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ABSTRACT

In the coming decade, three major developments will become important factors for change in vocational education. These are changes in the demographic profile and retirement practices, regional shifts in economic activity and in employment, and renewal of the industrial sector as a key ingredient in economic growth. Because of inflation, greater life expectancies, and changes in public policy and social attitudes, older persons will remain in the work force longer and will thereby become considerably more important in the market for vocational programs, provided that their needs and the need for sustaining enrollments in vocational education receive priority in the coming decades. Regional shifts in employment and economic activity have created the need for increased supplies of trained personnel in rapid growth areas. Recent inflation, high unemployment, and slow productivity growth rates will increase opportunities in technical and service fields and reduce opportunities for semiskilled factory operatives. If vocational education is to respond adequately to this major restructuring of the industrial economy, it must become aware of the economic changes at hand. (MN)

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VOCATIONAL EDUCATION AS A PARTICIPANT IN THE ECONOMIC DEVELOPMENT ENTERPRISE: POLICY OPTIONS FOR THE DECADE AHEAD

by

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FOREWORD

Vocational education is forging ahead as a vital factor in the economic development of America. In keeping with this role, it is essential that vocational educators develop effective plans for their participation in one of the most important endeavors facing our nation. Dr. Leonard A. Lecht presented the remarks contained in this paper at a National Academy for Vocational Education conference that focused directly on that role in the future.

Dr. Lecht's comments are based on his extensive and unique insight. He received a Ph.D. in economics from Columbia University and currently serves as an economic consultant. For the Conference Board in New York City, he has directed special projects research on economic and employment trends and private sector/government relationships in human resource development training programs. Prior to this, he conducted similar research as Director of the Center for Priority Analysis of the National Planning Association. He has served as a consultant and expert witness to numerous government agencies including the United States Congress. He was also the Chairman of Long Island University's Department of Economics.

On behalf of the National Center for Research in Vocational Education and The Ohio State University, it is with great pleasure that we bring you Dr. Leonard Lecht's presentation entitled: "Vocational Education as a Participant in the Economic Development Enterprise: Policy Options for the Decade Ahead."

Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

VOCATIONAL EDUCATION AS A PARTICIPANT IN THE ECONOMIC DEVELOPMENT ENTERPRISE: POLICY OPTIONS FOR THE DECADE AHEAD

Forces For Change

Planning strategies for vocational education are often identified through the annual plans submitted by education agencies to comply with the guidelines of federal, state, and local government funding sources. But in a more fundamental sense, planning involves looking ahead and anticipating changes in the larger society that can influence course offerings, enrollments, financial support, and careers for students in vocational programs. Such anticipation has become especially critical in the eighties, as the nation moves into an era where a changing population will take on greater importance in the evaluation of vocational education program performance.

In the coming decade, three major developments are seen as important factors for change in vocational education. They are as follows:

- Changes in the demographic profile and in retirement practices
- Regional shifts in economic activity and in employment
- Renewal of the industrial sector as a key ingredient in economic growth

State and local vocational education agencies will have to increase their adaptation to change as these developments increase in impact. More older persons will be enrolled in vocational programs. Vocational education also will become more involved with state and local economic development as the programs offered place a substantially greater emphasis on training persons to operate, maintain, and repair new and complex equipment. Because of their past involvement in both employability development and in adult, technical, and continuing education, vocational education agencies will be in a good position to respond to these changes.

A further consideration of these three developments can indicate the problems and opportunities they will create for the larger society, and their implications for change in vocational education planning.

Changes in the Demographic Profile and in Retirement Practices

Analyses of labor force changes in the seventies focused on the influx of women and sixteen- to twenty-four-year-olds into the labor market. Considerably less attention was given to another major development: the withdrawal of older men from the labor force because of earlier retirement ages. Inflation, greater life expectancies, and changes in public policy and social attitudes can be expected to reverse this trend of early retirement during the eighties. Older persons will become considerably more important in the market for vocational programs if their needs, and the need for sustaining enrollments in vocational education, receive priority in the coming decades.

In the past thirty years, there was a sharp decline in the percentage of men in their late fifties who remained in the labor force. This decline also shows up in the proportion of men sixty to sixty-four years of age and those over sixty-five who remain employed or who are looking for work. (See table 1.)

TABLE 1

PERCENTAGE OF MEN 60 AND OVER IN THE LABOR FORCE, 1947 to 1978

Year	Percent in Labor Force	
	60 to 64	*65 and over*
1947	—	48.0
1950	79.5	46.0
1960	78.0	33.0
1970	75.0	27.0
1978	62.0	20.5

SOURCE: Derived from *Employment and Training Report of the President.* Washington, D.C.: U.S. Government Printing Office, 1979; p. 236; and President's Commission of Pension Policy, *Variety of Retirement Ages.* Washington, D.C.: U.S. Government Printing Office, 1980; p. 7.

