job loss associated with the rationalization of the national railroad system following the financial collapse of several railroads), the Airline Deregulation Act of 1978 (compensating for job loss associated with the deregulation of passenger airlines), and the Department of Defense's Economic Adjustment Program (compensating for job loss associated with changing defense spending and siting decisions). Some analysts might also add such Federal efforts as the loan to the Lockheed Corp. and the loan guarantees to the Chrysler Corp. during the 1970's as special programs aimed at averting massive unemployment (among other goals). And, there are various efforts providing preferential assistance to veterans (whose career development is at least interrupted by military service).

There are also programs targeted toward specific areas, such as the Defense Manpower Policy #4, which encourages defense contracts to be awarded to labor-surplus areas. The Area Redevelopment Act and its progeny also stimulated economic activity in specific areas, in part to promote employment. Current interest in enterprise zones, favored by the Reagan administration, also focuses on area development to stimulate employment.

Recent Legislative Proposals

A variety of employment bills were intro duced during the first session of the 98th Congress. The number and content of the bills reflect the strong concern about high levels of unemployment, and uncertainty as to the duration of those levels. One bill (S. 1286, the Manufacturing Sciences and Technology Research and Development Act of 1983) appears to have linked the development of new technology with work force adjustment. That bill directed the Secretary of Labor to devise experimental programs for retraining "displaced workers" to facilitate the utilization of advanced manufacturing technology. Other recent legislative proposals regarding employment include:

- establishment of a system of tax credits for employers who hire individuals eligible for FSC payments, or provide tax credits for people hiring for businesses in enterprise zones;
- establishment of public works programs of either specified or indeterminate duration;
- activities to stimulate employment of specific groups, including senior citizens, railroad employees, and employees of relatively small defense contractors;
- reform of immigration laws and procedures, which would influence the supply of labor to U.S. jobs;
- establishment of plant-closing notification and consultation procedures; and
- establishment of a youth minimum wage.

● several recent CRS and CBO publications address TAA, See, for example, the CRS paper, "Unemployment Compensation and Trade Adjustment Assistance: Changes Made by the 97th Congress," Nov. 23, 1982.

[7] See "Current National Development%" *Employment and Training Reporter*, Oct. 5, 1983; and "New Law Qualifies More for 'TAA', 'UI'," *Employment and Training Reporter, Nov. 3, 1982.*

Options for Employment Policy

Options for employment policy range from continuing current programs (the status quo) to adopting new measures in one of three general areas: job creation, collection and dissemination of relevant information, and adjustment assistance.

Status Quo

The programs outlined above (together with the education and training programs described elsewhere) constitute the status quo. As a package, these programs provide relatively limited Federal involvement in long-term employment change. They principally aim for maintenance of income for individual members of the labor force who become unemployed, or for employment of disadvantaged groups who tend to have difficulty obtaining jobs from the outset. Also, they allow U.S. companies to rely on quick and massive layoffs (sometimes with plant closings) when business declines. Companies can achieve relatively quick, largescale movements of capital to more productive uses by closing unprofitable plants and building or acquiring more productive facilities. However, this practice causes employees and communities to bear most of the costs of economic adjustment. In contrast, companies abroad (e.g., large Japanese manufacturing firms) tend to adjust their work forces more slowly and through a wider range of measures.[8] That conduct involves slower movement of (and potentially lower returns on) capital resources, but distributes the adjustment burden more evenly among employees, managers, and investors.

Existing Federal labor market programs and institutions are ill-equipped to deal with long-term shifts in labor demand arising from technological and economic changes, and growing uncertainty in skill requirements. These factors may contribute to growth in long-term unemployment, including extended unemployment among groups other than the disadvantaged. Similarly, they are not designed to deal with large regional disparities in unemployment. This is a concern since at least the near-term employment effects of PA will be concentrated regionally. Under the status quo, the employee would bear most of the burden of employment change associated with PA; various levels of government bear, both directly and indirectly, some of the costs of unemployment that might occur.

[8] James A. Orr, Haruo Shimada, and Atsushi Seike, "U. S.-Japan Comparative Study of Employment Adjustment, draft, U.S. Department of Labor and Japan Ministry of Labor, Nov. 9, 1982.

Job Creation

While retraining prepares a work force for transition, job creation assures that people have work to do. It is appropriate to consider a Federal role in job creation, because job creation programs at the State level may merely sharpen interstate competition for a given number of jobs, shifting the location of job opportunities rather than generating new jobs overall. Since most job openings occur to replace departing personnel, past and proposed Federal programs for job creation aim to generate new jobs that represent growth in economic activity. The principal problem in developing a program to stimulate job creation is to avoid paying for jobs that employers would have created anyway, and to avoid shifting employment from one industry to another, either of which would diminish net job growth.* These problems have chronically plagued past public-service employment and job-creation incentive programs.

At the most general level, expansionary macroeconomic policy—including changes in the supply of money, interest rates, and tax rates-can lead to job creation by stimulating economic activity, although job development is not restricted to specific industries or locales. Also, macroeconomic policies that strengthen the dollar may make imports effectively less expensive than domestic products, discouraging growth in U.S. production.

*For example, a 5¢ per gallon Federal surtax on gasoline as enacted through the Highway Improvement Act of 1982 to fund a countercyclical public works program. When the legislation was proposed critics charged that the added cost of surface transportation would result in job losses elsewhere in the economy, including jobs associated with the distribution of goods by trucks.

At a less general level, Congress can foster and shape job creation primarily by legislating specific measures to stimulate hiring. In addition to tax credit programs such as the one already in effect, such measures include incentives for domestic production and, in the event of persistent labor surpluses, legislation for change in average work hours and increased production of so-called public goods and services. These measures are discussed below in general terms.

Congress can stimulate job creation by legislating financial incentives (or legislating an end to disincentives) for companies to produce (and buy supplies) within the United States, instead of overseas. The rationale for such incentives is that local production entails local employment. Harrison and Bluestone, for example, estimated that over 30 million jobs were lost during the 1970's to plant closings overall, including the relocation of production to overseas locations. Other analysts have come to similar conclusions.[8] The risk of such incentives is that they can encourage inefficient production practices and lead to higher prices by sheltering domestic producers from competition from foreign firms. Economic theory holds that where domestic production is less efficient than production abroad, U.S. consumers will pay more for domestically produced goods; also, they will pay more for foreign-produced goods whose availability is artificially depressed. Consequently, producers and consumers will have fewer resources available to them to put to other uses. Employment may be sheltered in the short term but foregone in the long term. This argument is frequently raised by economists against import restrictions such as tariffs and quotas. *

Two types of jobcreation programs might be considered in the face of persistent labor surpluses. The first is legislation to reduce average working hours (either tied to FLSA or as independent legislation, perhaps de signed so that reductions in work hours are triggered by certain economic conditions), and the second would be legislation stimulating production of so+called public goods and services. Products like defense or perhaps childcare, for which there is recognized public de mand which the private market is ill-suited or unable to meet, fall into this realm.