Shortly after World War II ended, nearly half of all men in the sixty-five and over category were in the work force. By 1978, only a fifth of the men in this age group were either employed or looking for work. But the most striking change occurred in the participation by men in the sixty- to sixty-four-year-old group. This shift was facilitated by the 1961 Amendments to the Social Security Act, which permitted retirement at age sixty-two with only modest reductions in benefits.

The propensity for men to retire at earlier ages received widespread support from business and labor. Employers came to regard retirement, especially early retirement, as an important aid in hiring and promoting younger persons. Such persons were assumed to be more productive and to possess more up-to-date skills than the older persons they replaced. Unions responded to technological changes and other changes threatening their members' jobs, with demands for generous and largely employer-financed pensions for their older members. It was assumed that older persons would prefer to retire if they were assured an adequate retirement income. Furthermore, unions coupled these demands with work guarantees for their younger members.

Since all parties concerned were assumed to benefit from such policies, they went through a series of successive liberalizations. The age at which persons could retire, with minimal losses in benefits, was gradually shifted downward by law, by collective bargaining, and by company policy.

Such a tendency would appear to be so firmly established that prospects for its reversal might be regarded as remote. Yet inflation, sharply rising retirement benefit costs, changes in the demographic profile, and the preferences of older people are all facilitating a shift in public policy and in personal decisions to retire. The shift is now toward encouraging older workers to remain in the labor force. Recent amendments to the Age Discrimination Act that outlaw mandatory retirement for most employees before age seventy symbolize these changes.

For Social Security and other federally funded retirement systems, inflation primarily affects program costs because it raises both wage levels and monthly benefit payments at the same rate as

increases in the Consumer Price Index. Benefits in private pension systems, and in most state and local government systems, however, are seldom adjusted or "indexed" to keep pace with changes in the cost of living.

Inflation affects these systems primarily because it both increases the wage level on which benefit payments are based, and erodes the purchasing power of retired persons.

For the Social Security system, each percentage point increase in the Consumer Price Index has been estimated to add $1.1 billion in outlays for old age and survivors insurance benefits.[1] The role of inflation in diminishing the purchasing power of a pension that is not indexed to changes in the cost of living can be illustrated by projecting the purchasing power of a $1,000 a month pension granted in 1980 through 1995. The projection shows the losses in purchasing power if there is either a 5 or 10 percent average annual increase in the Consumer Price Index.

TABLE 2

PURCHASING POWER OF A $1,000 MONTHLY PENSION ASSUMING ALTERNATIVE RATES OF INCREASE IN THE CONSUMER PRICE INDEX, 1980–1995

	Purchasing Power in 1980 Dollars	
Year	*5 Percent Annual Price Increase*	*10 Percent Annual Price Increase*
1980	$1,000	$1,000
1985	780	620
1990	610	390
1995	480	240

SOURCE: *Social Security Bulletin*, November 1978, p. 1

With inflation averaging 10 percent a year, a pension that is not indexed would lose five-eighths of its purchasing power by the end of the fifth year. At the end of fifteen years, the loss would be slightly greater than three-fourths. The assumed ten percent inflation rate in this table is somewhat less than the comparable rates for 1979 and 1980. With a substantial reduction in the rate of inflation (say to 5 percent a year), slightly more than half of the original purchasing power represented by the pension would be lost by the fifteenth year.

Private pension plans now cover approximately half the labor force. State and local government plans cover several million more people. These pension systems, which often are coupled with Social Security benefits, have allowed many middle-class persons to retire in modest comfort. Yet because of inflation, employees depending on such pensions today will frequently postpone their retirement with the hopes of maintaining their income and building up a larger pension reserve for when they do retire.

For the federal government, outlays for retirement systems and other income supports amounted to $170 billion in the 1979 fiscal year. This represented more than a third (34.5 percent) of the federal government's expenditures in that year.[2] Efforts to restrain the growth in the federal government's budget in the eighties will include slowing down these massive outlays, thereby encouraging older persons to remain in the labor force.

Since a larger percentage of the population during the next decade will be older, inflation will have a greater effect on more people. Reduction of mortality rates, formerly concentrated on younger age groups, has come to characterize older persons as well. Improvement in the treatment of heart disease in the past twenty years is a good example. At the other end of the age spectrum, declining birthrates since the mid-sixties will sharply reduce the size of the sixteen- to twenty-four-year-old group in the population and in the labor force in the next ten years. (See table 3.)

TABLE 3

PROJECTED POPULATION GROWTH, 16 to 24 YEAR OLDS AND PERSONS 65 AND OVER, 1980 to 1990

Age Group	*Estimated Population (in millions)*		*Percent Change 1980 to 1990*
	in 1980	*in 1990*	
16 to 19	16.7	13.5	-19.0
20 to 24	20.9	18.0	-14.0
65 and over	24.9	29.8	+19.5

SOURCE. *Employment and Training Report of the President*, Washington, D.C.: U.S. Government Printing Office 1979; p. 353. Projections represent U.S. Census Bureau intermediate fertility estimates.