The chief benefit of reducing average work hours is that it would allow a given amount of work to be shared among a larger group of people. The number of jobs available is a function of the (average) number of hours per job, as is the amount of leisure time available to citizens. The tradeoff between jobs and hours is not a new policy concept; one of the goals of FLSA was to increase employment by discouraging employers from resorting to overtime work by requiring them to pay more for longer hours. Both **economic** hardship (due to low pay and unemployment) and technological displacement were concerns during the Depression era, when FLSA **was** enacted.[10] Another argument, first raised during the late 1970's, is that reducing work hours offers a way to avoid disproportionate job loss among female and minority employees, who often have relatively low levels of seniority.

Reducing the average hours of work is not necessarily the same as "work-sharing," which tends to involve the redistribution of existing work. The difference is important in contemplating income effects. A major perceived disadvantage of programs that reduce work hours is that individual employees may experience real wage losses (see ch. 4). This is especially likely for work-sharing. Broader distribution of work without growth in total wages will not lead to the same generation of new jobs that can result from growth in wages and spending.

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[8] Mary Jane Belle, "Plant Closings and Business Relocations," CRS Issue Brief IB83152, Sept. 27, 1983.

*Note that there may be noneconomic arguments fOr sheltering a domestic industry. Usually, those arguments center on national security-on claims that there is a national interest in assuring domestic knowhow and production capability for certain products, usually involving defense-related technology. The test of national interest is a difficult one to make, as evidenced by the controversy over recent Houdaille and NMTBA petitions for restrictions on machine tool imports.

[10] Irving Bernstein, *The Lean Years* (Boston: Houghton Mifflin Co., 1960).

Some people, however, will willingly trade reduced work-hours and lower pay for increased leisure time.11

Changes in work hours may also cause businesses to incur additional costs for changing their operations and procedures to deal with greater numbers of personnel and for increased spending on fringe benefits. Firms may also lose efficiency, if the workers "picked up" through work-sharing are not appropriately qualified.* On the other hand, companies may face lower UI tax liabilities, which often rise for companies that lay off personnel. Also, work-sharing may encourage greater reductions in force where there are administrative benefits to doing so. For example, while a 10-percent cutback might satisfy a company's financial needs, a 20-percent reduction tied to a move to a 4-day work week may be easier to administer.

The actual costs and benefits of reducing work hours depend on how a program is structured—how funded, how phased in, etc. The current UI system, for example, implies that higher wage personnel would lose more than lower wage personnel because UI replaces less of their wages. Also, the experiencerating system, under which employers with worse ratings bear more of the cost of UI than others, implies that low-rated employers might effectively shift their work-sharing costs to higher cost firms.

Already, several States have provided for temporary reductions in work hours as a means of preserving unemployment during slack periods. These programs typically involve a reduction in work week for participating companies and pro-rated UI benefits for nonworked days. While employees in declining industries and areas may benefit in the short term, longer term gains would require a program with broad coverage that could help shift people into stronger industries. This, in turn, would shift adjustment costs to a broader range of industries and individuals and away from communities and governments. For even distribution of costs and benefits, a nationwide, Federal program may be necessary. In the near term, Congress might at least consider further encouragement of temporary hours-reductions and work-sharing, including facilitating necessary adjustments in UI and other programs to allow for altered terms of unemployment. [12]

Stimulating production of so-called public goods and services would also create jobs. It is not a make-work option: The production of public goods and services does not have to be met by expanded public sector employment; as in the case of defense procurement, public investment can stimulate private sector employment. If the economy is incapable of employing available labor resources in the production of private goods and services-a condition that has not yet ban established conclusively–it is possible to increase production of public goods without reducing production of private goods. As employment grows, demand for private goods may grow in turn, shifting the balance between production of private and public goods and services. An often unrecognized advantage is that public goods spending may raise productivity in private goods production. For example, highway building and improvement can lower trucking costs and thereby reduce costs to the consumer, while child-care services can freeup parents for employment (as well as lower transfer payments for unemployed, child-rearing parents).

The principal disadvantage of public goods programs historically has been the risk of diverting productive resources from private goods production. This charge has been leveled against defense programs, for example, which support a handful of industries and tend to employ relatively high-skill personnel. It was also raised during the 1982 debate over funding public works projects with an increase

[11] "20 Million Opt for Shorter Work Week," *Employment and Training Reporter*, Nov. 16, 1983.

*However, unqualified workers may be less able to benefit from or afford work-sharing, insofar as employers resist hiring them, or because the full time wages for their work are already low.

[12] Judith Cummings, "Novel Ways Being Used to Save Jobs,." *The New York Times*, Jan. 28, 1983. Also, as noted above, TEFRA mandated study of work-sharing by the Department of Labor.

in the Federal gasoline tax, which was expected to reduce economic activity among a broad range of concerns depending on truck transportation and other heavy users of gasoline.

Labor-Market Information

Because programmable automation offers the prospect of radical and ongoing changes in the deployment of labor, expanded collection and analysis of occupational employment data would provide a means of measuring the rate, extent, and direction of change within and between occupational groups. At present, it is not possible to compare detailed occupational data over short periods of time (e.g., 1 to 3 years). Also, official analyses of the effects of technology change on employment levels and staffing patterns are few and far between. Better data collection by the Department of Labor and the Bureau of the Census would improve the modeling exercises (using input-output analysis) already undertaken by those Federal agencies to describe and forecast employment trends, and it would improve the information disseminated to educators, counselors, and individuals by the Department of Labor through the Occupational Outlook Pro gram and the Dictionary of Occupational Titles. It would also provide data for measuring "best practice" among firms in deploying labor, information that would be useful to managers, labor organizations, and educators.

As Federal statistics programs have been cut back during the past few years, debate over the appropriate Federal role in the gathering and disseminating of various forms of data has grown. The minimalists hold that Federal efforts should be confined to meeting the specific needs and priorities of government agencies. Their arguments are rooted in broader interests in deregulation and reducing government paperwork required of businesses. Supporters, by contrast, argue that agency needs and priorities change and are hard to predict or circumscribe; that private sources lack the wherewithal and authority of the Federal Government for collecting data: that there is a need for statistics that describe overall social and economic conditions across the Nation; and that there is a need for the Federal Government to provide citizens with information.[13] Limited funding for Federal statistics programs forces Federal agencies to channel resources to those activities of most immediate use by the Government, such as statistics describing overall employment and economic performance characteristics. This practice serves short-term information needs, but raises questions about the effectiveness of even the favored programs in the long term, because the most-used aggregate statistics de penal on more detailed data-gathering, analysis, and modeling.

Adjustment Assistance (Excluding Training)

Public attention to Federal activity in adjustment assistance is growing because many States are affected; States are competing for jobs; and growing numbers of potentially affected workers are not covered by collective bargaining. Because those displaced by programmable automation are likely to have been at risk of displacement from other factors such as rising imports, expansion of overseas production, and plant closings generally, any Federal program of adjustment assistance would best be provided as part of a broader program to assist the long-term displaced; as experience with the Trade Adjustment Assistance program shows, it is difficult in practice to isolate single causes of displacement for determining eligibility for program participation. *

[13] Daniel Melnick, "Recent Changes in the Coordination of Federal Statistical Data Collection., " Congressional Research Service, Sept. 15, 1982.

*A broad range of options for adjustment assistance programs has been evaluated in detail in recent publications by CBO, including "Dislocated Workers: Issues and Federal Options" (July 1982). As noted by CBO, a critical problem in structuring adjustment assistance programs is defining the target group. How eligibility for assistance is defined determines whether a program covers all categories of affected personnel ("vertical equity' and/or all people affected within categories ("horizontal equity"). Different criteria have different implications for client base size, cost, and coverage of people with varying capabilities for adjusting on their own. Table 74 shows the CBO comparison of different approaches to targeting adjustment assistance. Among the categories discussed in debates over programs (excluding retraining) for displaced workers include older workers (age 40 and older), workers in so-called declining industries, and workers in disadvantaged areas (including new entrants to the labor force).

Table 75.—Sensitivity of Estimated Numbers of Dislocated Workers in January 1983 to Alternative Eligibility Standards and Economic Assumptions

Eligibility criteria	Number of workers		
	High trend[a]	Middle trend[b]	Low trend[c]
Single criteria:			
Declining industry[d]	1,065	880	835
Multiple criteria:			
Declining industry and other unemployed in declining area[e]	2,165	1,785	1,700
Declining occupation	1,360	1,150	1,095
Ten years or more of job tenure	835	710	675
More than 45 years of age	1,050	890	845
More than 26 weeks of unemployment	760	560	535
Declining industry[d] and ten years of job tenure	275	225	215
45 or more years of age	250	205	195
26 weeks of unemployment	145	110	100
Declining industry including other unemployed in declining areas[e] and ten years of job tenure	430	355	340
45 or more years of age	490	395	375
26 weeks of unemployment	330	255	245
Declining occupation and [f]ten years of job tenure	235	195	185
45 or more years of age	***335***	***280***	***265***
26 weeks of unemployment	165	120	105

[a]High trend assumes continuation of March 1980 to December 1982 growth rates in the number of unemployed workers in each category Specifically, the number of workers unemployed from declining industries Increased by 32 percent in this period—a monthly average of 1 4 percent
[b]The middle trend assumes that th, number of dislocated workers will remai n constant from December 1981 to January 1983 The number of dislocated workers In December 1981 IS estimated by adjusting March 1980 Current Population totals for changes in the level and composition of unemployment through December 1981
[c]The low trend assumes that the number of dislocated workers i n each category decreases proporf ionately with the projected change in the aggregate number of unemployed workers between the first quarter of 1982 and the first quarter of 1983, a reduction of nearly 5 percent
[d]Th, declining industry category includes all job losers from industries with declining employment levels from 1978 to 1980 See Marc Bendick, Jr and Judith Radlinski Devine, "Workers Dislocated by Economic Change' Is There A Need for Federal Employment and Training Assistance?"
[e]1 f a declining Industry was located i n an area defined as declining, all other job losers in the area were included Declining areas are defi ned as those ex periencing declines in population from 1970 to 1980 or with an 85 or higher percent unemployment rate in March 1980
[f]The declining Occupation category includes all job losers from occupations with declining employment levels from 1977 to 1980

SOURCE Congressional Budget Office, based on tabulations from the March 1980 Current Population Survey and other *sources* noted above

While the debate over aid to displaced workers overall tends to focus on external aid, such as income maintenance or relocation assistance, the spread of programmable automation raises questions about the role of employers in the adjustment process. Two employer actions in particular might be encouraged by legislation. The first is advance notice of technological change and displacement, and the second is incentives for replacement of personnel by employers.

Advance notice of technological change allows workers to plan for change, evaluate training needs, and seek new work before a re duction in force is put into effect. It also allows management, communities, and labor to work together to ease the adjustment process. Nevertheless, companies often resist providing advance notice as an extension of the view that technological change is a management prerogative. The University of South Florida, for example, reports that its robotics experts have been asked to perform robot feasibility studies with the proviso that "under no circumstances are employees to find out. "[14] A disadvantage borne by companies is that key personnel will often be the first to leave, possibly putting future operations in jeopardy. This concern has been a central argument in opposition to plant-closing legislation and to voluntary resignation (buy-out) programs.

Encouraging employers through financial incentives to re-place personnel either within or outside of the firm is another option. This option, like job creation, increases the adjustment burden on companies relative to employees, communities, and local labor markets. It may stimulate cooperative activities among industry, local government, educators, and labor, perhaps building on efforts associated with the Jobs Training Partnership Act. On the other hand, it is primarily feasible for large

[14]"USF Engineers Extending Robots' Limited Capabilities, " Sue Stremmel, Oracle, June 15, 1983.

employers, especially those with multiple facilities, broad product lines, and adequate training facilities and funds.

Existing Federal Work Environment Policies

The Federal Government already has policies that regulate the work environment, such as legislation covering wages and hours and occupational safety and health. These same policies will apply to the introduction and use of PA in manufacturing, although they may not be adequate to meet new concerns.