By 1990, these Census Bureau projections anticipate that there will be 5 million *more* persons who are age sixty-five and over. There will be some 6 million *fewer* people in the sixteen- to twenty-four-year-old age group. The bulk of the population and labor force increases will occur in the twenty-five to forty-four-year-old category: the "baby boom" generation of the two decades following World War II.

Labor force growth in the eighties will undergo a marked slowdown as fewer young people are added to the work force. Over three-fifths of the growth that *does* take place will be due to an increase of female employees.

As can be expected, the pressures to retire will diminish as fewer young people are added to the labor force. For persons over sixty-five who continue working, important issues will have to be resolved. These include, among others, the problem of fringe benefit costs to employers, the higher wage rates due to seniority for many older employees, and the frequent needs for further education and training to upgrade older employees' skills. Other problems will arise because older workers often prefer to work on a part-time basis, and on a more flexible arrangement than the forty-hour week or fifty-two-week year.

All these economic and demographic factors can be seen as strategic influences on the long-term labor force participation of older persons. The overall attitudes of older people who have retired or who are in the age group approaching retirement can be traced as influencing the decision to retire or to continue working. The Harris Survey for 1979, for example, reports the following:

- Forty-six percent of those already retired would prefer to be working.
- Forty-eight percent of the persons surveyed in the fifty to sixty-five age group with to continue working after age sixty-five.[3]

Evidence from the Harris surveys and related studies shows that older persons are seeking greater freedom of choice in their options to continue working or to retire, to retire or to return to school, to work full-time or part-time, to earn income from work, or to participate as volunteers.

The changes influencing population growth in the eighties will make it more difficult for all educational institutions to maintain enrollment. The decline in the population of young persons already has become apparent to high school and post-high school educators as enrollments have tapered off. In the absence of a dramatic increase in the percentage of traditional school-age students who choose vocational programs, demographic developments among the younger age groups indicate a prospect for serious losses in vocational education enrollments. The impact of the population decline in these age groups would be offset, and important economic and human needs served, if vocational education systems today undertake changes that will increase their appeal to new audiences.

There has been growth in the number of educational programs available to older persons. But in terms of enrollment, these individuals remain underrepresented in all educational programs, including adult and vocational education. For example, only 7 percent of the persons enrolled in courses through the adult education state grant programs in fiscal year 1979 were age fifty-five or older. This represents a decline from 12 percent in the 1966 fiscal year. The largest single group of enrollees in these programs in 1979 were sixteen- to twenty-four-year-olds. They made up over two-fifths (41 percent) of the enrollees.[4]

The limited information available shows that older persons make up an important *potential* audience for vocationally oriented programs. For example, a recent survey of "would-be learners" in the fifty-five- to sixty-year-old age group reported that vocational subjects were the leading preference among choices of study. (See table 4.)

TABLE 4

DISTRIBUTION OF "WOULD-BE LEARNERS" PREFERRED CURRICULAR CHOICES, AGE GROUP 55 TO 60

First Choice	*Percent Indicating Choice*
Vocational Subjects	30
Hobbies, Recreation	17
General Education	16
Home and Family	13
Personal Development	8
Religion	7
Other	9
Total	100

SOURCE: McNulty, M., and Palmer, M., *Educational Programs to the Elderly.* Menlo Park, CA: Institute for the Future, 1977, p. 26.

As you can see, vocational subjects were listed as a first choice almost as frequently as the next two leading categories combined. Such interest in vocational courses includes the interest of persons who regard the programs as preparation for a second career, or as an opportunity to upgrade obsolescent skills. The group also includes others who were seeking to acquire a useful repair skill such as auto mechanics, or a hobby such as woodworking.

In practice, the preferences of "would-be learners" are only partially reflected by the enrollment of older persons in educational courses. Recently the largest enrollments have been in subjects related to hobbies and recreation. Vocational programs that attract "would-be learners" in the future will have to have a different orientation than current programs. They need to concentrate on updating participants' interpersonal skills that have been in use in the past. Persons fifty and over typically have less interest in formal courses or degrees than young persons do. Individuals with years of work experience who are seeking new careers or part-time jobs require different guidance and placement assistance than young persons seeking entry into the world of work. Older persons often have work histories in declining industries or occupations, or their work skills have become obsolete because of technological change. Their opportunities for continued employment may depend on modifying or expanding existing skills to make them usable in different job contexts. Former typists, for instance, can be taught to qualify as work processors. A production foreperson ready to retire from the footwear or garment industry could build on managerial experience and acquire the skills needed in an expanding field, for example, in supervision of operations for a hospital laundry.

The vocational education system is strategically situated to make the shift toward serving non-traditional groups of students who wish to return to the labor market. The involvement of local vocational education agencies in adult and continuing education can supply the basis for attracting students in their fifties and sixties. The extent to which vocational education utilizes its potential for attracting these students in the eighties will depend on the steps taken by educational institutions to adapt their programs to the interests of older students.