Legislation

The principal safety statute relevant to pro grammable automation is the Occupational Safety and Health Act of 1970. It has as its purpose to "assure so far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources. " Under the provisions of the act, the Department of Labor is responsible for promulgating and enforcing occupational safety and health standards. The Occupational Safety and Health Administration (OSHA) was formed in April 1971 within the Department of Labor to implement the OSH Act. Additional legislation addresses worker safety in mining and atomic power environments. Traditionally, safety and health concerns in the workplace centered mainly on safety and protection from the most obvious exposures to toxic chemicals and other dangerous substances. More recently, greater emphasis has been placed upon occupational health, long-term exposure problems, job stress, and toxicological problems.[15]

Other laws focus on how employees and management may address work environment concerns. The National Labor Relations Act (NLRA) was passed in 1935 to encourage the practice of collective bargaining. The act was amended in 1947 (Taft-Hartley Act) and again in 1959 (Landrum-Griffin Act). The NLRA and its regulations govern the conduct of collective bargaining in the United States. With respect to the introduction of new technology, rulings to date by NLRB suggest that it is bargainable if the technology deprives employees of jobs, work opportunities, or otherwise causes a real change in working conditions.l" Thus, the introduction of new technology may be treated similarly to decisions on whether to contract out work. Since the collective bargaining process directly benefits only workers in unionized settings, these protections may be lacking for workers in nonunion plants. The issue of coverage is important because, although unionization is relatively high in the metalworking industries, the use of programmable automation is increasing in a broad mix of industries. With current estimates of union membership in the United States totaling be tween 20 and 25 percent of all workers at most, there is a large segment of the population that will not be protected by the process of collective bargaining.

The Department of Labor administers programs to encourage labor-management cooperation on a number of issues. These programs take **place in union and nonunion settings.** Provisions are sometimes **made in contracts** for joint labormanagement safety committes that meet periodically to discuss safety problems, to work out solutions, and to implement safety programs in the plant." Insofar as labor organizations or workers perceive technology as a health issue (e.g., if there is substantial evidence to suggest that new forms of machine monitoring and pacing of work are unhealthy) labor representatives may push for measures to protect workers against such hazards.

Other Programs

The Department of Health and Human Services, through the National Institute for Occupational Safety and Health (NIOSH), is

[15] "Steven Deutsch, "Extending Workplace Democracy: Struggles to Come in Job Safety arid Health, " *Labor Studies Journal,* vol. 6, No. 1, Spring 1981, p.?

[16] *See Automation and the Workplace: Selected Labor, Education, and Training Issues* (Washington, DC.: U.S. Congress, Office of Technology Assessment, OTA-TM-CIT-25, March 1983), p. 55.

"*Characteristics of Major Collective Bargaining Agreements,* Jan. 1, 1980.

responsible for recommending new standards, conducting research on which new standards can be based, and implementing education and training programs for producing an adequate supply of manpower to carry out the purposes of the act. In addition to Federal involvement in the protection of workplace safety and health, there are agencies responsible at both the State and local levels as well.

Options for Work Environment Policy

Congressional policy considerations with re spect to the effects of programmable automation on the work environment fall largely in two areas. One is assuring that sufficient data are available to make informed judgments about current or prospective impacts of PA on workers and the workplace. The second area is determiningg whether current policy is sufficient to cover the health and safety aspects of the new technology. If Congress decides to act in these areas, options that warrant consideration include: maintaining the status quo, monitoring the workplace effects of PA more closely, increasing support for social impacts research, supporting new workplace standards, and considering broader workplace legislation.

No Increased Federal Role

Congress could choose to take no additional action on the workplace effects of PA. Although no single policy instrument specifically addresses the impacts of PA on the work environment, various mechanisms (including collective bargaining, OSHA regulations, and others) are already in place at the Federal, State, and local levels that cover workplace concerns in general, particularly in the areas of health and safety. In addition, PA is being introduced at a time when there is increasing awareness of and sensitivity to the effects of the introduction of new technology in all facets of American life.

There are some efforts in both the public and private sectors to plan for the workplace consequences of new technology, sometimes involving both management and labor. Such cooperative efforts are often tied to broader quality of work life programs and increased worker participation in decisions that affect their workplace. Two examples of joint efforts include arrangements between AT&T and the Communications Workers of America, and be tween the United Auto Workers and Ford Motor Co. Such programs are often restricted, however, to large, unionized companies. Similar opportunities may not be available to workers in small shops or nonunionized environments, primarily due to the requirements for associated time, effort, and cost . In addition, it is often the case that the traditional, adversarial postures of management and labor limit increases in cooperation and worker participation in decisions concerning increased automation. Concern for the displacement effects of PA may make employees reluctant to contribute to planning for PA.

The principal advantage of maintaining the status quo rather than initiating additional policy at this time is that congressional action on the workplace effects of PA may be premature. The technology and its applications are at an early stage of development, and the speed of its diffusion is uncertain. It is also difficult to know how many of the problems encountered in the workplace are transitional ones characteristic of any technological change. Consequently, there is a lack of data on the nature of the impacts of PA, especially over the long term. The information that exists is largely qualitative or anecdotal and often cannot be generalized for industry- or sector-wide responses.

Reliable information is critical if the OSH Act is to serve as the basis for PA-related work environment policy. The OSH Act is an enforcement statute which is implemented through investigations and measurements. While physical safety and health conditions tend to be relatively easy to measure objectively, psychological conditions are often less so. Broadening the scope of investigations would require additional investigator skills and procedures for which data on PA impacts would provide a foundation.

Additional Government action beyond the status quo could create mechanisms to collect data that would allow a more careful evaluation of the impacts of PA on the work environment, thereby permitting better planning to eliminate potentially serious problems. Both reliable data and better planning would contribute to a more focused development of policy initiatives over time, as appropriate. Without such Federal action, information on PA and the work environment will continue to be piecemeal and fragmentary, and anecdotal rather than quantitative. If use of the technology spreads more rapidly than expected, the United States may find itself reacting to the workplace effects of PA, rather than planning in advance to address its potential impacts.

Increase Oversight and Monitoring

Congress could increase the emphasis placed on the workplace effects of computerized manufacturing automation through its oversight and monitoring activities. Considerable attention has been given to these issues by a number of congressional committees over the past several years, particularly in oversight hearings. For example, in September 1981, the Subcommittee on Science, Research, and Technology of the House Committee on Science and Technology sponsored a series of hearings on "The Human Factor in Innovation and Pro ductivity" which focused on new technology in the workplace. *

This type of activity increases the visibility of the subject and provides a public forum for information-sharing and presentation of diverse viewpoints. In addition to its own oversight activities, Congress could designate responsibilities for OSHA and NIOSH, such as monitoring and assessing the effects of PA on the work environment or evaluating the applicability of existing OSHA standards to computerized settings.

The advantage of this option is that it would provide a Federal approach to monitoring and assessing the impacts of PA on workers in all types of manufacturing settings—unionized and nonunionized, large and small. In addition, it would help to assure that Congress is kept aware of the most current thinking with respect to the impacts of PA on the work force. The principal disadvantage is that it could potentially result in a piecemeal effort with little or no coordination of activities or sharing of information. Thus, designation of authority, participation criteria, and accountability would be necessary in the design of an oversight and monitoring initiative.