Regional Shifts in Employment and Economic Activity

Regional shifts in employment and economic activity have caused slow growth in job openings in the northeastern and midwestern regions of the United States. Slow growth, and sometimes decline, has been especially characteristic of the older manufacturing states such as Michigan and Ohio. Yet there has been rapid growth in the southern and western regions. Vocational education systems can contribute to economic development in both rapidly and slowly growing regions. In the rapidly growing areas, local vocational education agencies can help to maintain the momentum of growth by increasing the supply of trained personnel for firms already in the area. This increased supply of personnel also will help to attract new firms. In the more slowly growing areas, vocational programs can contribute to development by providing trained workers to relieve specialized labor shortages that often cause employers to relocate. They also can provide trained replacements for shortages due to attrition losses in industries that are not expanding rapidly.

Regions with a high number of long established manufacturing plants have been characterized by below average employment growth in the past ten or fifteen years. The regions with more rapid increases in employment have been the areas where the introduction of manufacturing plants is a relatively new development. This relationship can be seen by comparing the percentage of the nation-wide economic value added by manufacturing in different regions in 1976 with the percent change in employment from 1968 to 1978. (See table 5.)

The east north central and middle Atlantic states were responsible for nearly half (45 percent) of the manufacturing value added to the United States economy in 1976. Yet in both areas, percentage increases in employment during the period from 1968 to 1978 contributed less than a third of the total national increase in employment. The areas with the large percentage increases in employment (the mountain and west south central states) were responsible for only about a tenth of the total value added by manufacturing in 1976. This pattern is more a reflection of the decline in employment for old manufacturing centers than a reluctance to increase the importance of manufacturing

in the economies of rapidly growing areas. These shifts help explain the lack of openings in the traditional, semiskilled blue-collar jobs in manufacturing that once provided entry level positions for many young people in the northeastern and north central states.

Such regional patterns of employment and economic growth have been reflected in a similar pattern of regional migration. The northeastern and north central states have lost population in the migration, while the southern and western states have been gainers. (See table 6.)

TABLE 5

PERCENTAGE OF TOTAL VALUE ADDED BY MANUFACTURING, 1976, AND EMPLOYMENT GROWTH BY REGION, 1976 TO 1978

Region	*Percent of Total Value Added by Manufacturing in 1976*	*Percent Increase in Employment — 1968 to 1978*
All Regions	100.0	24.3
New England	6.2	16.4
Middle Atlantic	17.8	8.7
East North Central	27.5	15.4
West North Central	7.0	27.4
Mountain	2.3	57.9
Pacific	11.7	34.5
East South Central	6.1	23.8
West South Central	8.6	40.2
South Atlantic	12.8	31.7

SOURCE: U.S. Department of Labor, *Monthly Labor Review*, March 1980, p. 14; *Statistical Abstract*, 1978, p. 800.

TABLE 6

PERSONS MOVING TO AND FROM EACH MAJOR REGION, 1973 TO 1976

Major Region	*Migrants (in thousands) into region*	*out of region*	*Outmigration as a Percentage of Immigration*
Northeast	1,058	1,829	173.0
North Central	1,935	2,400	124.0
South	3,254	2,407	74.0
West	2,106	1,718	81.5

SOURCE: "Youth Labor Force Activity," *Monthly Labor Review*, March 1980; p. 15.

While some persons move for noneconomic reasons such as the desire for a change of climate, the primary reason for relocation has been due to employment and economic opportunities. Such regional migrants, on the average, have been younger and better educated than the nonmigrants. The tendency for young, educated persons to migrate to the South and West adds to the factors facilitating the development of high technology manufacturing industries in these areas.

These regional shifts have been accompanied by similar changes in economic activity and employment in the larger cities within the regions. Eroding industrial bases, with corresponding losses in population, have been characteristic of the larger cities of the Northeast and Midwest from Boston to St. Louis. Correspondingly, there have been large gains in population and manufacturing jobs in large cities of the South and West, such as Phoenix and Houston. These patterns of central city decline/growth have been partially associated with the regional shifts. But they also stem from the movement of population and economic activity to the suburbs. The overall effect of both of these factors has been to make older central cities into concentrations of unemployed and disadvantaged persons with limited job opportunities in their skill areas, the manufacturing industries. (See table 7.)

According to table 7, all of the "growing" cities are in the South and West. (Honolulu is included in the U.S. Bureau of the Census' West region, although it is outside the continental United States.) All of the declining cities, except Baltimore, are in the northeastern or north central regions. Baltimore, of course, is a border city, and its economic makeup more closely resembles the old manufacturing and port cities of the Northeast rather than southern cities such as Atlanta or Houston. While part of the population gain of growing cities is due to the annexation of surrounding suburbs, the increases primarily represent growth in population for reasons other than an expansion of city boundaries.