Increase Support for Work Environment Research

Work environment ramifications of the use of PA are central to both its effectiveness and its other impacts. Congress could support research addressing such areas as the long- and short-term physical and psychological effects of PA, management strategies and policies in introducing and using PA, worker participation, identification of hazards and how to control them, skill changes, changes in work content and organization, and changes in organizational structure, among others. Wide dissemination of the results would improve the general level of understanding of practical ways in which PA technologies can be used to enhance the work environment. Research efforts could also lead to the development of models or guidelines for installations with favorable effects on the work environment which could be used by those who are contemplating or making changes. Demonstration projects, seminars, and experiments would enhance understanding of the effects of PA and the extent to which it can be shaped to improve the work environment.* Congress also could assure that all parties involved—managers, employees, educators, and equipment builders—would have timely access to relevant information.

*The Congressional Research Service produced a committee print analyzing the testimony and discussion.

*Topics cover might include successful implementation efforts (and the other side of the coin—those that were not successful and why), innovative ways to organize work, and successful labor-management cooperative efforts.

Current research into the impacts of PA on the manufacturing work environment is modest in scope and support; funds for this purpose have been extremely limited. This situation has arisen in part because social science research funding is particularly vulnerable to reduction when funds are scarce. It has also arisen because work environment issues have traditionally not been major concerns to technology developers, industry, or even the social science research communities. Relevant research conducted by industry, universities, unions, and Government agencies is often piecemeal and short term. Human factors research, for example, is often narrowly defined to meet the performance needs of specific military (or industry) projects. Not surprisingly, therefore, there is no formal coordination of technology and work environment research efforts, nor evidence of a coherent plan or approach. By contrast, study of the impacts of new technology on the workplace is more common in Japan and Western Europe, where the subject has historically received more attention across sectors. In particular, many foreign countries combine work environment analysis with engineering research. To learn from their efforts and experience, Congress could direct an agency such as the Department of Labor to both survey relevant foreign activities and, in particular, to translate and disseminate foreign reports. However, recent cutbacks have already affected relevant research activities in the Employment and Training Administration and elsewhere in the Department of Labor.

Additional or redirected funding could be made available for activities administered by the National Science Foundation, NIOSH, the Department of Labor, or DOD to enable researchers to conduct both qualitative and quantitative research to determine the extent of the impacts of PA on the workplace. NSF would be in a position to extend the scope of relevant engineering research to include the social aspects of PA. It already funds separately relevant social science research. NIOSH could provide a perspective that would link and compare the safety and health aspects of PA to other occupational safety and health issues. The Department of Labor would be in a position to link the impacts of PA to other labor issues. DOD has already looked at some human factors issues in their ManTech program. In addition to individual agency efforts, increased interagency coordination of research efforts would have the advantage of combining the expertise of a variety of disciplines, e.g., engineering, sociology, and management.

In contemplating the Federal research budget, Congress may want to assure that work environment research, in particular, involves industry, labor, and academia together. Cooperative efforts provide academic researchers with access to a valuable source of data for analysis of long-term effects, while industry and labor may benefit directly from the findings in the short and long terms. Cooperative programs for research carried out over a period of time rather than accomplished in a onetime visit would be particularly informative to policymakers. Such research might be supported by any of the agencies listed above.

One disadvantage of increased funding for social impact research is the potential burden it might place on companies and individuals to respond to requests for in-depth studies. Some strategy for securing the cooperation of both labor and management would be needed to minimize potential burdens. The participation of professional and trade associations as well as labor organizations in the pkuming and execution of such research could help in overcoming some of the difficulties that might arise in gaining access to research sites.

New Standards

Both the framework and the mandate exist in the OSH Act for safeguarding occupational safety and health of Americans. If it were established that PA creates new occupational safety and health hazards that were not adequately addressed by manufacturers and users, new OSHA standards might be required. The previous two options, monitoring and additional research, are prerequisites to this option. Reliable information would be needed on

the numbers of people at risk, on the nature of the risks, and on the costs of establishing new regulations.

Advance Notice

Congress may wish to propose legislation that would require employers to give advance notice of any technological change that will affect the working conditions of its employees. A number of union contracts include a clause covering such notice, and such clauses are becoming more common. Legislation would espe cially benefit and protect employees of firms that are not unionized. Advance notice can benefit employees by providing time for thea to plan for the change (possibly in cooperation with employers, communities, and educators) and to update their skills if required; it provides employees with the means and the responsibility to plan for change. It also pro vides the opportunity for employees to participate in some of the decisionmaking that directly affects their work, if employers wish to involve them in this way. While advanced notice of technological change might be as controversial as advance notice of plant closings, the potential costs for workers and managers would likely be smaller. (See above discussion under employment policy.)

Omnibus Work Environment Legislation

Although the United States already has a statutory framework for protecting occupational safety and health, other aspects of the introduction of new technology in the workplace, such as the potential for monitoring and surveillance and the need for advance notice of technological change, suggest the desirability of taking a broader approach to work environment policy. In addition, a broader approach would ensure that the interests of all workers would be protected, given the limited coverage of collective bargaining.

A number of European countries have taken an omnibus approach to workplace concerns. In Norway and Sweden, for instance, work environment legislation has been in effect since 1977. One of the purposes of this legislation is to protect workers' mental as well as physical health in the workplace, particularly in the context of technology change, and to give employees an opportunity to influence the design of the work environment. Such legislation elevates these concerns to policy levels, and provides a framework for more concrete actions, such as those described below.

An American approach to legislation has been proposed by the International Association of Machinists, which has drafted a Technology Bill of Rights to "amend and redefine official labor policy" (see table 52).[18] In addition to advocating the use of new technology to promote full employment, this proposed measure includes such work environment safe guards as prohibiting monitoring and surveillance of workers, advance notice of technological change, and requirements for training. The Technology Bill of Rights has been made available by I AM to local unions for guidance in collective bargaining. Because of its breadth, however, if such a Bill of Rights were enacted as an amendment to U.S. labor laws, enforcement would be difficult.

Workplace legislation could establish a clear institutional focus for work environment concerns to enhance the general appreciation of these issues and their contribution to the economy and society. One example of such an institution is the Swedish Work Environment Fund, which provides funds for research and development in the work environment, addressing aspects of both physical and mental health. Its function is to collect and disseminate information, and to coordinate relevant program efforts. Financial support is provided by a variety of sources, including the government, employers, and workers. Such an institution might be considered for the United States, which presently has only limited institutional involvement in the work environment area concentrated on protection of physical health and safety.