Many important national issues are involved in both the regional shifts and in the growth and decline of the large cities. The older regions can expect a loss of political influence as population losses lead to a reapportionment of congressional seats. The newer regions will gain political weight for the same reason. Labor unions will often face difficult problems as employment either grows slowly or declines in the older regions and in industries that comprised their membership base. In contrast, in many areas where unions historically have been weak, employment will be growing rapidly. National policy will be viewed increasingly from the perspective of its anticipated impact on the fortunes of different regions. For instance, the decision of the recent administration to permit more generous depreciation allowances for building new plants can be expected to hasten some firms' decisions to move from the Northeast to the South. Because of these tax writeoffs, such moves will be less costly than they otherwise would be. National policy for unemployment is faced with the alternatives of encouraging the movement of people to where the growth in jobs is taking place, or undertaking measures that would increase available jobs in cities with high unemployment rates.

Such regional and urban shifts also will present problems and opportunities for local vocational education agencies. In rapidly growing areas such as Phoenix and San Diego, any enrollment declines due to falling birthrates in the past fifteen years will be offset at least partially by the effects of rapid population growth. In the older cities, enrollment losses due to the decline in birthrates have been augmented by the movement of many families, especially young families, to the suburbs or to the more rapidly growing regions.

Vocational education systems in both the slow and rapidly growing regions can enhance their prospects for growth if they become active participants in state and local economic development efforts. These include efforts by government agencies, local chambers of commerce, and similar organizations.

TABLE 7

POPULATION CHANGE AND CHANGE IN EMPLOYMENT IN MANUFACTURING, GROWING AND DECLINING CITIES, SELECTED YEARS, 1970s

City	Region	Population Change 1970–1980 (in thousands)	Change in Manufacturing Employment, 1972 to 1977
Growing Cities:			
Dallas	South	+ 52	+ 5,500
Honolulu	West	+ 131	—0—
Houston	South	+ 273	+ 39,400
Los Angeles	West	+ 138	+ 35,500
Phoenix	West	+ 192	+ 6,000
San Antonio	South	+ 75	+ 3,900
San Diego	West	+ 173	+ 8,200
Declining Cities:			
Baltimore	South	- 123	- 17,900
Boston	Northeast	- 79	- 8,100
Buffalo	Northeast	- 106	- 6,800
Chicago	North Central	- 400	- 64,600
Cincinnati	North Central	- 70	- 3,800
Cleveland	North Central	- 178	- 10,400
Detroit	North Central	- 322	- 27,100
Milwaukee	North Central	- 84	- 14,900
Minneapolis	North Central	- 64	- 5,900
New York City	Northeast	- 880	- 147,800
Philadelphia	Northeast	- 270	- 45,100
Pittsburgh	Northeast	- 96	- 7,000
St. Louis	North Central	- 174	- 3,600

SOURCE: Kamer, Pearl. "Municipal Finance: How [illegible] the Crisis." *Metropolitan Economic Association*, mimeographed report, 1981.

One of the factors emphasized by many development agencies in seeking new industry for their areas has been the availability of a labor supply that possesses the skills required by the new firms. These skills often include use of the new technologies in computers, microprocessors, and similar applications of automation to industry. Development programs in other areas will focus on advanced technologies to obtain energy from sources that were not economically feasible when oil prices were lower. Instances include extracting oil from shale rock, or shipping coal by pipeline slurry. Economic growth in energy resource regions will in turn lead to an expansion in the business and consumer service industries that will require many employees trained in technical and business skills. Vocational education agencies in high growth areas can provide the trained personnel to utilize the more complex technologies, or to provide the business and consumer services that usually accompany growth.

In the more slowly growing areas, local economic development agencies will seek to strengthen and build on the healthy economic cores that these areas typically possess. The recent growth in business services, international finance, and tourism in New York City illustrates this type of development. Growth in finance and tourism in this city has created many jobs in data processing, administration, travel and recreation, and business machine repair. Revival in financial, legal, and other business services also has meant revival in related industries, in printing and publishing, or in construction. In the past, many of the more desirable jobs in these fields were held by commuters because local residents lacked the skills to fill them. City-based vocational education agencies can train many local persons who would otherwise be bypassed by growth in the central cities.

In both high and low growth areas, vocational education programs should continue to serve disadvantaged groups by providing them with employability skills. The unemployment rate for blacks and other nonwhites, for example, was approximately double the white rate of unemployment in both high and low growth areas. In Houston and Dallas, for example, the unemployment rate for whites in 1979 was between 2.9 to 3.6 percent. Unemployment rates for nonwhites in the two cities were in the 6.4 to 6.9 percent range.[5] Continued efforts by vocational educators will help to reduce such gaps.