The principal advantage of an institution of this kind is that it provides a coordinated

[18] "Let's Rebuild America," IAM, p.195.

focus for workplace research, and it establishes the workplace as an area of national concern. It would help to overcome much of the fragmentation of workplace research efforts currently evident in the United States by providing a central thrust and source for dissemination of information, demonstration projects, etc.

Existing Federal Education, Training, and Retraining Policy

At present, instruction for PA is funded through a variety of public and private sources. Federal funding of education, training, and retraining efforts of this type is authorized under broad legislation designed to encourage career awareness and occupation-related instruction on the elementary, secondary, and postsecondary levels.

The Federal role in education has traditionally been that of supplementing or enhancing State and local activities. However, in recent years, there has been a movement toward lessening direct Federal involvement with the establishment of educational block grants to States in place of categorical grants targeted for use with particular population groups or in specific types of programs. In spite of this trend, there are still many Federal laws that influence curriculum content and overall operations of local school systems and institutions of higher learning.

In contrast, the Federal role in training and retraining efforts—particularly for the economically disadvantaged-has been a dominant force since the 1960's. The enactment of the Manpower Development and Training Act (MDTA) and the establishment of a nationwide apprenticeship system did much to enhance the existing delivery system for training and retraining. In keeping with the trend toward decentralization, the recently enacted Job Training Partnership Act (Public Law 97-300) assigns responsibility for administration and regulation of federally funded training and retraining activities to the States.

For the purposes of this report, this section will briefly discuss in general terms selected Federal laws and proposed legislation that are present or potential sources of support for PA instructional programs.

Legislation

Elementary, Secondary, and Vocational Education.—The Education Consolidation and Improvement Act of 1981 (ECIA) called for the creation of a block grant to States in lieu of over 40 separate categorical grants to elementary and secondary schools, many of which were directed at special populations such as the handicapped and the economically disadvantaged. The intent of ECIA is to afford greater flexibility to State agencies and local school systems in how Federal funds will be utilized in support of State and local priorities. The major criticism of the Educational Block Grant Program is that numerous State and local educational priorities must compete for the same funding pool. Funding authorized under the Vocational Education Act of 1963—legislation now being considered for reauthorization beyond 1984—represents approximate ly 10 percent of the resources. State and local education agencies designate funds for secondary and postsecondary vocational education and training.[18] Funds made available under the act are utilized by a variety of institutions, including vocational\technical schools operated by local school systems, Stakoperated skills centers, and community colleges. Among the typical expenditures allowable under State-administered vocational education programs are facilities maintenance and improvement, equipment purchase, and curriculum development.

Postsecondary Education. —The Higher Education Act of 1968 authorizes Federal funds for use by public and private colleges and universities to supplement tuition proceeds, State funds, and private donations or endowments. Allowable expenditures under the act include facilities maintenance and improvement,

[18] Daniel M. Saks, "Jobs and Training, " Setting *National Prior'-ties: The 1984 Budget* (Washington, D. C.: The Brookings Institution, 1983), p. 165.

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equipment acquisition, and curriculum development.

Since the 1960's, the Federal Government has operated Student Financial Assistance Programs-among them the Guaranteed Student Loan Program (GSL) and the Pen Grants. The original intent of these programs was to provide broader access to higher education for individuals from low- and middle-income families. However, increased default rates and concern for overall program expenditure levels ($3.1 billion in fiscal year 1983) led to recent congressional action to tighten eligibility by requiring all applicants to undergo financial needs analysis, regardless of income. The Pen Grants, the largest of the student financial assistance programs, is also currently undergoing reevaluation. Both GSL and the Pen Grants have been sources of financial assistance to students enrolled in public and private colleges and universities and postsecondary, proprietary business, and technical schools.

Private Sector Training and Retraining- The recently enacted ob Training Partnership Act (JTPA) replaced as of October 1, 1983, the Comprehensive Employment and Training Act (CETA) as the legislation authorizing Federal involvement in occupational training and retraining. JTPA represents an expanded version of title VII of the CETA Amendments of 1968, known as the "Private Sector Initiative Program," designed to stimulate more direct business involvement in training, retraining employment of the economically disadvantaged. While the target audiences for programs designed and operated under JTPA are economically disadvantaged youth and adults who lack marketable job skills, title III of the act authorizes the expenditure of funds for retraining and related services for displaced workers. JTPA is administered at the State level, and programs are implemented through a network of local private industry councils that assess local needs and establish performance standards for training and retraining programs funded under the program. Unlike CETA, JTPA does not stipulate that living allowances will be provided to trainees under certain circumstances. Such provisions are left to the discretion of State legislatures.

Recent Legislative Proposals

Education, training, and retraining has been high on the list of priorities for both the 97th and 98th Congresses. This is due in part to concern over current and potential future work force effects of shifts in the industrial composition of the economy, and in part to the emergence of "excellence in education" as an issue of national concern. In addition, the rising national debt and reduced State and local revenues have generated considerable bipartisan support for reexamining the Federal role in education, training, and retraining. Recent legislative proposals with a bearing on instruction for programmable automation include the following

- strengthening precollege science and math education by increasing the supply of qualified instructors and encouraging curriculum development;
- encouraging computer literacy through teacher education, the creation of incentives for placement of computer hardware and software in local school systems, curriculum development, research, and other means;
- stimulating improvement in adult literacy;
- providing assistance to the States to ensure that target populations such as the economically disadvantaged, the handicapped, men and women entering nontraditional occupations, veterans, and adults requiring training and retraining are ade quately served by vocational education programs;
- creating tuition tax credits, and individual education and training accounts to stimulate greater individual participation in instruction; and
- creating tax incentives to encourage employers to provide additional training and retraining to employees as needed.

Options for Education, Training, and Retraining Policy

There is considerable pressure on the U.S. instructional system to be more responsive to structural economic change. Economic and technological change may well result in more frequent shifts in work force skill requirements, and it may well require greater flexibility and mobility among work force participants than ever before. The ramifications of PA for education and training area subset of this larger issue. There may be a new mandate for the U.S. instructional system as a whole to gear education training, and retraining programs of all types more to long-range, structural changes in the labor market. This focus, a change from the past orientation to relative ly static occupational demands, will also require a heightened awareness of skills that are common to a variety of occupations-skills that, by their very nature, may provide individuals with greater occupational mobility. New approaches to curriculum design, more frequent review and modification of existing curricula in keeping with substantive labor market change, an increase in the supply of qualified instructors in some disciplines, and more attention to maintaining instructional facilities and using state-of-the-art equipment, will be necessary.

While industry, labor unions, and educators are all providers of PA-related training and other types of instruction, they have limited resources and sometimes hold different views of the nature and scope of instruction required, as well as the most appropriate modes of delivery. In light of these conditions, and the roles being assumed by industry and labor, the Federal role in education, training, and retraining needs to be reexamined. The following Federal policy options are proposed for consideration by Congress.

No Increased Federal Role

Congress could choose not to modify Federal involvement in education, training, and retraining in light of instructional needs associated with programmable automation. If this option were pursued, PA-related instructional requirements would compete with all others for Federal dollars earmarked for elementary, secondary, vocational, and higher education, and for training and retraining. Producers and vendors of PA equipment and systems would provide, as they do now, the bulk of initial training to employees of user firms.* Companies utilizing PA would or would not provide additional in-house instruction based on available corporate resources and priorities.** Community colleges and trade and technical schools, based on their varying readings of available labor market forecasts, student demand, familiarity with local labor market needs, and resources, would choose whether or not to develop PA-related degree and nondegree programs. Colleges and universities would, with existing resources, choose whether or not to adapt their engineering, computer science, business administration, and career guidance programs to the needs of automated manufacturing environments, based on their understanding of industry and/or student demand. In elementary and secondary education, creating an awareness of career opportunities in automated manufacturing and providing information on skills requirements would be left to the discretion of the school district, institution, or individual instructor.

The advantage of maintaining the existing Federal role in PA instruction is that programmable automation is still in the earliest stages of utilization. Little is known about how PA will change or modify skill requirements, af-

*In the summer of 1982, OTA commissioned a survey of views of education, training, and retraining requirement associated with the use of programmable automation. Results of telephone interviews with producers of PA equipment and systems indicated that 93 percent of producer firms provide instruction for their customers, but that the training is narrowly focused and designed for use with a variety of occupational groups.

**The OTA commissioned survey of views of PA-related education, training, and retraining requirements found that 40 percent of the representative manufacturing facilities contacted utilized some form of PA, and of this number, only 22 percent sponsored or conducted education and training for automated manufacturing. Among the plants currently not offering instruction of this type, only 18 percent indicated any plans to implement programs in the future. The most common reason cited was "low benefits relative to costs."

feet job design, or trigger job loss, particularly over the long term. Current labor market forecasts shed little light on possible new career opportunities within automated manufacturing on which to base instructional priorities.

The disadvantage of not modifying Federal involvement in education, training and retraining for PA is that the Federal Government would forego potential roles unlikely to be assumed by other levels of government or the private sector, such as assisting in the coordination of instructional activities, ensuring that adequate labor market forecasts are developed and that information derived from such forecasts is actively disseminated to individuals, educators, and trainers. For example, State governments are unlikely to encourage instruction that increases individual mobility within the work force (and between States), although increased mobility may further national employment objectives. In addition, shortages of instructors, inadequate facilities and outdated equipment among traditional deliverers of technical instruction are national concerns. These conditions should be considered in determiningg possible Federal roles in instruction for programmable automation and in examining overall Federal involve ment in education, training, and retraining.

Increase Support for Facilities, Equipment and Qualified Instructors

Congress could choose to build on the existing Federal role in elementary, secondary, and postsecondary education by targeting resources for the purchase or lease of state-of-the-art equipment and/or by making selected facilities ready for use in future periods of intense instructional demand. It could further increase instructional capacity by creating tax incentives that would encourage user firms to purchase state-of-the-art equipment and systems for training purposes and to expand their in-house instructional facilities. Congress is currently considering proposals to strengthen science and math instruction on the elementary, secondary, and postsecondary levels by improving curricula and stimulating more interest in teaching careers in these fields. It could also consider methods to encourage interest in careers in engineering education and other forms of technical instruction.

The advantage of these congressional actions is that upgrading facilities and equipment, as well as stimulating the supply of instructors, would remove the major barriers to the establishment of relevant instructional programs within the public and private sectors. Such actions would serve to shorten the time from the identification of new skill requirements to the development of instructional programs. Removing impediments to the timely design of instruction would be particularly valuable for displaced workers and others seeking to develop new skills or enhance existing skills quickly.

The disadvantage of congressional actions of this type is that they might stimulate too much interest in PA-related instruction at the expense of other types of education and training. Doing so would result in the establishment of excess capacity for PA-related skills development. In addition, there is the danger that facilities improvements and equipment purchases could overshadow attention given to needs assessment, curriculum design, and instructional program delivery.

Encourage Curriculum Development

Congress could choose to encourage the development of curricula for various educational levels and instructional programs geared to the development of PA-related skills, perhaps by fostering the development of voluntary guidelines for PA-related curriculum content. This could be accomplished by establishing a program within the Department of Education that would provide grants to educational institutions to develop model curricula. Alternatively, funds for relevant curriculum development could be designated within the existing program of Educational Block Grants to States. By encouraging industry and labor participation in curriculum development at all levels, and by encouraging interjector cooperation in defining instructional requirements and

strategies generally, Congress could reinforce ties between industry, labor, and the instructional community.

Such congressional actions would create an environment for anew and coherent approach to curriculum design. At present, many programs for PA-related skills development consist simply of adding PA components to existing curricula. For example, a number of robotics maintenance and repair programs are based on long-established curricula for electromechanical technology or electronics. This approach to curriculum design is not necessarily ineffective; it simply needs to be examined and evaluated. However, curricula that are tied too closely to specific occupations may not stand the test of time, particularly Since present **skills requirements associated with PA may represent only** the first wave of change. Encouraging comprehensive curriculum design and the establishment of voluntary guidelines for curriculum content would guarantee some degree of standardization to both enrollees and employers. Such standardization would foster the development of common skills that would, in turn, encourage more standardized approaches to job content and greater individual mobility within the work force. This would encourage proactive education and training.

The disadvantage of such congressional actions is that, unless carefully devised, they might stifle creative approaches to curriculum design and content that are ongoing or that might otherwise develop on the institutional level. There is also a risk that the importance of PA issues might be overemphasized in overall curriculum design.