Vocational education agencies have historically concentrated on local area labor markets in planning their programs for career opportunities and personnel needs. This local labor market has frequently been identified with the political jurisdiction served by the educational system—usually a city. Such planning methods assume that graduates will obtain employment primarily in the local political unit. It also assumes that schools have a special obligation to serve the local area that provides the bulk of their funds. Recently, this approach has lost a great deal of its validity, and it is likely to lose more in the coming decade. Local labor market concerns now extend far beyond the city's political borders, as employers and jobs have moved to the suburbs and beyond. In many fields, particularly those that require specialized post-high school education, the relevant labor market has become regional or national in scope. Planning in vocational education can serve students, employers, and the nation more effectively by encompassing regional and national opportunities, as well as local career opportunities, in developing their programs.

Strengthening the Industrial Economy

A combination of high inflation rates, high unemployment rates, and slow productivity growth rates has characterized the American economy for the past few years. Considerations growing out of such "stagflation" have become an important influence for change not only in national policy, but also in economic policies intended to revive the economy's industrial base. These developments will have many implications for vocational education planning in the eighties. While they will increase career opportunities in technical and service fields and in new growth industries, they will reduce opportunities for semiskilled factory operatives. Such developments also will change job profiles in other industries.

The American economy has been undergoing major structural changes since the seventies. These changes will continue, and probably accelerate, in the eighties. Some industries, primarily those involved in energy and high technology fields, have been expanding rapidly. The regions in which they are concentrated, mainly in the "Sunbelt" states, have likewise become high growth areas.

The industries that have been experiencing slow growth or decline include many of the old manufacturing industries in which the United States was the world leader. These industries include

automobiles, steel, rubber, consumer electronics, and selected nonmanufacturing industries such as railroads. The slow growth regions in the past decade have been the areas, mainly in the Midwest and Northeast, in which these industries are concentrated.

Losses to foreign competitors such as Japan or West Germany have highlighted the problems of the United States' old manufacturing industries. Japan, for example, has become the world leader in automobile production and in the production and utilization of industrial robots. And while productivity levels per hour worked have been higher in the United States, productivity level *growth* frequently has been higher in other countries. Continuation of these productivity growth differentials for another five or ten years will mean that foreign productivity levels (output per hour worked) will reach or exceed the levels in comparable American industries. Two types of growth—slow productivity growth in the United States, and the more rapid productivity growth in other nations—are summarized in table 8.

TABLE 8

ANNUAL AVERAGE PERCENT CHANGE IN OUTPUT PER HOUR, MANUFACTURING INDUSTRIES, SELECTED NATIONS, 1970 TO 1979

	Annual Percent Change	
Country	*1973 to 1979*	*1978 to 1979*
United States	1.4	0.8
France	4.8	4.7
West Germany	5.3	5.2
Japan	6.9	8.1

SOURCE: U.S. Department of Labor, *Monthly Labor Review*, December 1980; p. 33.

The growth rate in output per hour in manufacturing in the United States during the 1973 to 1979 period was about a fifth the comparable growth rate in Japan. It was slightly more than a fourth of the increase in West Germany, and somewhat less than a third of the growth rate in France. In the most recent years of the 1973 to 1979 period (1978-1979), output per hour in American manufacturing industries increased at an annual rate of less than 1 percent. The increases in France and West Germany remained near their overall 1973 to 1979 levels in this period, while the percentage growth in output per hour increased in Japan.

Slow productivity growth, accompanied by substantial increases in wage rates and fringe benefits, has translated into rising labor costs for many manufacturing industries. This development has encouraged a manufacturing shift from the United States to other nations. Furthermore, multinational corporations have facilitated the development of manufacturing "export platforms" in places such as Hong Kong, Malaysia, Mexico, South Korea, and Taiwan. Electronics manufacturers in the United States, for example, frequently have components assembled in these countries. The new American "world cars" contain parts drawn from American subsidiary plants in Brazil, Mexico, Spain, and other countries.

Quality control considerations also have been a factor in the loss of U.S. export markets to foreign competitors. For instance, Japanese exports of semiconductors to the United States rose from $20 million in 1973 to over $250 million in 1979. One reason for this rapid growth was that

rejection rates for the Japanese-produced units were one-half or less than the comparable rate for domestically produced equivalents.[6]

All of these developments have been directly or indirectly accentuated by the steep increases in U.S. energy costs since 1973. In many older industries, escalating energy prices have made plants and equipment obsolete because their use requires large quantities of energy.

Within the United States, the response to foreign competition, slow productivity growth, rising labor costs, and high energy costs has been to engage in large-scale capital outlays to restructure industrial plants. These capital outlays are intended not only to increase productivity, but also to produce products that require less energy. The automobile industry is a leading case. General Motors, for example, anticipates spending some $40 billion in the coming decade to build new plants and reequip existing plants to reduce costs and to produce a new generation of smaller, more fuel efficient motor vehicles.[7]

These massive capital outlays frequently will introduce a more complex production technology involving the use of automated and computerized processes. Industrial robots supply a good illustration of the new technology.[8]

The Institute of Robotics estimates that in 1980, some 3,200 industrial robots were in use in the United States. Their main uses have been in the automobile industry or in foundry-type operations. They also foresee the possibility that robots will become a $2 billion a year industry by 1990.[9]

Robots in the automobile industry are used primarily in painting and welding automobile bodies. General Motors, for example, plans to add 2,000 more robots to its assembly lines by 1983. Future projections for the company envision as many as 14,000 robots in use by 1990.[10]

Such long-term prospects for robots point to their use for advanced, computerized systems that both design equipment and direct production. The robots that will figure in these computerized design and manufacturing systems (CAD-CAM) will be programmable—thus they will have the capacity to sense and react to their environment as well as to perform repetitive operations. Robots represent one important example of the new, rapidly expanding high technology processes that are organized around the use of microprocessors and computers. Use of such technology has mushroomed as the costs of computing have declined. For instance, the cost of storing one unit or "byte" of information in a semiconductor memory chip fell by 98 percent in the past ten years.[11] Much of the capital outlay in restructuring the nation's manufacturing plants will make use of "smart" machines involving the new microprocessor technology. In the next two decades, these applications of scientific knowledge are likely to be joined by far-reaching applications of biological research in genetic engineering. The General Electric Company, to cite an instance, has received a patent for developing a species of bacteria that can help clean up oil spills by consuming the oil.[12]

In the eighties incentives to use advanced, computerized technologies such as robots will stem from the improved quality control and increased productivity that the new technology makes possible. For example, a General Motors spokesperson noted that traditional methods for painting automobile bodies retained only 30 percent of the paint actually sprayed on the vehicle. The rest was either lost in powerful exhaust systems that protect workers from paint fumes or in other systems. By programming robot sprayers, it is now possible for General Motors to retain more than 50 percent of the paint on the cars.[13]

Beyond their technical advantages, robots cannot join unions, go out on strike, take coffee breaks, become alienated from work, or require environmental, health, and safety protections to reduce hazards in the work place.

New technologies will continue to appear and will probably accelerate the slow growth or declines in employment opportunities for semiskilled workers in manufacturing industries. This tendency is illustrated by the experience of the automobile industry since the end of World War II. In 1948, some 713,000 auto workers in the United States and Canada produced 5.96 million automobiles, trucks, and buses. In 1978, 839,000 auto workers produced nearly 14.26 million motor vehicles.[14] Seventeen motor vehicles were produced per automobile worker in 1978 as compared with a little more than eight vehicles in 1948. Developments similar to those in the automobile industry have led to considerably slower growth in employment for production workers in manufacturing than for workers in other nonagricultural occupations. (See table 9.)

TABLE 9

TOTAL NONAGRICULTURAL EMPLOYMENT, AND EMPLOYMENT FOR PRODUCTION WORKERS IN PRIVATE MANUFACTURING, 1948 TO 1979

Year	*Total Nonagricultural Employment (in millions)*	*(1948 Index=100)*	*Employment for Production Workers in Manufacturing (in millions)*	*(1948 Index=100)*
1948	44.9	100.0	12.9	100.0
1960	54.2	120.7	12.6	97.5
1970	70.9	157.9	14.0	108.8
1979	89.5	199.4	15.0[3]	116.3

SOURCE: Adapted from *Employment and Training Report of the President,* Washington, DC: U.S. Government Printing Office, 1980, pp. 305-306. Figures listed refer to payroll employment.

Total nonagricultural employment nearly doubled in the generation after World War II. Jobs for production workers in manufacturing increased by about one sixth. During the seventies, the overall nonagricultural employment grew by 18.5 million workers. The comparable increase for production workers in manufacturing was 1 million. The lack of substantial manufacturing job growth in the seventies has made it difficult for the economy to absorb the large number of women entering the labor force and the "baby boom" generation born in the later 1950s or early 1960s.

Greater capital outlays for more complex technologies in the eighties are intended to bring about a renewal of the industrial economy without a comparable increase in requirements for semiskilled and unskilled blue-collar labor. Furthermore, many of these capital outlays are designed to decrease labor requirements.

The displacement that will be created by computerized technologies will be concentrated in one occupational group: semiskilled operatives. Over three-fourths (77 percent) of the 11 million persons employed as operatives in 1979 (excluding operators of transportation equipment) were at work in manufacturing industries. Jobs that are created by increased capital investment will be concentrated in professional, technical, and skilled areas; in designing and producing equipment, or in operating, maintaining, and repairing it. Few of these positions could be filled by a displaced automobile worker, for example, without a good deal of additional training.

Although economic concerns have focused on renewing the industrial base, the bulk of the job growth in the eighties is expected to take place in service industries. In addition, there is a

rapidly growing yet often ignored service sector in manufacturing industries made up of persons who will provide data processing, financial, legal, public relations and advertising, and other business services. Many of these service firms also will be introducing microprocessor technology and other related advances. However, growth in these industries is expected to be rapid enough to more than offset the displacement effects of new technology. These patterns of job growth are illustrated by the U.S. Bureau of Labor Statistics projections of employment growth by industry between 1977 and 1990. (See table 10.)