Encourage Renewed Emphasis on Basic Skills and Problem-Solving Skills

Congress could choose to encourage at all levels of instruction a renewed emphasis on strong, basic skills in reading, math, and science. Special emphasis could be placed on the development of individual problem-solving skills, since these are important prerequisites to training **for careers in automated manufacturing, as well for nonmanufacturing occupations.** Many individuals are unable to participate in PA-related instruction due to basic skill deficiencies. Others have received technical instruction that was geared to the development of manual skills and that provided limited opportunities for the development of more abstract problem-solving abilities. Some have held jobs for long periods that did not require use of conceptual skills that may be more important for work in computerized settings. Congress could emphasize the importance of both basic skills and problem-solving skills at all levels of instruction, and take steps to coordinate basic-education programs for school-age youth and adults. This could be accomplished by strengthening the coordination function now performed by the Department of Education for elementary, secondary, vocational, technical, and higher education. Currently, the Department sponsors research on alternative approaches to basic skills and problem-solving skills development for different levels of education and for students of different age groups.

There are a number of advantages in pursuing this option. First, it can make the labor supply more resilient in the long-term by raising the overall skill level. Second, it creates a common foundation of skills that could be enhanced over time (as needed) through the development of job-related skills, including those associated with PA. Third, this approach does not feed the process of “skills obsolescence” by tying individual instruction too closely to specific technologies.

The disadvantage of this course of action is that it risks overemphasis of the basic skills to the neglect of broader educational experiences and the stimulation of career interests. In addition, it represents only part of a long-term solution, and it does not address the need for the development of specific, PA-related skills needed in the short-term, such as maintenance, repair, and programing.

Intensify Efforts to Gather and Broadly Disseminate Labor-Market Information

In order to adequately prepare for participation in the work force, individuals need access to current, reliable information on labor market trends, especially trends for occupational employment. Educational and career guidance personnel at all instructional levels, as well as individuals who provide job counseling and placement assistance to adults, also need access to current, reliable information. Congress could choose to strengthen the national database for labor-market information and encourage the development of strong links to State and local databases, where they exist. It could also encourage more systematic dissemination of labor market information, in cooperation with the private sector, by modifying the responsibilities of the Bureau of Labor Statistics and designating broad-based information dissemination as a primary BLS function. These actions would require an increase in appropriations, in light of recent cutbacks in Federal statistical programs.

One advantage of this type of congressional action is that it would enhance public and private sector knowledge of labor market conditions, facilitating "informed" planning by individuals, employers, educators, and all levels of government. Another advantage is that the database could be used in combination with information on industrial activity (e.g., plant and facility improvements) as an early warning system for major shifts in skills requirements in older or emerging growth industries.

The disadvantage of enhancing current labor-market information gathering and dissemination programs is that additional Federal expenditures would be required in a period of relatively limited Federal resources. The success of such a program would hinge on the close cooperation of industry and labor unions with the Federal Government in sharing information on emerging skills requirements and current approaches to job design.

Encourage Individual Participation in PA-Related Instruction

Congress could choose to influence the numbers of individuals who seek PA-related instruction or retraining for jobs in nonmanufacturing sectors. Measures such as those already being considered by Congress to make individual participation in instruction more economically feasible could be used to encourage PA-related skills development. These proposals include: the creation of individual tax incentives; the designation of trainingas an allowable expense under the Unemployment Insurance System; and the establishment of individual education or training accounts.

This course of action would increase the role of individuals in the adjustment process. Incentives to individuals would be particularly valuable in instances where employers do not provide PA-related skills development opportunities to their employees beyond the level of introductory training. Displaced workers who wish to pursue careers in computerized environments or elsewhere would gain the resources for acquiring necessary skills.

Possible disadvantages in congressional initiatives of this kind include overstimulation of individual interest in PA-related skills development that, unless carefully monitored, could result in a skills glut; proliferation of PA instructional programs that are not necessarily of high quality; and a disincentive to industries utilizing PA to provide employee instruction.

Encourage Industry-Based Instruction

Findings of an OTA-sponsored survey of views of instructional requirements for programmable automation suggest that the majority of firms currently utilizing computer-automated equipment and systems have no plans at this time to establish in-house instructional programs in the near future.[20] These

[20]For additional information on this OTA-sponsored survey, see *Automation and the Workplace: Selected Labor, Education, and Training Issues,* op. cit., March 1983.

findings are in keeping with ongoing, private sector concern about the high costs associated with providing in-house, technical instruction. Congress could choose to encourage users of programmable automation to establish or enhance existing, in-house technical training and education programs through the creation of tax incentives that help defray the costs of instructors, equipment, expansion of instructional facilities, and curriculum development.

This type of congressional action would stimulate additional training to meet short-term industrial needs. It would also encourage firms already providing PA-related instruction to broaden what is commonly very narrow course content; to provide access to training to a wide range of occupational groups-including production line workers; and to consider establishing longer range human resource development programs. Training associated with proprietary processes might be stimulated by the availability of additional resources, Incentives might be particularly useful in making training in small firms more structured and focused; it traditionally occurs informally on the job due to limited resources and other factors.

One risk of such congressional initiatives is that they may not assist manufacturing workers who need it the most: lower skilled production line workers and skilled craftsmen who have become unemployed or are at the greatest risk of job loss, since industry has traditionally provided little training to these worker groups. The design of specific initiatives would determine whether the unique needs of these worker groups are taken into account in instructional programs. There might also be a disincentive for some individuals to pursue PA-related education and training programs that are not offered by their employers.

Intensify Research Efforts

Since programmable technologies are still maturing and PA diffusion is still in the earliest phases, it is likely that additional changes in skill requirements for automated manufacturing will emerge over time. Congress could choose to increase Federal sponsorship of research to identify changing skills requirements within existing manufacturing occupations and emerging occupations, and to provide for broad-based dissemination of the findings to better equip educators and trainers for curriculum development. Congress could also use a research program to encourage the development of instructional standards that are in keeping with PA-related skill requirements. It could authorize the Departments of Education and Labor to establish mechanisms for regular review and reassessment of these standards by industry, labor, and educators. Strengthening the labor-market information database, as proposed in a previous option, is a prerequisite for this initiative.

Individuals, educators, industry, and labor would all benefit from an increased understanding of changing skills and emerging occupations, especially since little research of this kind is conducted within the private sector. Broad-based dissemination of this information by Federal and State governments, nonprofit associations, and other entities would ensure that workers of all types would have access and the opportunity to determine what it means in light of their career goals and skill levels. Over time, the availability of this information would give individuals and institutions a stronger basis from which to forecast future skills changes and to initiate instructional activities based on these changes. The creation of instructional standards would encourage the development of high-quality education, training, and retraining programs with content that accurately reflects industrial skills requirements.

A disadvantage to this option is that it would require an expanded Federal role in sociotechnical research in a period of limited Federal resources. Another disadvantage is that the creation of instructional standards could stifle creative approaches to curriculum content at the institutional level, and instructional responses to the needs of particular industries with unique PA applications.