TABLE 10

EMPLOYMENT FOR SELECTED MAJOR INDUSTRIAL SECTORS, 1977 NAD PROJECTED 1990

Sector	*Employment (in millions)* 1977	*Projected 1990*	*Percent Change 1977 to 1990*
Total Civilian Employment	93.7	118.6	26.6
Manufacturing, Transportation, Public Utilities	19.8	23.9	23.0
	4.8	5.7	16.9
Wholesale and Retail Trade	20.9	27.4	30.9
Finance, Insurance, and Real Estate Services[1]	4.9	6.7	37.0
Services[1]	17.7	26.7	51.3

SOURCE: *Employment and Training Report of the President*, Washington, DC: U.S. Department of Labor, 1979; p. 362.

1. Excluding private household workers

The U.S. Bureau of Labor Statistics' projections foresee a future in which employment in manufacturing will grow more slowly than total employment. The growth in manufacturing employment will represent the combined effects of slow growth in the older manufacturing industries and more rapid growth in the new high technology industries. Three-fifths of the overall increase is expected to take place in two economic sectors: service and trade industries.

Unanticipated changes in the projections, such as rapid development of new energy sources, could create even larger increases in employment for energy industries and manufacturing industries that are heavy users of energy. But the predominant theme in the projections is a continuation in the shift to a post-industrial society as the major factor affecting employment in the eighties.

Most cost-saving figures for the use of new technology represent the savings that result from continuous operation. Industrial robots, for example, are currently estimated to involve an initial unit capital outlay in the $70,000 to $80,000 range.[15] Much of the savings anticipated from the investment would be lost if the machines were frequently out of use because of the need for maintenance and repairs.

In the introductory phases, repairs to complex equipment such as robots are often made by the "superstars," or persons with graduate degrees in science or engineering. Later on, the responsibility falls to specially trained technicians and mechanics.

Accordingly, the emphasis on industrial renewal in the eighties will place new and greater demands on vocational education systems. For example, courses in electronics will provide the basic foundation for training in the fields related to the new technology. The level of complexity involved in automated technologies suggests that the bulk of the training will be given in post-secondary institutions. Many of these institutions already have extensive expertise in electronics technology. Work-study and cooperative education programs can be effective ways to give students a working familiarity with industrial advances.

Yet vocational programs in the secondary schools can arouse student interest by providing basic training and employability development courses that familiarize students with the work world. These programs will be able to serve as a basis for later, more specialized training in industrial settings.

So far, the high cost of equipment required to train persons in the new technology has kept private schools from assuming a major role in training. None of the member schools of the National Association of Trade and Technical Schools, for example, offer courses in robotics. Yet it is likely that equipment costs will decrease with a greater volume of production. A reluctance by public vocational institutions to train persons for the jobs that will grow out of industrial revival will have the effect of encouraging private institutions to take on a larger role in this field.

In the past, there has been great emphasis on the need to identify new occupations that might be suitable fields for vocational training programs. Robots and related technologies illustrate another tendency: changes in job content in existing occupations as a response to technological advances. Changes in the content of machinists' jobs, resulting from the introduction of numerically controlled machine tools, illustrate this development. In the coming decade, the job content of many electronic technicians' jobs will include a working knowledge of advances in fields such as robotics. Programmers and designers will discover their job skills undergoing change with the more widespread integration of computer assisted design and manufacturing.

Vocational education systems, like other institutions, must adapt to change if they are to serve their students, the larger society, and their own need to grow. Planning in vocational education can supply an early warning system for increasing sensitivity to changes that will require a response by vocational educators. Priority factors for renewing the nation's industrial base, such as demographic changes and regional populations/manufacturing shifts, illustrate the long-term developments that will figure prominently in the agenda for vocational education planning.

NOTES

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2. For an analysis of these outlays, see Leonard Lecht, *Expenditures for Retirement and Other Age Related Programs: A Major Shift in National Priorities* (New York: Academy for Educational Development, 1981).

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4. National Advisory Council on Adult Education, *A History of the Adult Education Act* (Washington, DC: U.S. Government Printing Office, 1980), p. 35.

5. U.S. Department of Labor, Bureau of Labor Statistics, *Geographic Profiles of Employment and Unemployment, Report 619* (Washington, DC: U.S. Government Printing Office, 1980), p. 9.

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8. For an analysis of the implications of the utilization of industrial robots, see R.U. Ayres, *A Preliminary Technology Assessment: Industrial Robots and CAM* (Pittsburgh: Carnegie-Mellon University, 1980).

9. *Wall Street Journal*, 28 November 1980.

10. *Business Week*, 1 June 1981, p. 98.

11. *Business Week*, 1 June 1981, p. 96.

12. *Business Week*, 16 March 1981.

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14. Research Department, United Auto Workers Union, *Memo* (Detroit: United Auto Workers Union, 20 October 1980).

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